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Road Safety Policy in Addis Ababa: A Vision Zero Perspective

Henok Girma Abebe

Division of Philosophy, Department of Philosophy and History, KTH Royal Institute of Technology, 100 44 Stockholm, Sweden; hgirma@kth.se

Abstract: In this article, the Addis Ababa city road safety policies are examined and analysed based on the Vision Zero approach to road safety work. Three major policy documents are explored and assessed in terms of how they compare with Vision Zero policy in Sweden, concerning how road safety problems are conceptualised, the responsibility ascriptions promoted, the nature of goal setting concerning road safety objectives, and the specific road safety interventions promoted. It is concluded that there is a big difference between the Swedish Vision Zero approach to road safety work and the Addis Ababa road safety approach in terms of how road safety problems are framed and how responsibility ascriptions are made. In Addis Ababa, policy documents primarily frame road safety problems as individual road user problems and, hence, the responsibility for traffic safety is mainly left to the individual road users. The responsibility extended to other system components such as the vehicles, road design, and the operation of the traffic is growing but still very limited. It is argued that in order to find and secure long-term solutions for traffic safety in the city, a paradigm shift is needed, both regarding what are perceived to be the main causes of road safety problems in the city and who should be responsible for ensuring that road fatalities and injuries are prevented.

Keywords: road safety; Addis Ababa; vision zero; Sweden; goal setting; policy implementation; road safety strategies; responsibility for road safety

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1. Introduction

Road traffic crashes are one of the biggest public health problems in the current world, claiming over 1.3 million lives and leading to 20 to 50 million serious injuries every year [1]. Road traffic crashes are the eighth leading cause of death worldwide but the WHO forecasts that unless an urgent and concerted effort is taken, the problem will eventually become the fifth leading cause of death by 2030. It is the recognition of this alarmingly growing public health problem that led world governments to include road traffic safety as one integral aspect of the sustainable development agenda. The 2030 Agenda for Sustainable Development includes both short- and long-term road safety targets. For instance, Sustainable Development Goal (SDG) 3.6 aspires to 'halve the number of global deaths and injuries from road traffic accidents by 2020'. The importance of road safety is also part of SDG 11, which promotes the creation of 'inclusive, safe, resilient, and sustainable' cities and human settlements. Recently, the United Nations General Assembly passed a resolution proclaiming 'the period 2021–2030 as the Second Decade of Action for Road Safety, with a goal of reducing road traffic deaths and injuries by at least 50 percent from 2021 to 2030' [2]. The resolution emphasised the importance of strengthening efforts to achieve road safety related goals included in the SDGs. Following the passing of the resolution, a global plan for the Decade of Action [3] was adopted which called on governments and stakeholders to move past business as usual and promote an integrated Safe System approach to address road safety problems. At the center of the global plan is the emphasis on enhancing road infrastructure safety, vehicle safety, and post-crash emergency medical services.

Regionally, important improvements in road safety have been observed in Europe, Australia, and the USA over the past few decades. Despite the fact that there are more

cars than ever before in these parts of the world, a shift in emphasis from the traditional approach to safety work to a systems approach has resulted in a significant improvement in traffic safety. This is mainly a result of the continued improvement in the safety of vehicles, road designs, and emergency services, among others [1].

There is a different, and perhaps opposite, reality in low-income countries. Despite the fact that middle and low-income countries only account for about half of the world's total vehicle population, they account for more than 90% of the road traffic deaths [1]. The problem is particularly acute in Africa, the region that has the highest road injury death rate, 27.0 per 100,000 people [4]. The economic, social, and environmental impacts of road traffic are also more troubling for these countries. A growing economy and the subsequent increase in the level of motorisation coupled with the absence of strong commitment to addressing traffic safety is expected to lead to a further exacerbation of the problem. Between the years 2013 and 2016 not a single low-income country was able to reduce the number of road traffic deaths [5].

Ethiopia provides a good example of countries where the problem of road fatalities and injuries continues to increase despite government efforts to curb the problem through different interventions. According to a government report based on police records, there were 4352 fatalities in 2016, however, the WHO estimates that the real figure could be six times what the police reports indicate [1]. Addis Ababa, the Ethiopian capital, shares this reality as road fatalities have increased by a yearly average of 6% between 2010 and 2016 [6]. Between 2013 and 2016, an average of 391 people died in the city due to road crashes, according to police reports [6]. In 2016 alone, 463 people were killed by traffic crashes, and more than 80% of these were pedestrians [7] (p. 3). Road traffic crashes primarily affect young people between the ages of 18–30 [8,9]. The socio-economic costs of road traffic crashes are also immense in the city.

Given that road safety problems continue to pose a huge public health and development issue for Ethiopia in general and Addis Ababa in particular, it is critical to examine the nature of policies, strategies, and interventions promoted to address road safety problems in the city. In particular, it is vital to study how the policy documents frame the problem of road safety, how they ascribe responsibility for ensuring traffic safety, and the different instruments and measures promoted to address specific risk factors. It is also equally important to examine the issue from a normative point of view, i.e., what is the best, or most adequate, way of framing the problem, and who should be given the responsibility for addressing the problem and by what measures. The purpose of this paper is to do both things. In the paper, the present Addis Ababa road safety policy is described and analysed using the Vision Zero (VZ) framework as a normative starting point. Specifically, the adoption and implementation of VZ in Sweden and the responsibility ascription enshrined in it will be explored to draw possible lessons for road safety work in Addis Ababa. It is argued that enhancing road safety work in Addis Ababa requires emphasizing the systemic nature of the causes of road safety problems, i.e., the fact that fatalities and serious injuries are mainly the results of a defective design and functioning of the road traffic system. Moreover, it is highly important that the prevention of road fatalities and serious injuries becomes normative criteria that determine the overall design and operation of the road transport system. Preventing fatalities and serious injuries in a sustainable manner primarily calls for the redesign of the road traffic system in a way that takes into account road user fallibility and their physical fragility. Implementing such a systemic change would require the primary responsibility of major stakeholders that significantly shape the design and operation of the road traffic system, such as the road traffic and transport authorities, vehicles manufacturers, and procurers. To promote proactive prevention of fatalities and serious injuries on the roads it is important to enhance a proactive engagement of all factors that influence the safety of the present road system in ways that go beyond educational and enforcement initiatives.

The paper is structured as follows. In Section 2, the VZ approach to road safety work will be presented. In Section 3, the material and methods used in the analysis are discussed.

In Section 4, the main features of the present Addis Ababa road safety policies are presented, focusing on four aspects: (1) framing of the problem, (2) goal formulation, (3) strategies and interventions for road safety work, and (4) responsibility ascription for road safety work. Section 5 presents the results of the study. Section 6, critically examines the Addis Ababa road safety policy using the VZ framework presented in Section 2 as normative starting point and identifies some recommendations. The last section is the conclusion.

2. Theoretical Framework: The Vision Zero Approach

VZ is a policy innovation that has radically changed the way road safety problems are framed and addressed. It is a strategy that differs in significant respects from the traditional approach to road safety work in terms of problem framing (Section 2.1), goal formulation (Section 2.2.), choice of strategies for road safety intervention (Section 2.3), and responsibility ascription (Section 2.4) [10]. The following section provides a brief overview of these important aspects of VZ.

2.1. Vision Zero and the Reconceptualisation of Road Safety Problem

VZ is a road safety policy innovation that involved a re-framing of road safety problems that departed fundamentally from the traditional approach to road safety work. Traditionally, the emphasis of road safety work has been the prevention of accidents, and the cause of road accidents was believed to be individual road user errors. Hence, the goal of road safety work was to prevent all accidents through the interruption of 'conscious and subconscious faulty human action' [11,12]. The traditional approach used education, training and policing of road users to achieve this purpose [11–13].

VZ departs from the traditional approach to road safety in that it shifts the focus of road safety work from accident prevention to injury prevention. From the VZ perspective, the prevention of accidents per se should not be the prime focus of road safety work unless they are associated with a fatal and serious loss of health [11] (p. 676). This is because it is recognised in VZ that not all accidents can be prevented due to human fallibility. Hence, the focus of road safety work is only on the prevention of fatal and serious injury crashes. In VZ, the main reason why people get killed and seriously injured in road crashes is mainly because the design and operation of the road traffic system allow road users are exposed to external violence that their bodies cannot physically tolerate.

2.2. Vision Zero as a Long-Term Goal for Road Safety Policy

VZ is the long-term goal of road safety policy, which states that 'no one should be killed or seriously injured as a result of traffic accidents within the road transport system' [14] (Since 1998, two consecutive 10-year short-term interim targets have been used to supplement the overarching goal [15]). According to the government, no number above zero is, thus, an acceptable outcome in the long run. This commitment to zero fatalities and serious injuries is based on an ethical premise, namely that preventable road crashes are morally unacceptable and that safety shall not be compromised for the purpose of promoting mobility in the road system [16,17]. The VZ goal has been reaffirmed repeatedly by the Swedish government in the last two decades, most recently in the government's 2016 official recommitment to VZ [18] (p. 6). According to the government, VZ expresses the only morally acceptable goal for traffic safety work.

From a goal setting perspective, the function of VZ is to guide and motivate actions towards the achievement of the desired end state, i.e., the eventual elimination of fatalities and serious injuries from the road system [19–21]. VZ fulfills this 'achievement-inducing' function by coordinating and motivating action, both temporally and among individuals and organizations [19–21]. Moreover, VZ functions as 'a normative framework against which road safety measures can be developed, implemented, evaluated, and adjusted' [22].

Here it is important to understand the motivation of policymakers and politicians behind the adoption of the VZ goal in Sweden. It should be noted that Sweden was already one of the best performing countries in the world in terms of road safety prior

to the adoption of the VZ goal. However, in the early 1990s up to the adoption of VZ in 1997, the country was generally struggling with plateauing in the number of fatalities and injuries. Also, fatalities and injuries seem to fluctuate as the economy of the country fluctuates. When the economy performs better fatalities increase due to higher motorisation and travel levels [14]. Just prior to the adoption of the Vision Zero goal, in the winter of 1995, a severe crash occurred that led to the death of young children when their vehicle collided with a concrete foundation. This crash led to public outcry and pointed out the need to promote new strategies to address fatalities and serious injuries in the Swedish road system. Therefore, the government and politicians in the Swedish parliament were convinced that new innovative strategies and interventions have to be implemented to significantly reduce fatalities and serious injuries in the road system. The government also questioned the disproportionately high number of fatalities and injuries in road traffic as compared to other transport sectors [14]. It attributed this discrepancy between road traffic safety and other transport sectors, such as aviation and railway safety, to the requirement they place on safety. The government bill stated that other types of traffic have developed to a greater extent on the basis that no accidents may occur in the system that result in death or serious personal injury. Developments in these modes of transport have largely focused on increasing the security of the system rather than on improving the individual's ability to act safely. Supportive technology has been used there to increase the security level of the systems and counteract the serious consequences of human error [14]. Therefore, by adopting VZ, the government proclaimed that, similar to other transport systems, the road traffic system should ultimately aim for the goal of zero fatalities and serious injuries. To achieve this goal the government called for the importance of going beyond policies and strategies that merely target individual road users. By rejecting business as usual and demanding the inherent safety of the road system, the government was departing from a road safety culture that had traditionally allowed road fatalities and serious injuries as acceptable.

2.3. VZ and the Choice of Strategies

Since road fatalities and serious injuries are mainly a result of a defective road system design that ignores fundamental road user limitations, the best strategy to prevent fatalities and serious injuries in the road system is to recognize fundamental facts about the nature of road users in the design of road system [10–13]. In VZ, therefore, a basic departure point for road safety work and design of the road system should be human body's physical ability to withstand external violence. The ultimate strategy to a safe road traffic system from the VZ perspective is to manage kinetic energy in crashes and collisions. 'It is kinetic energy that kills and injures the road user–not the accident.' [13] (p.828). Johansson [13] identifies two general principles of Separation and Integration that are important in the management of kinetic energy in road crashes in VZ. The idea is the management of kinetic energy by 'integrating compatible traffic elements and by separating incompatible ones'. For instance, VZ demands that (to avoid fatalities and serious injuries) unprotected road users are physically separated from motorised vehicles in areas where speed exceeds 30 km/h. In areas where these two groups of road users mix, VZ requires speed to be reduced to 30 km/h. Similalry, according to VZ strategy, car occupants should not be exposed to oncoming traffic (other vehicles of approximately same weight) at speeds exceeding 70 km/h or 50 km/h if oncoming vehicles are of considerably different weight. If this cannot be satisfied then separation, homogenisation of weights or reduction of speeds to 70 (50) km/h could be used to prevent fatalities and serious injuries to car occupants.

One major implication of the VZ strategy is that speed become dependent on the nature, function and safety features of the road environment and vehicles on the roads. That is why in many places that have adopted VZ, the major strategy to prevent fatality and serious injury has been speed management based on the safety level of the system components [23]. Another major practical implication is the responsibility ascription for road safety work. Given that VZ views fatalities and serious injuries in the road system as

a result of system defects, then it is merely logical that those actors behind the design of the road system and its components are assigned responsibility for traffic safety. The next section discusses the responsibility ascription enshrined in VZ.

2.4. Vision Zero and Its Responsibility Ascription

As noted above, VZ views road fatalities and serious injuries as being a result of systemic defects. Hence, it places the ultimate responsibility for traffic safety on 'system designers'. The government policy document states that system designers are responsible for taking additional steps to ensure that road user mistakes do not lead to fatal and serious injuries [24]. System designers are entities that shape the design and operation of the road transport system, such as road administrators, the automotive industry, transport service providers, and actors responsible for various support systems, such as the police, driving schools, and emergency services, health care, and rehabilitation professionals [25] (pp. 4–5). These groups of system designers have to everything in their power to prevent the occurrence of a fatal or serious injury in the road system.

Two specific groups of system designers have had a special role in the prevention of fatalities and serious injuries in the Swedish road system. These are the road infrastructure designers on the one-hand and vehicle manufacturers and procurers on the other. In 2008, the Swedish parliament adopted the European Union Directive 2008/96/EC [26] on road infrastructure safety management [27]. The directive formally regulates the safety of road infrastructure in the trans-European road system, which accounts for about 20% of the Swedish road system but about 67% of road traffic in the network [27] (p. 91). In 2010, Sweden adopted a Road Safety Act (2010:1362) [28] that explicitly assigns responsibility to Swedish road administrators concerning the Trans-European road network. According to §9 of the Road Safety Act, the Swedish road operator has the responsibility to 'systematically and continuously take the measures necessary to prevent serious injuries as a consequence of the use of the roads. Measures to tackle the immediate risk of such injuries shall be taken first.'

Another important milestone in the history of Swedish road safety work in relation to responsibility ascription is the Ordinance (2009:1) on environmental and traffic safety requirements for government cars and car journeys [29]. According to Belin and Tillgren [27], the government considered that state authorities and government offices are important users of vehicle transportation and procurers of vehicles, and the nature of vehicles used by authorities has important implications for safety and the environment. It was considered that the state and government agencies should take the leading role in the transition to safer transportation [10]. Therefore, the new law required government offices and state authorities to 'only buy cars and commission car travel that met high environmental and safety requirements. Among other things, cars that an agency purchases or leases should be fitted with alcohol interlocks to the greatest extent possible' [27] (p. 92). Since 2010 government authorities 'who purchase, lease, and use vehicles for certain contracted road transports' are legally required to install alcohol interlocks [30]. Quite a number of private companies and government organisations in Sweden use this vehicle technology to ensure their drivers are sober. By 2011, over 55,000 alcohol interlocks had been installed in commercial fleets in Sweden [30] (p. 378). In 2017, 97% of the busses providing public transport services in Sweden had an alcohol interlock instituted [31]. Moreover, school buses and taxi service providers are required to equip their vehicles with alcohol interlocks.

In addition to the formal requirements on the safety of government vehicles, there are also strict regulations in Sweden on the safety features of vehicles allowed to be used in the road system by the public. Cars in Sweden should fulfil frontal impact standards, electronic stability control, pedestrian protection and motorcycle anti-lock braking system [18]. There are also obligatory standards for the installation of passive safety systems in vehicles. It is mandatory that new cars have seat belts, air bags, crumple zones and underrun protections. Moreover, active safety features such as the anti-skid system, anti-lock brakes are standards in the modern vehicle fleet [18]. The use of automation and auto-brake function have also

contributed greatly to improve the safety not only of passengers in vehicles but also of pedestrians and cyclists [18] (p. 13).

In conclusion, VZ puts the ultimate responsibility for traffic safety on system designers such as road designers and vehicle manufacturers, and procurers.

3. Materials and Methods

This study relies on qualitative policy content analysis. Qualitative content analysis is a research method used in the analysis of text data and focuses mainly on 'the content or contextual meaning of the texts being analysed' [32]. In this article, government transport and traffic safety policy documents currently being implemented in Addis Ababa city are identified and analysed by taking the VZ policy as a normative framework. The three government policy documents used in the analysis are the Addis Ababa Transport Policy [33], the Addis Ababa Road Safety Strategy 2017–2030 [34], and the Addis Ababa Non-Motorized Transport (NMT) Strategy 2019–2028 [7]. The policy documents are available online; however, in contrast to government policy documents produced in Europe and many other countries, the Addis Ababa policy documents are not accompanied by any preparatory works. There are no green or white papers available that can be used to determine the intentions of the policymakers or the considerations made when deliberating between different road safety strategies.

An informal interview was also made with a former mayor of Addis Ababa city in Amharic language. The interview, which lasted for about 65 min, contained questions on the nature and extent of road safety problems in the city and the nature of the different policies, strategies and interventions promoted to address road safety problems.

4. The Addis Ababa Road Safety Policies and Strategies

Road safety in Addis Ababa is presently regulated through three main policy documents adopted at the city level. In 2012, Addis Ababa approved its first ever transport policy with a general objective of providing a 'safe, efficient, comfortable, affordable, reliable and accessible transport service for the urban dwellers' [33] (p. 16). The policy covers many aspects of urban transportation, including urban land use, infrastructure, traffic management, and social issues. It also contains statements related to road safety; the high rate of traffic accidents is identified as one of the main challenges facing urban transport in the city.

In 2017, in line with the directions provided in the transport policy, the city administration adopted the Addis Ababa Road Safety Strategy 2017–2030 [34]. The strategy is meant to serve as a long-term guiding framework for traffic safety work in the city and contains road safety targets for the years 2023 and 2030.

A third important milestone in the history of road transport in Addis Ababa was the adoption, in 2018, of the Addis Ababa Non-Motorized Transport (NMT) Strategy 2019–2028. The Strategy was adopted with the vision of providing 'safe, efficient, and accessible pedestrian and cycling networks to improve access to opportunities and mobility for all residents, foster equitable allocation of street space, and create a dignified walking and cycling environment' [7] (p. 10). According to the city administration, the NMT strategy is consistent with the Addis Ababa city master plan and the transport policy in which the importance of expanding non-motorised transportation is promoted for the triple purposes of expanding accessibility, promoting pedestrians and cyclists' safety, and enhancing the quality of the environment through the promotion of active transportation.

Below, the three main policy documents related to road safety in Addis Ababa are analysed from the viewpoints of: problem framing (Section 4.1), goal formulation (Section 4.2), responsibility ascription (Section 4.3), and policy implementation/choice of strategies (Section 4.4).

4.1. Framing of the Problem

The Addis Ababa Transport Policy [33] was necessitated as a systematic response to a multitude of different transport related problems facing the transportation sector in the city. The policy clearly recognised the human, social and material costs of road traffic crashes and identified the promotion of traffic safety as one of the 10 major concerns the policy seeks to address. The transport policy identified a multitude of causal factors behind the problem of road traffic accidents in the city, including the high number of vehicles in the city, the behaviour and skills of individual road users, lack of safe infrastructure for vulnerable road users, vehicle technical problems, lack of systematic data on the causes and magnitude of road accidents, weak emergency service provision, and weak traffic management system [33].

The Addis Ababa Road Safety Strategy was simultaneously released together with the first ever road safety status report on the nature and state of road safety problems in the city [35]. The road safety status report, which formed the basis of the Road Safety Strategy, drew on findings of three different studies conducted prior to the adoption to the strategy. First, three years of police crash reports were used to identify 'where and when crashes were occurring, the road characteristics and vehicles types involved, the vehicle maneuvers being undertaken, and the victims.' [36] (p. 1). According to Hirpa et al. [36], the evidence from these reports showed that 86% of road traffic crash victims were pedestrians, up to 84% of accidents occurred on roads with good pavement condition, and 73% of crashes occurred at midblock and major undivided two-way roads. In addition, 67% of causalities occurred by vehicles moving straight ahead and involved in dangerous overtaking. It was also reported that 59% of fatal road crashes involved commercial goods and passenger transport vehicles. Generally, lack of attention to pedestrian safety in road infrastructure design, pedestrian and driver impairment, speeding, and driver fatigue were identified as problematic causal factors for road accidents in the city. Although the type of vehicles involved in crashes are presented, i.e., whether they are private or commercial vehicles, the evidence presented in Hirpa et al. [36] does not show if the police report used as a basis for the making of the Addis Ababa road safety strategy also discusses the nature and safety level of vehicles involved in crashes. That means that although, for instance, commercial vehicles are involved in most of the violations and crashes in the city, the roadworthiness and crashworthiness of these vehicles are not clearly known. This is mainly because Ethiopia in general and Addis Ababa city, in particular, lacks vehicle safety standards on imported vehicles.

In addition to the police crash data, the first status report also contained results from the observational surveys that the city has been conducting since 2015 concerning four key risk factors: speeding, drunk driving, helmet use, and seat belt and child restraint use [37,38]. The surveys, which were conducted by the John Hopkins International Injury Research Unit and the Addis Ababa University School of Public Health, show that speeding, drunk driving, and low seat belt use are critical problems in the city. The evidence shows that, between the years 2015–2018, 58% of cargo trucks and 47% of buses were involved in speed violations. In 2017, Vital Strategies [39] reported that 90% of buses and commercial vehicles were involved in speed violations in the city. Moreover, the observational survey shows that speeding violations were higher during weekends than weekdays and in the early mornings than in the evenings. Concerning the use of seat belts and restraints, the study showed that only 5% of adult passengers and 3% of children use seat belts in the city.

Another important risk factor identified in the report is that of drunk driving. An investigation on alcohol blood content at sobriety checkpoints showed that 2.4% of drivers had an alcohol content beyond the legally permitted level. The problem of drunk driving is reported to be higher for male drivers in the city and during weekends [38].

Thirdly, the city's road safety status report was based on a study by the International Road Assessment Program (iRAP) on 114 km of main roads in Addis Ababa. The investigation found that only 39% of roads were safe for vehicle occupants, and only 14% were safe for pedestrians [37] (p. 23).

The Addis Ababa NMT Strategy framed the problem in a similar way to the 2012 Transport Policy and the 2017 Road Safety Strategy. The NMT Strategy attributes the high number of pedestrian fatalities in Addis Ababa to 'the fact that just 14 percent of city roads were rated acceptable for pedestrian safety, compounded by the high prevalence of risky driver behaviour, including over-speeding and drunk driving.' [7] (p. 5). In addition, the NMT Strategy emphasised road safety and environmental problems associated with the steadily increasing number of motor vehicles in the city. Particularly, the strategy mentions the 'negative impact of outdated and poorly maintained vehicle fleet' in the city [7] (p. 4).

In summary, the main causes of road safety problems identified in the three Addis Ababa policies analysed in this paper are a growing motorisation level in the city, poor road infrastructure for vulnerable road users, vehicle technical problems, weak emergency service, and problematic road user behaviour including but not limited to speeding, drunk driving, and seat belt use problems. Moreover, the policy documents identify the lack of relevant scientific data, weak management and lack of resources as hindrances to effective and efficient road safety work in the city.

4.2. Goal Formulation

The Addis Ababa Transport Policy identified three objectives in relation to traffic safety [33] (p. 28): 'to reduce' traffic accidents and adverse consequences associated with road traffic crashes, to mobilize and coordinate stakeholders, and, finally, to increase awareness about the problem. However, it also stated that the road 'traffic safety strategy shall be guided based on long-term vision and detailed program' [33] (p. 28).

The Addis Ababa Road Safety Strategy 'envisions Addis Ababa city free from road trauma by 2030' [36] (p. 3). The strategy was adopted with the targets of: (1) halving the number of fatalities and injuries due to road traffic crashes by 2023 and (2) providing access to safe, affordable, accessible and sustainable transport systems for all by 2030. Reaching the stated target would require the city to reduce fatalities and serious injuries in the road system by 10% every year from the baseline year, 2015, when the number of fatalities and serious injuries was 448 and 1912, respectively [7]. Although the Addis Ababa Transport Policy states that the road traffic safety strategy will be 'guided based on long-term vision and detailed program', it has been argued that the Road Safety Strategy lacks a 'detailed and quantified intermediary objectives for implementation of the strategy' [40].

The vision of the NMT Strategy [7] (p. 10) states that:

Addis Ababa will provide safe, efficient, and accessible pedestrian and cycling networks to improve access to opportunities and mobility for all residents, foster equitable allocation of street space, and create a dignified walking and cycling environment.

Road safety improvement is one of the four different goals contained in the NMT Strategy (The other three goals are 'Increased mode share of walking, cycling, and public transport', "Reduction in the use of personal motor vehicles (PMV)", and "Improved air quality" [7] (p. 10)). Moreover, the NMT strategy adopted a 10-year target of reducing pedestrian and cyclist fatalities by 80% between the years 2018–2028. In addition to this, the NMT strategy has similar 10-year targets for different road infrastructure developments that facilitate pedestrian and cyclists' safety and mobility.

In summary, taken together, the three Addis Ababa policies analysed in this paper include both long-term visions for road safety work and short- and medium-term targets.

4.3. Road Safety Strategies and Interventions

The Addis Ababa Transport Policy identified numerous policies and strategies with the intention of addressing the problem of road safety in the city. Specifically, the policy identified sixteen strategies, seven of which relate to education and enforcement initiatives. The policy document identifies two strategies related to road infrastructure: correcting dangerous black spots through pedestrian over-passes and zebra crossings and the introduction of traffic islands on corridors with arterial roads. With regards to future strategy on the improving vehicle component for the purpose of promoting road safety, the policy

only states upgrading vehicles' 'technical fitness' and taking 'stringent and timely vehicles' technical inspection' without clearly operationalizing how each of these different measures should be implemented. Organizing traffic safety databases and promoting traffic safety research are two additional strategies promoted in the policy.

The Addis Ababa Road Safety Strategy identified seven safety directions to be pursued during the implementation period [34,36]. The seven safety directions are: (1) developing a road safety management system, (2) focusing on the main roads, where trauma is most concentrated, (3) prioritizing pedestrians first, second and third, (4) enforcing key safety laws, (5) improving Crash and Injury Data Management, (6) improving Post-crash trauma response, and (7) demonstrating, and scaling up investment. Since pedestrians account for the greatest number of road users in the road system and are the major group affected by road safety problems, the strategy gave primary emphasis to improving the safety of this group. According to the strategy's "Safety Direction 3", pedestrian movements "should get the highest design priority". Thus, the new strategy promoted safe road design standards that promote the safety of pedestrians, reduction of allowed speed in areas of high pedestrian activity, improvement of pedestrian signals, and enforcement of key traffic safety laws and awareness campaigns, among other things.

The NMT Strategy, on the other hand, was based on two principles [7], (p. 8):

- Systematic traffic calming on smaller streets to reduce motor vehicle speeds and provide safe places for the mixing of pedestrians and other modes (shared lanes);
- Pedestrian and cycle infrastructure that is physically separated from motor vehicle traffic on larger streets, paired with traffic calming or traffic control to facilitate safe crossings. Pedestrian footpaths should provide clear space for walking, with other elements positioned in a strategic manner . . . Similarly, dedicated cycle tracks should be provided, separate from the mixed traffic carriageway. Large streets require signalisation or traffic calming at crossings and intersections to enable pedestrians and cyclists to cross the street safely.

In addition, the NMT Strategy also identified speed reduction through road infrastructure design as an important strategy in road safety work. According to Addis Ababa City Administration [7] (p. 9):

> "Street designs that reduce motor vehicle speeds can significantly improve pedestrian safety since the likelihood of pedestrian death in a traffic collision increases dramatically when motor vehicle speeds rise above 30 km/h. A pedestrian has a 90 percent chance of surviving being hit by a car travelling less than 30 km/h, but only a 50 percent chance of surviving impacts at 45 km/h."

Moreover, the NMT Strategy specified certain design standards for pedestrian crossings and intersections. Moreover, several engineering proposals were identified to improve the safety of vulnerable road users at road intersections, with such interventions as the tightening of corner radii, medians and refuge islands, creating direct pedestrian crossings, and the narrowing and aligning of vehicle travel lanes. The Addis Ababa City Road Authority was also tasked to design and invest in 'high-quality walking and cycling facilities' [7]. The city also implemented a speed management program in 2017, and to this end constructed speed limiting infrastructures, revised its speed regulations adopting the speed limits of 50 km/h on arterial roads, and 20 km/h on streets that lack dedicated paths for unprotected road users [41]. According to UN Habitat, the implementation of the speed limits has resulted in the reduction of average over-speeding by 10 km/h in the city while the implementation of speed-limiting infrastructures reduced road deaths at treated locations by 90%.

4.4. Responsibility Ascription

Although it is not clearly stated who has the ultimate responsibility for ensuring traffic safety in the city, the different policy documents identify numerous government agencies with their corresponding tasks concerning road safety. The Addis Ababa Transport

Policy, for instance, clearly calls for the importance of establishing traffic safety councils 'to coordinate and enhance participation' of stakeholders in the process of addressing the problems of road safety in the city [33], (p. 28). The policy also emphasises the importance to 'establish Addis Ababa City Transport Enterprise/Bureau to lead as a higher authority and coordinate activities of transport planning and service, transport infrastructure development and construction, traffic management, research and development in transport, and leads the enforcement of traffic and transport laws and systems' [33], (p. 42). With regards to the overall implementation of the transport policy, in which road safety is a key component, the Addis Ababa Transport Policy also states [33] (p. 46):

> 'the Ministry of Transport and the City Administration are expected to create conducive environment by providing a study that enables to establish the institution that could lead the sector, by crafting legal provisions that helps/enables to lead and coordinate the activities of the stakeholders, identify investment finance and resources necessary to expand the sector and that the resources are effectively used for that particular activity and create condition, cooperation, and lead the sector in partnership with federal institutions of the government and development partners.'

The policy also identifies the role of the private sector, educational institutions, civil societies, and non-governmental organizations in enhancing the transport sector, and the provision of training and education to the wider public [33].

The Addis Ababa Road Safety Strategy and the NMT Strategy, on the other hand, both identify the Addis Ababa Road Traffic Management agency as the lead agency responsible for ensuring road safety in Addis Ababa and for the implementation of safety interventions [7], (p. 34). The Addis Ababa Road Safety Council, which contains numerous governmental and non-governmental institutions, is tasked with the role of coordinating with stakeholders in relation to road safety initiatives [7]. The traffic police and the Addis Ababa Road Authority are also assigned with the responsibilities of controlling traffic operations and the construction of high quality road infrastructure, respectively [7].

Although the policy documents identify different agencies with different responsibilities, it appears that the ultimate responsibility for road safety in the city resides with the individual road users, whose responsibility for road safety, unlike the agencies identified above, is legally codified in different proclamations and regulations. In Ethiopia, as in many other countries, legal responsibility for traffic safety has since long resided with individual road users, who have to be alert and cautious to prevent the occurrence of crashes. (Transport amendment Regulation No. 279/1963) The transport regulation identifies two provisions directed at drivers and road users generally. First, it requires drivers not to drive recklessly and negligently. Second, the regulation also requires all road users to behave 'cautiously and circumspectly'. The transport regulation demands road users to respect traffic rules and regulations, including road signs. Also, the so-called Driver's Qualification Certification License Proclamation No. 600/2008 was adopted in 2008 'to ensure that drivers operate vehicles in appropriate condition by acquiring adequate driving skill to achieve safe transport service'. The regulation requires potential drivers to have the necessary theoretical knowledge and take practical training before sitting for an examination the result of which determines if one is eligible for a driving license. The regulation also imposes age, physical and medical restrictions on who can obtain driving licenses. Moreover, offences and associated penalties for failure to behave in accordance with the proclamation are presented.

In 2011, Ethiopia adopted the Road Transport Traffic Control Council of Ministers Regulation No. 208/2011, which established the Traffic and Transport Control Authority with the power to control traffic flow and enforce the provisions of this regulation. A recent amendment to the 2011 regulation, prohibiting texting and talking over the phone while driving, was adopted in 2017. (Road Transport Traffic Control Council of Ministers Regulation No. 395/2017) The emended regulation obligated all road users to observe road signs, markings, signals, and instructions. It is also stated that 'any person moving

by sitting on animals' back or driving animals or towing animals or driving animals which tow any carriage shall take necessary care'. Apart from road users, however, these different transport proclamations and regulations do not specify the responsibilities of other stakeholders for traffic safety and, hence, the other important components of the road traffic system are largely absent from formal responsibility ascriptions in road safety work. A good example is that in Ethiopia there is still no legal framework to control the safety and standards of motor vehicles and road infrastructure developments. Currently, there is a minor emphasis on infrastructure and vehicle safety improvements in the efforts to address road safety.

In conclusion, the different policy documents assessed in this study identify different stakeholders with different responsibilities concerning road safety. However, with the exception of road user responsibilities, it is not clear from reading these policies whether the different agencies have regulated responsibility to execute their tasks. Only the responsibility of road users for road safety is legally obligated, while the responsibility of major system designers such as road designers, vehicle importers and procurers, and emergency service providers is not.

5. Results

The results of the analysis of the present Addis Ababa road safety policy are summarised in the left-hand column of Table 1. Below, the differences and similarities between the Addis Ababa road safety policy and (the Swedish) VZ, summarised in the right-hand column, are explored in detail.

Table 1. A comparison of Addis Ababa road safety policies and the Vision Zero approach.

	Addis Ababa Road Safety Policy	**Swedish VZ**
Problem framing	- Recognizes the role of different causal factors for road safety problems. However, policy documents do not identify system defects as the fundamental reason for why people are killed and injured in the road system. - Emphasizes prevention of all accidents	- Exposure to harmful energy due to systemic defects as the fundamental causal factors for road fatalities and injuries. - Primarily focuses on the prevention of fatal and serious injuries.
Ga Goal setting	- Vision to create a road free from road trauma in 2030 - Short term targets for 2023 (AARSS) and 2028 (NMT strategy)	- VZ as long-term goal and a normative framework that guides the road transport system - Uses short term interim targets
Responsibility ascription	- Legal responsibility of individual road users - Unregulated responsibility for safe road infrastructure development and other stakeholders - Responsibility of vehicle exporters, importers, and procurers not emphasized. The role of insurance companies in road safety efforts is not identified.	- Ultimate responsibility is put on system designers that includes transport planners, road designers, municipalities, vehicle manufacturers and procurers, insurance companies, etc. - Regulated responsibility for road infrastructure owners and vehicle manufacturers, and procurers
Strategies and interventions	- Major emphasis on education, campaigns and police enforcement to prevent accidents. - Growing emphasis on safe infrastructure design principles - Speed management - Regulations - No clear strategies on vehicle safety improvement - Recognition of the importance of promoting efficient post-crash emergency service - Reliance on police crash data and investigations.	- Control of harmful energy through the design of the road system in a way that recognizes road user limitations. - Speed management through road infrastructure designs - Major emphasis on safe road infrastructure designs, vehicle safety and technology - Regulations - Education and campaigns to promote safe behavior and demand for safety. - Targeted policing of risky behaviors associated with fatal and serious injuries. - In-depth investigation of fatal accidents involving police and engineering experts. - Dual system of crash data collection by police and hospitals.

5.1. Differences

The Swedish VZ clearly recognizes the problematic design and function of the road system as the fundamental cause of road safety problems, i.e., fatalities and serious injuries are presented as being a result of a defective road traffic system. In contrast, in the Addis Ababa policy documents, as well as different studies conducted on road safety problems in Addis Ababa (e.g., [6,35,42]), road safety problems are mainly framed as individual road user problems. The major implication of viewing road safety problems as individual road user problems is that, in Addis Ababa, road safety interventions target individual road user behaviour as the primary way of addressing road safety problems. To achieve desired behaviour in the road system educational and enforcement efforts are promoted in Addis Ababa policy documents, while less emphasis is extended to improving the safety of other major system components. Although, for instance, there is an increasing emphasis on the problematic nature of road infrastructure, the policy documents do not commit to designing a road traffic system in such a way that the fallibility and physical fragility of road users is taken into account.

Also, the role of unsafe vehicles and other major system components is mostly overlooked in present policies. Hence, the policy documents do not clearly identify and stress the problematic nature of the safety and crashworthiness levels of vehicles operating in the city and their impacts on the safety of car occupants and other road users. For instance, the role of the vehicle component and the absence (or presence) of passive and active vehicle safety features in preventing fatalities and injuries are barely identified and discussed. In addition, the causes why people choose to engage in risky behaviours such as drunk driving and speeding and the role of the vehicle component in this regard have not been studied. It seems that these violations are just taken as moral lapses on the part of the drivers, and vehicle technological solutions to these problems are not discussed in the policy documents.

The different policy documents do not adequately identify and discuss how the vehicle component could protect vulnerable road users when crashes occur between the two. Therefore, policies and interventions are missing on how to improve the design of the vehicles to enhance the safety of the most affected road users in the city, i.e., pedestrians, are missing. Consequently, road safety work misses the point that road safety problems are systemic in nature and addressing them requires a broad systemic response that takes into account the major system components, such as the vehicles operating in a road system. Given that Addis Ababa is a highly motorised city and the majority of vehicles operating in the city are old second-hand vehicles, failure to include the vehicle aspect in road safety efforts will continue to cost lives

The role of post-crash emergency medical service is highly important in mitigating injury severity. Although the transport policy and road safety strategy of Addis Ababa recognizes that post-crash emergency provision is weak, the NMT strategy does not say anything about the problematic nature of post-crash emergency provision in the city and its impact on the safety of road users. This is highly problematic given that efficient and effective emergency medical service provision has an important role to play in mitigating the severity of injuries involving pedestrians and cyclists, two groups of road users the safety of which the strategy seeks to promote.

The Addis Ababa road safety policies and the VZ policy are also different in their use of educational and enforcement efforts. The primary difference is in the ultimate purpose of such interventions. The purpose of educational and enforcement interventions in the context of VZ is only for short-term safety improvement. From this perspective, it is recognised that education and policing will not provide the ultimate protection against fatalities and serious injuries in the road system. This is because of the basic underlying assumption in VZ that road users are fallible by nature. Therefore, it is accepted that despite educational and enforcement efforts, mistakes will be made. As a result, in VZ, the primary objective of road safety work is to eliminate road fatalities and serious injuries by creating an error tolerant road system. This means that even if road users continue to

make intentional and unintentional errors, the design of the road system should prevent severe health consequences. In general, control of harmful energy through safe road system design is the major strategy to prevent fatalities and serious injuries in VZ. In contrast, policing and educational efforts in Addis Ababa are the major interventions promoted to prevent accidents. The purpose of these interventions is to create law-abiding road users that always respect and operate according to traffic rules and regulations. However, this is problematic if we take into account the fact that road users are fallible by nature and we cannot really expect them to always act perfectly in road traffic. Another major difference is that in Addis Ababa educational interventions are used to raise awareness among drivers and road users on rules of proper conduct in road traffic. However, in VZ educational tools are primarily used to promote demand for safer vehicles and technologies. A very good example is the new car assessment programs (NCAPs) that have been promoted in Sweden since 1997. The purpose of this program is to assess, monitor, and communicate to potential buyers the safety level of cars available in Swedish vehicle markets. Similar assessment and informative programs in other countries have proved highly effective in raising levels of vehicle safety [1,43–45].

The Addis Ababa road safety work and the VZ also differ in terms of whom they present as ultimately responsible for addressing road safety problems. VZ recognizes and promotes the responsibility of system designers for road safety. Moreover, there are regulated responsibilities for stakeholders such as vehicle manufacturers, vehicle procurers, and road infrastructure owners and designers. The Addis Ababa road safety work recognizes the role and responsibility of lead agencies and other governmental and non-governmental institutions in the promotion of road safety in the city. However, the policy documents analysed do not express that the ultimate responsibility for road safety falls on the system designers. Moreover, although the policy documents identify, for instance, the importance of safe road designs it is not clear if the implementing agencies have a regulated responsibility to construct safe road infrastructures as per the design standards stated in the policy documents. Concerning the vehicle component, as well, the different policy documents do not identify and specify the role of government, vehicle manufacturers, importers, and procurers concerning the promotion of vehicle safety in the city. Both the Addis Ababa Road Safety Strategy and the NMT Strategy lack statements on the responsibility of vehicle exporters, importers, owners, buyers and the government in terms of how improvements to the vehicle component could enhance the safety of road users in the city. Vehicle safety improvement is not included in the future directions of road safety improvement listed in the Addis Ababa Road Safety Strategy, and the transport policy does not put future directions and strategies for vehicle improvement when it comes to addressing their road safety impacts.

5.2. Similarities

The analysis also shows that the Swedish VZ and the Addis Ababa road safety have some similarities. The most important features they share in common can be found in their goal formulations and the general road design principles they promote.

Similar to VZ, the Addis Ababa road safety work has a long-term goal of eliminating road fatalities and injuries. However, goal setting in road safety work in Addis Ababa seems to differ from VZ in that the prevention of fatalities and serious injuries is not the guiding ethical normative framework that determines the design and operation of the road transport system This means that although there is a goal of eliminating road trauma, the different policy documents in Addis Ababa do not commit to the ethical imperative that safety shall never be compromised for promoting mobility in the road system. Hence, the Addis Ababa policy documents do not commit to the prioritisation of safety in the design and operation of the road traffic system in a way that protects road users against fatal and serious injuries.

Another important similarity between VZ and the Addis Ababa road safety approach is their strategies for road design. For instance, the Addis Ababa NMT Strategy promotes

the scientific approach to road and street design promoted in VZ. The scientific approach is mainly based on the relationship between kinetic energy exposure and human physical tolerance. The NMT strategy, like the VZ, seeks to reduce allowed speed to a level where a fatal or severe injury will not occur if crashes occur between vehicles and vulnerable road users. It also stresses the need to physically separate vulnerable road users from fast moving vehicles in parts of the road system where higher speeds are required. The Addis Ababa road safety strategy also 'focuses on speed management as a high priority for protecting road users. In 2017, speed limits were reduced on many roads and new signage installed [. . .]. Design standards and model intersection transformations have also been put in place to reduce speed and overall risk to pedestrians' [38] (p. 2).

6. Discussion

Our analysis in this article shows that, when compared to VZ, the Addis Ababa road safety policies advance different views on what the ultimate cause of fatalities and serious injuries are in the road system, and in their responsibility ascriptions for road safety. Unlike VZ, the fact that the design and operation of the road system in Addis Ababa is not adapted to road users' limitations is not identified as a primary reason for why people are killed and injured in road crashes in the city. As a result, the policy documents do not commit to adjusting the design and operation of the road traffic system to road users' limitations as a primary way to prevent fatal and serious injuries. Moreover, policy documents overlook the responsibility of major system designers, such as vehicle manufacturers, foreign exporters, local importers, and procurers in the efforts to address road safety problems. Rather, road safety problems are mainly viewed as individual road user problems. As a result, road safety work promotes policies and strategies that primarily target individual road users, at the expense of other important system components.

The framing of road safety problems as individual road user problems and the associated emphasis on individual road user responsibility in the prevention of fatalities and injuries is partly because road safety work and road safety research in Addis Ababa relies on accident reports by the traffic police authorities. Traffic police are responsible for collecting road crash data in Addis Ababa and Ethiopia in general [46]. The normal procedure is that the police assess the crash situation depending on the available rules and regulations. The primary aim of the police investigation, therefore, is to identify who violated traffic rules and regulations [46] and not necessarily to investigate if and how fatal injuries could have been prevented through better road designs or vehicles safety. Due to a lack of knowledge and expertise, it is rarely the case that the police would also investigate the technical and safety problems associated with vehicle and road infrastructure designs. It is rarely the case that other experts, such as vehicle safety experts, road designers, and medical professionals conduct in-depth investigations of fatal road crashes to identify the contribution of other system components, such as the road and the vehicle designs, to the probability and severity of crashes. However, in the absence of a proper and holistic investigation of road crashes, it is difficult to identify the relevant multidimensional causal factors for road fatalities and serious injuries. This, therefore, calls for the importance of promoting an in-depth investigation of, at least some fatal and serious injury, crashes as it is being done in many places where the VZ and safe systems approaches have been adopted. For example, of such in-depth studies in Sweden and Norway, please see [47–51].

Significant safety improvement in low-income countries and cities such as Addis Ababa would necessitate designing and implementing holistic strategies and system wide interventions in the process of creating a safe traffic system. Most importantly, the overall design and operation of their road traffic system should recognize the fallibility and physical fragility of road users as its starting point. This means that, in the long run, the design of the road system needs to be adapted in such a way that it protects road users against harmful energy that could lead to fatal and serious injuries even when mistakes are committed.

Practically achieving this would require the promotion of proven road safety strategies and interventions in Vision Zero and systems approaches to road safety work. Accordingly,

since higher speeds are the main cause of fatal and serious injuries, the prime strategy to improve safety in Addis Ababa would be the implementation of a system wide speed reduction. This is particularly necessary given the low protective capacity of the road infrastructure and vehicles operating in the city. However, in order to enhance the effectiveness of system wide speed reductions, road transport, and safety practitioners could promote system wide adjustment of the road infrastructure with designs that would help drivers reduce their speed. In Ethiopia, roads are primarily built to cut travel time and this is often achieved by building roads that facilitate higher speed. However, evidence shows that newly built roads are hotbeds of fatal and serious injury crashes in the country [6], and this is primarily due to the higher speed involved [52]. In contrast, in countries that have promoted VZ and the safe systems approach, there is a shift towards road designs that nudge drivers operate their vehicles at reduced speed. For instance, narrow roads and roundabouts have become major characteristics of the Swedish road traffic system since the adoption of VZ and, as a result, speed related fatalities and injuries have significantly improved [53]. The significance of narrow roads is that in addition to their speed reducing effects, they are also effective in preventing, for instance, risky overtaking. From a VZ point of view, roundabouts are also very desirable because they reduce the speed at intersections, and, therefore, reduce the chances of fatal and severe injury crashes. However, the negative side of roundabouts is that they tend to increase the number of minor crashes at intersections [10]. Even then, from the VZ point of view, roundabouts are more preferable than traffic lights because the probability of fatal crashes is very low. The use of traffic lights has the opposite effect on safety. Even though the number of crashes that occur when traffic lights are used is low, the crashes that do occur tend to have fatal and severe consequences for the parties involved. Evidence from Addis Ababa, where traffic lights are the major safety interventions at intersections, also shows that intersections are prime locations for fatal and serious injuries [54]. Therefore, Addis Ababa might significantly improve road user safety at intersections if roundabouts become major safety interventions replacing the current emphasis on traffic lights. For Addis Ababa and other low-income countries where a shortage of electricity is often rampant, roundabouts would in addition be a more reliable safety intervention at intersections than traffic lights. Since roundabouts can easily be constructed, their use can also reduce procurement and maintenance costs associated with traffic lights.

However, in areas where higher speeds might be necessary, the VZ principle of separating motor vehicles from unprotected road users could significantly improve safety. There has already been an attempt at this in Addis Ababa with the implementation of elevated pedestrian crossings at some major intersections and high-speed roads. However, the effectiveness of this intervention has been questioned. For instance, Ref. [54] (p. 62) states that "Despite the availability of elevated pedestrian crossings on the fully access-controlled ring road in Addis Ababa, illegal pedestrian overcrossing is a major issue that increases the risk of fatal injuries. There are various approaches to address this problem, including increased police enforcement, increased provision of public transport, additional infrastructure (e.g., fences), and education campaigns." However, it should also be recognised that most pedestrian crossings in Addis Ababa suffer from major design defects in that they ignore the needs of certain groups of road users such as the elderly, children, and the disabled. They are often inconvenient, laboursome, and risky for these groups of road users. As a result, some people would, understandably, prefer taking a short cut to cross the road than climb the overcrossing. To enhance the effectiveness of such over-crossings, therefore, their design should be friendly to the interest of these neglected groups of road users. For example, instituting elevators could nudge the elderly and other road users to effectively utilize the over crossings. However, since this would be economically costly and inefficient in a setting like Addis Ababa where the electricity problems are rampant, it is important to supplement pedestrian over crossings with other road infrastructure designs that could facilitate safer crossing. For instance, introducing speed bumps or other speed

reducing interventions at pedestrian crossings could significantly improve safety in Addis Ababa city.

Evidence from VZ committed countries shows that proactively preventing fatalities and serious injuries requires emphasizing the role of certain system components that have the potential to significantly improve safety in the road system. A very important system component in this regard is the vehicle. However, in Addis Ababa and Ethiopia in general, there is a big lag when it comes to promoting vehicle safety. Given that up to 80% of vehicles imported to the country are second-hand vehicles, and the majority of these vehicles have an average age of 15 years [55], and given the fact that the country to this day has not adopted major international regulatory frameworks to control the safety of vehicles [56], there is a huge potential for enhancing road safety through in-creased vehicle safety requirements Experience from Sweden and many other countries shows that vehicle safety is important in protecting not only car occupants against risks of fatalities and serious injuries. Vehicle technologies are also important strategies used to induce desired behaviour in drivers and car occupants. The WHO [1] promotes standardising vehicle crashworthiness, the use of seat belts and seat belt reminders, airbags, automatic stability control systems, and alcohol interlocks. Mandatory requirements of these proven safety features on vehicles would have significant safety benefits for road users in Addis Ababa. Just to give a simple example, empirical evidence shows that the combined use of airbags and seat belts alone could prevent more than 80% of fatalities in head-on passenger car collisions [57]. A recent study on patients involved in motor vehicle accidents evaluated the effect of airbag and seat belt use on the severity of injury in traffic accidents and determined that the severity of the injury and the hospitalisation rate were lower in the restrained and airbag deployed patient group [58]. There is also a body of evidence showing that vehicles provide protection to pedestrians and cyclists [1,59].

In addition to improving the safety of occupants and unprotected road users, vehicle safety technologies play a significant role in promoting safe driving behaviour in road traffic. For instance, empirical evidence shows that the presence of automatic audible reminders significantly increases seat belt use. According to one study in Sweden, Ref. [60] seat belt use was 98.9% in cars with seat belt reminders, while in cars without SBR, only 82.3% of the drivers used the seat belt. Another observational study [61] in six European countries and five cities in Sweden showed a significant difference in seat belt wearing rate in the cars with seat belt reminders and those without. Recent studies also confirm the effectiveness and efficiency of these interventions in enhancing seat belt use [60,62–64]. It is, therefore, very important that cars operating in the city have automatic seat belt reminders to enhance seat belt use. However, road safety work should investigate and identify factors that could prevent the effectiveness of seat belt use and other technologies. For instance, with regards to seat belt use, it should be recognised that even in a situation where all occupants of a vehicle are wearing a seat belt, the likelihood that the seat belts protect passengers in case of a head-on collision depends highly on the speed and the weight of vehicles involved. In case of a head-on collision between a heavy freight vehicle and a passenger vehicle, it is less likely that occupants of the smaller car survive even if they are wearing a seat belt. In such situations, the best strategy to prevent fatalities and serious injuries to car occupants from head-on collisions is to physically separate on-coming traffic with the use of median guardrails or through the institution of 2 + 1 roads (2 + 1 roads have 'one continuous lane in each direction with a middle lane changing direction and a separating median barrier. This is created by introducing a continuous median barrier and adding overtaking lanes within an overtaking strategy. The differences are the existence of 1 + 1-sections, less overtaking opportunities, and a slightly narrower cross-section.' [65] (p. 331)). In Sweden, these interventions have proved to be effective in avoiding head-on collisions, and hence, fatal and serious injuries have been reduced on roads that received these treatments [53].

Another major vehicle safety technology that could help in promoting safe driver behaviour is the alcohol interlock. In traditional road safety work and in the moral analysis

of specific traffic crashes, the role of the vehicle component in crashes involving drunk driving is rarely discussed [66]. However, it should be noted that one way of addressing the problem of drunk driving is to design cars in such a way that drivers cannot start the vehicle if a certain amount of alcohol is detected in their blood. In the US, Australia, Sweden, and many other European countries, the alcohol interlock has proved effective in preventing drunk driving and recidivism, compared to other traditional measures such as education and policing [67]. Moreover, it has been argued that alcohol interlocks provide a way out of the morally problematic nature of heavy criminalisation of drunk driving [68]. In Addis Ababa too, the use of alcohol interlocks could be one way of addressing the problem of drunk driving, especially when it comes to professional drivers. Capable institutions that manage a large number of vehicles could be required to use alcohol interlocks. This could be relevant, for instance, on vehicles owned by foreign embassies, international NGOs and certain government organizations. Public and private school buses, taxi and ride sharing companies, and other key federal and regional institutions based in Addis Ababa could also be required to use this technology. Other government institutions in the city and public transportation providers such as the Anbessa Bus may gradually be required to apply the technology when the technology becomes cheaper and accessible for general use. Such technologies might also become a requirement on vehicles operated by drivers that have a history of recidivism in connection to drunk driving. However, road safety work should investigate, identify and address systemic factors that may significantly reduce the effectiveness of alcohol interlocks. One prime example of such a systemic factor is a national law on acceptable blood alcohol levels. In Ethiopia, the legal blood alcohol concentration is 0.08 g/dL for all types of drivers [1]. However, empirical evidence shows that the presence of any amount of alcohol in blood increases both the likelihood and severity of a crash [1]. According to WHO, "any amount of alcohol has been shown to impair driving behaviour, and there is a rapid and exponential increase in risk for levels exceeding 0.05 g/dL for the general driving population. Reducing blood alcohol concentration (BAC) from 0.1 g/dL to 0.05 g/dL may contribute to a reduction of 6–18% in alcohol related road traffic fatalities." [1] (p. 31). As a result, in many countries allowed alcohol blood concentration has been reduced to (0.05 g/dL) and to 0.02 g/dL for the general population and young novice drivers, respectively. Therefore, in order for a technology such as the alcohol interlock to be effective and efficient in reducing fatalities due to drunk driving, its use must be complemented by the promotion of stricter and scientifically supported alcohol blood level laws.

In general, in addition to the use of education and policing to promote sober and safe driving and seat belt use, road safety work in Addis Ababa should explore the use of proven vehicle safety features and technologies to this end. This, in turn, calls for the importance of promoting in-depth investigations into the causes of road crashes and the role of the vehicles involved. Since police officers are often not properly trained in analyzing and collecting data related to vehicle aspects, it is imperative that expert vehicle safety engineers are also involved in crash investigation and data collection. Moreover, whether vehicles operating in Ethiopia in general, and in Addis Ababa in particular, have proper safety features should be further investigated. To this end, Ethiopia and Addis Ababa could benefit from joining the Global New Car Assessment Programs (Global NCAP) and the 'Safer Cars' projects in Africa. The objective of these initiatives is to conduct crash tests to assess, rate, and communicate the safety level and protective capacity of different vehicle types manufactured and sold in the car market. These programs have proved very effective in promoting demand for safer vehicles and discouraging the production and procurement of unsafe vehicles in many other countries [69]. Similarly, by showing that old vehicles that lack relevant safety features are major risk factors, Addis Ababa city may discourage the increasing demand for old used vehicles. The city may also use similar campaigns like the ones used by the Global NCAP to discourage the manufacture, import, and procurement of unsafe vehicles. For instance, Global NCAP uses the #NoZeroStarCars campaign to 'name and shame' manufacturers that sell models that still fail to meet the most important UN

vehicle safety standards. Similar campaigns could be used in road safety work in Addis Ababa. In other words, rather than limiting educational and campaign interventions to the promotion of safe behaviour among individual road users, campaign and educational interventions could also be extended to promote demand for safer vehicles in the city and to discourage unsafe vehicles.

In conclusion, in order to gain considerable improvement in safety in the road system, it is imperative that road safety policies and strategies in Addis Ababa recognize that road safety problems are systemic problems primarily linked to defective road infrastructure design and vehicle safety problems. As evidence from Sweden and other VZ committed countries and cities show, framing road safety problems as systemic defects is important as it opens other major venues that provide effective and efficient ways of preventing fatalities and serious injuries in the road system. Among others, an emphasis on system wide strategies and interventions to mitigate harmful energy exposure is critical to significantly improving safety. Moreover, special attention needs to be put on improving vehicle safety by enhancing the responsibility of vehicle manufacturers, foreign exporters, local importers and sellers, and state and individual procurers. Introducing international vehicle safety regulations would have significant safety benefits. Moreover, policymakers involved in road safety work may benefit from strategies and interventions that could enhance demand for safer vehicles while discouraging heavy reliance on very old and unsafe vehicles. It is, however, very important to note that introducing proven safety interventions and strategies firstly requires breaking away from the traditional complacency towards road fatalities and serious injuries [70]. Road fatalities and injuries pose a major public health challenge to residents of Addis Ababa. Most of these fatalities and injuries are preventable if effective safety strategies and interventions are put in place. As in the case of Sweden and many other places that are committed to VZ and safe systems approach, the starting point for the promotion of proven road safety strategies is the ethical commitment that even one death in the road traffic is too many. It is highly important that road safety work in Addis Ababa also operates from a standpoint that presents road fatalities and serious injuries as morally unacceptable. Road safety work in the city and the public should challenge the view that fatalities and injuries are acceptable prices that should be paid for mobility and economic development.

7. Conclusions

This study made a critical analysis of the Addis Ababa road safety policies and strategies by using VZ as a normative framework. The assessment seeks to compare and evaluate three policy documents (Addis Ababa Road Safety Policy, the Addis Ababa Road Safety Strategy, and the Addis Ababa Non-Motorized Transport Strategy) to the VZ in terms of problem framing, goal formulation, responsibility ascription, and road safety strategies. The three policy documents analysed in this paper–the Addis Ababa transport policy, the city's road safety strategy, and the NMT strategy–are progressive policy documents that recognise the multifaceted and complex nature of road safety problems in the country. However, the policy documents lack an explicit ethical commitment to create a safe forgiving road system through the accommodation of fundamental road user limitations as the starting point for the design and operation of the road traffic. In order to address the growing problem of road fatalities and serious injuries, it is imperative that road users' fallibility and their physical tolerance to external violence become the normative starting point for the design and functioning of the road traffic system. Moreover, in addition to individual road user responsibility, road safety work in the city should emphasize the responsibility of key system designers such as vehicle manufacturers and procurers. The absence of a clear policy and strategy on vehicle safety and technology is particularly troubling given the low safety level of vehicles operating in the city. In countries that have registered significant safety improvement, such as Sweden, road safety work increasingly emphasizes the responsibility of system designers and the implementation of new innovative road designs and car technologies to help alleviate the problem of fatalities

and serious injuries. Such approaches to road safety could be important for cities like Addis Ababa in their efforts to prevent fatalities and serious injuries. However, implementing bold and proactive strategies would first require viewing fatalities and serious injuries in the road system as morally unacceptable.

This research is an important contribution to road safety research in low-income countries where road safety problems continue to rise despite efforts to contain the problem through different policies and strategies. The VZ approach to road safety work, on the other hand, is one of the successful road safety policies currently recognised by the major international institutions such as the UN, and WHO in the efforts to address road safety problems. Some of the major principles underlying the UN's decade of action for road safety are the contributions of VZ. Therefore, it is very important to compare and contrast road safety policies in cities such as Addis Ababa, with successful road safety policies such as VZ to better understand how they frame road safety problems, distribute responsibility for road safety, and the nature and type of interventions they promote to address road fatalities and injuries.

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