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ABBREVIATIONS AND ACRONYMS

ABS	Anti-Skid Braking System
APRP	Annual Public Roads Programme
ASIRT	Association for Safe International Road Travel
AU	African Union
BAC	Blood Alcohol Content
AVIS	Assessment of Vehicle Inspection Schemes
CITA	International Motor Vehicle Inspection Committee
CRS	Civil Registration Services
EMS	Emergency Medical Services
EMT	Emergency Medical Technician
EOC	Emergency Operation Centre
ERSF	European Road Safety Federation
EU	European Union
FBO	Faith Based Organization
FY	Financial Year
GDP	Gross Domestic Product
GRSP	Global Road Safety Partnership
GVW	Gross vehicle weight
HGV	Heavy Goods Vehicles
HI	Handicap International
HR	Human Resource
IAC	Inter-Agency committee
iRAP	International Road Assessment Programme
IRF	International Road Federation
IRTAD	International Road Traffic and Accident Database
ITF	International Transport Federation
JAES	Joint Africa-EU Strategy
JICA	Japan International Cooperation Agency
KPA	Key Result Area
KPI	Key Performance Indicator
LMIC	Low- and Middle-Income Countries
MoH	Ministry of Health
MTP	Medium Term Plans
NCAP	New Car Assessment Programme

NDMU	National Disaster Management Unit
NGO	Non-governmental organizations
NHTSA	National Highway Traffic Safety Administration
NTSA	National Transport and Safety Authority
OECD	Organisation for Economic Co-operation and Development
P2W	Powered two wheel vehicle
PHTLS	Pre-Hospital Trauma Life Support
PSV	Public Service Vehicle
PVS	Public service vehicles
RES	Resolution
RSM	Road Safety Management
RSMCR	Road Safety Management Capacity Review
RTA	Road traffic Accident
SER	Self-Explaining Roads
UEMOA	Union Economique et Monétaire Ouest Africaine; or WAEMU West African Economic and Monetary Union
SLA	Service Level Agreements
SOE	State Operated Enterprises
SPI	Safety Performance Indicators
SPR	Special Purpose Roads
SWOT	Strengths, Weaknesses, Opportunities, and Threats
SWOV	Stichting Wetenschappelijk Onderzoek Verkeersveiligheid
SWRW	Safe Way Right Way
TAHN	Trans-African Highway Network
TIMS	Transport Integrated Management System
TTTFP	Tripartite Transport and Transit Facilitation Programme
UK	United Kingdom
UN	United Nations
UNECA	United Nations Economic Commission for Africa
UNECE	United Nations Economic Commission for Europe
UNRSC	United Nations Road Safety Collaboration
USA	United States of America
VOSL	Value of Statistical Life
WB	World Bank
WP	Work Package

1 Introduction

Road and vehicle design standards form the support for setting the requirements with respect to road planning, design, maintenance and operation and for allowing and operating vehicles and participating in the traffic on public roads. Internationally both these domains have evolved, and various standards organisations have adopted international treaties and requirements to provide some form of standardisation and uniformity when it comes to road and vehicle design. These treaties not only serve to improve the quality of roads and vehicles but more importantly aim to ensure that these provide optimal levels of safety to eliminate/reduce crashes or at worst, to ensure that the effects of crashes on injuries are minimised (Schermers *et al.*, 2019).

In terms of both road and vehicle standards countries on the African continent have been found to be lagging behind most international standards and practices (World Health Organisation, 2015). Generally, vehicles in African countries are old, poorly maintained and regulated. The same applies to the road networks in many African countries and this has added to the growing road safety problem being experienced in many African countries.

1.1 Road design standards

Roads and particularly public roads are designed and built according to set standards. These are generally adopted by authorities responsible for road infrastructure in a country and provide a basis for stipulating quality standards for roads.

Road design standards apply to the design, construction, maintenance and operation of roads and are generally supported by guidelines and standards for aspects related to road signs and markings, signalisation, fencing, and verge management and others. In the context of SaferAfrica, and in particular Task 5.5 of Work Package 5, the focus is on particularly the (geometric) design of roads which is the most closely linked to road safety and is intended to ensure that roads are designed to provide adequate levels of safety given the selected designs speeds. This report will not deal with aspects related to pavement design and construction, bridge and tunnel design and construction, materials, etc. since these fall outside the scope of this study.

Geometric design of roads relates to the positioning of the road and its elements in a given physical (and financial) space with the aim of optimising the efficiency and safety of traffic that is expected to use the road and with minimal impact to the environment. Geometric design of roads deals with the horizontal and vertical alignment of the road and its cross-section and intends to ensure that a roadway is built in such a way that it does not surprise road users and allows them enough time/space to correct for errors or avoiding dangerous situations.

Task 5.5 of the SaferAfrica project aimed to develop recommendations fostering the adoption of continental standards for vehicles and road infrastructures through the improvement and/or integration of current legislations.

This short report will focus on these standards in Burkina Faso, based on the Capacity review made in task 5.3 from the same work package 5; as written down in the deliverable 5.3e (Cardoso, et al. 2018).

Although the most important issues are already described in deliverable 5.3e (and for a part also in deliverable 5.1e (Vandemeulebroek & Kluppels, 2017)), this report will summarize the essential findings and make more concrete suggestions for improving the road infrastructure and vehicle legislation in Burkina Faso.

1.2 Vehicle standards

Regarding vehicles, the situation is more homogeneous. Vehicle manufacturers, try to produce them in a relatively standardised way, although in those regions without enforcement of standards, there is a clear lack of safety performances[1].

Any comprehensive road safety policy shall contain provisions to ensure that vehicles entering into the fleet fulfil some minimum requirements, and those requirements are kept, in a reasonable way, as long as the vehicle is on the road.

Vehicles may enter a country as new or used and, therefore, it is necessary to set the criteria to accept vehicles in both cases. Regardless of the usage of the vehicle, all countries submit them to registration. This administrative procedure is the right moment to assess if vehicles fulfil the minimum standards required in that country.

Once vehicles are on the road, many things may happen: breakdowns, tear and wear, modifications, crashes, maintenance, change of use[2], etc. It is necessary to set up the right scheme to ensure that vehicles keep their performances above a minimum level. The two key tools for roadworthiness are unexpected road-side inspection and periodical vehicle inspection.

Since the conception of vehicles has a global approach, it makes sense to take advantage of the already existing international frameworks of vehicle standardisation, and in particular of the UN Agreements of 1958 and 1998 for new vehicles and 1997 for periodic technical inspections. Standards are already defined and available.

There are many advantages to adhere to an already existing vehicle standardisation scheme:

- The European Union and many other regions in the world are already applying them: vehicle manufacturers are used to UN Regulations and setting up additional requirements may increase the price of vehicles;
- It is not necessary that countries applying the standards to build expensive testing facilities since they can recognise the tests and approvals undertaken in other parts of the world;
- Countries may decide the degree of implication they want to have with standards: full mutual recognition or just acceptance
- Countries always can keep their sovereignty regarding the entrance of vehicles

Disclaimer
All reasonable efforts have been taken to identify the right regulatory framework, although there is no complete certainty that all legal texts are considered for each country. Additional or different legal documents may change the considerations of this document. Authors can't be liable in that case.

[1] http://www.globalncap.org/

[2] Example of change of use: the same car is submitted to quite different conditions if used privately or as a taxi

2 Consolidation of the capacity review and literature results

This chapter partly includes the main conclusions from the capacity review (Cardoso, et al., 2018) concerning both subjects of this deliverable: road infrastructure and vehicle standards. For each, a short description of the actual situations is given to understand a little bit more of the reality in which the legal standards or directives are applied (or not).

The second part of each subchapter shows the current state of affairs with regard to the existence and application of official guidelines in the country.

2.1 Road Infrastructure

2.1.1 Burkina Faso and its road network

Located in West Africa, Burkina Faso has a surface of 274.200 km², hosting according to the 2017 projections of the National Institute of Statistics and Demography (INSD) a population of 19 632 147 inhabitants. Burkina is a rural country where only 30% of the population lives in urban areas, mainly in Ouagadougou and Bobo-Dioulasso. If currently, Burkina Faso is one of the least urbanized countries in the world, urbanization is accelerating under the effect of the rural exodus. Uncontrolled, urbanization is reflected in a proliferation of informal settlements creating new challenges, particularly in terms of road safety.

Burkina Faso's road network includes 15304 km of classified roads, 350 km of urban roads and almost 46000 km of unclassified rural roads (2014). Almost 3650 km of classified roads are paved roads and the remaining 11660 km of dirt roads.

Figure 1 shows the distribution of roads by pavement category. Six categories of roads are considered by the National Institute of Statistics and Demography: paved roads, dirt roads with modern geometry, ordinary dirt roads, improved 'type A' tracks, improved type B tracks and ordinary tracks. The general technical characteristics of each of its road categories are presented in Appendix 7.4.

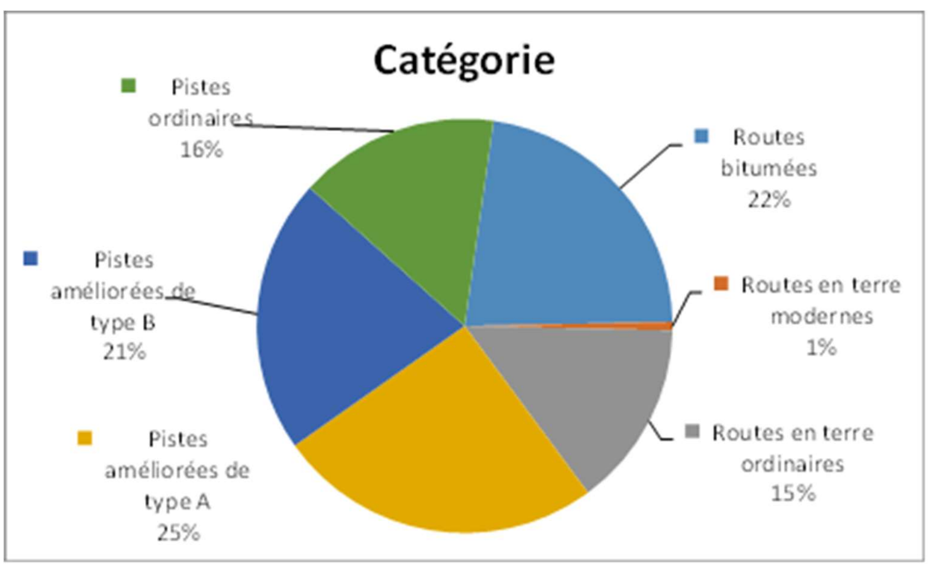

Figure 1: Distribution of the road network of Burkina Faso by road category (Source: INSD, 2017)

This categorization is not based on the functionality of roads but on the type of surface and the possibility and/or the necessity to maintain and to stabilize the road.

It's clear that only 22% of roads in Burkina Faso are paved roads. Nevertheless, the road network is of big importance. Burkina Faso itself, but also other countries as Mali and Niger, depends a lot on the trades with the West-African countries on the see-side. According to the statistics of the National Institute of Statistics and Demography (INSD), nearly 70 % of merchandise trade is by road (totalling approximately 2.020 thousand tons per year).

To realize this, fifteen international axes have been developed:

1) Ouagadougou - Koupèla - Fada N'Gourma - Kantchari - (Niger)
2) Ouagadougou - Koupèla - Tenkodogo - Bitou - (Togo) et (Ghana)
3) Ouagadougou - Pô - (Ghana)
4) Ouagadougou - Léo - (Ghana)
5) Ouagadougou - Kaya - Dori - (Niger)
6) Ouagadougou - Yako - Ouahigouya - Thiou - (Mali)
7) Bobo-Dioulasso - Faramana - (Mali)
8) Bobo-Dioulasso - Orodara - Koloko - (Mali)
9) Bobo-Dioulasso - Diébougou - (Ghana)
10) Yako - Koudougou - Léo - (Ghana)
11) Bobo-Dioulasso - Ouessa - (Ghana)
12) Ouagadougou - Bobo-Dioulasso - Léraba - (Côte d'Ivoire)
13) Diébougou - Gaoua - Kampti - (Côte d'Ivoire)
14) Sakoinse - Koudougou - Dédougou - Nouna - (Mali)
15) Fada N'Gourma - Pâma - (Bénin)

These international roads get prior attention by the government and most of the funding for maintenance is dedicated to these roads.

Some first conclusions:

- Road traffic is the economic engine of the country; in their absence, the country would be isolated commercially.
- Most roads are unsealed (non-paved) roads, and nearly 50% of all roads are categorized as 'tracks' of which maintenance and sanitation works are only provided exceptionally.
- While inadequate infrastructure is certainly one of the causes of accidents in Burkina Faso, the misuse of infrastructure is also a problem. Thus, according to the General-Directory of the Road Infrastructure. DGIR, it is not only a question of making improvements to the road network but also of raising awareness of the good use of roads

2.1.2 Legislation on road infrastructure

Burkina Faso is a country in full development, with a concrete action plan for road safety and a lot of different legal documents on standards and directives. Both will be described in general terms.

Action plans

Based on the 'Plan of Action of the Decade of African Road Safety: 2011-2020' of WHO, a national road safety action plan for 2011-2020 was adopted by the National Road Safety Council on July 26, 2011. It is a multisector plan with the national objective of halving the number of accidents and a 25% reduction in the number of people killed by 2020.

The Burkinabe Plan defines strategic axes whose measurable and achievable objectives are planned in the short and medium-term. Component 4 on road infrastructure contains four axes:

1) Define norms for the design and the construction of roads
2) Reduce 'accident black spots'
3) Reinforce and improve the signalization on roads
4) Control the speed on roads.

Component 4 Improvement of the road infrastructure	4.1 define norms for the design and the construction of roads	○ develop standards for the technical conditions for the development of road infrastructures; ○ develop standards on the use of natural materials in the construction of road infrastructure; ○ develop regulatory and technical texts for road signs; ○ develop and apply the texts relating to the evaluation of road projects and the audit of existing road infrastructures.
	4.2 reduce accident black spots	○ Develop a program to identify black spots of accidents; ○ Develop a program to treat black spots of accidents.
	4.3 strengthen and improve signage on roads	○ carry out a technical audit of traffic signals in the cities of Ouagadougou and Bobo-Dioulasso; ○ carry out an audit of road signs on paved roads; ○ develop and implement a Road Signage Master Plan; ○ improve the training of local teams responsible for signing road works; ○ improve user protection at level crossings; ○ strengthen and maintain road markings.
	4.4 improve shoulders on asphalt roads	○ prepare a sidewalk and shoulders program in major urban centres; ○ generalize raised, wide and continuous sidewalks in urban areas, to protect pedestrians from vehicles; ○ develop footbridges for pedestrians; ○ create rest areas, parking areas and car parks outside the road right of way.

Table 1: Component 4 of the National Road Safety Plan for Burkina Faso (source: ONASER)

Besides a National Road Safety Plan, also the municipalities have to develop a communal plan for road safety. The commune of Ouagadougou is the only commune in Burkina Faso for which an action plan has been published for road safety (www.mairie.ouaga.bf). The plan, which spanned the 2012-2016 period, was established as part of the implementation of the "Joint Program for Strengthening Urban Security" under the UN-Habitat Program and also following the adoption of the national plan for road safety. Therefore, the plan incorporates the objectives of the National Plan at the scale of the city of Ouagadougou. The goal was to "halve the number of traffic accidents and reduce by 25% the number of fatal accidents in the city of Ouagadougou by 2012".

During the visits to the streets of Ouagadougou in the framework of the capacity review, the authors observed that many asphalt roads still have to undergo the interventions provided for in the road safety plan. The redevelopment of non-bituminous roads in urban areas is less obvious because if redevelopment is necessary, especially to improve the conditions of access to residences, in the current state the speeds are controlled and maintained at a low level

Even at the national level, it seems that the implementation of the National Plan is facing difficulties mainly related to the lack of financial means. Indeed, if the overall budget for the implementation of the plan is estimated at 32 400 000 000 CFA francs (49 393 000 €), there is no financial partner for the implementation of the plan. Each responsible structure listed in the Plan must mobilize its own human and financial resources, in addition to other missions. Even the ONASER, the main body in charge of the implementation of the plan is only 20% funded and must therefore mainly self-finance through the controls it organizes. This lack of staffing dedicated to the execution of the Plan is undoubtedly the main problem with the good execution of this one.

Agencies responsible for the road infrastructure

The Ministry of Infrastructure is responsible for infrastructure, transport and to look for access to the whole country. Until recently, the Ministry had a single Directorate General of Roads, which was divided into four directions; each of them has the competence for a specific issue on road infrastructure.

1) La ***Direction Générale de l'Entretien Routier -DGER*** (The Directorate General of Road Maintenance) is in charge of the **maintenance** of the roads The priority of the road works is done on the basis of ***the intensities of the traffic*** (counts twice a year), the ***economic needs*** and ***the political choices.*** Accident statistics and analyses would also be taken into account in the planning of the road works. The administration would have a database of accident zones provided by ONASER.
2) La ***Direction Générale de la Normalisation, des Études Techniques et du Contrôle -DGNETC*** (The General Directorate for Standardization, Technical Studies and Control) is responsible for monitoring projects from preliminary studies to financing through the road safety audit. For each project, a support committee, made up of the various stakeholders, is set up by the management to **validate the final plans**. Any subsequent modifications by the DTR must be validated by this committee.
3) La ***Direction Générale des Infrastructures Routières -DGIR*** (The General Directorate of Road Infrastructure) and the *Direction des Travaux Routiers* - DTR (Directorate of Road Works) are charged with the **execution of the different projects and the follow up of the work zones.**
4) ***La Direction Générale des Pistes Rurales - DGPR*** (The General Directorate for Rural roads) is in charge of the different **rural roads** in the countryside.

2.2 Vehicles

2.2.1 Burkina Faso and its vehicle fleet

Burkina Faso's fleet of vehicles is large and growing. We observe an increase in the number of vehicles regardless of the category, the number of motorized two-wheelers has almost doubled between 2012 and 2016. The number of motorcycles registered in 2016 was 2,051,103, corresponding to 85.7% of all vehicles registered in Burkina Faso (Figure 2).

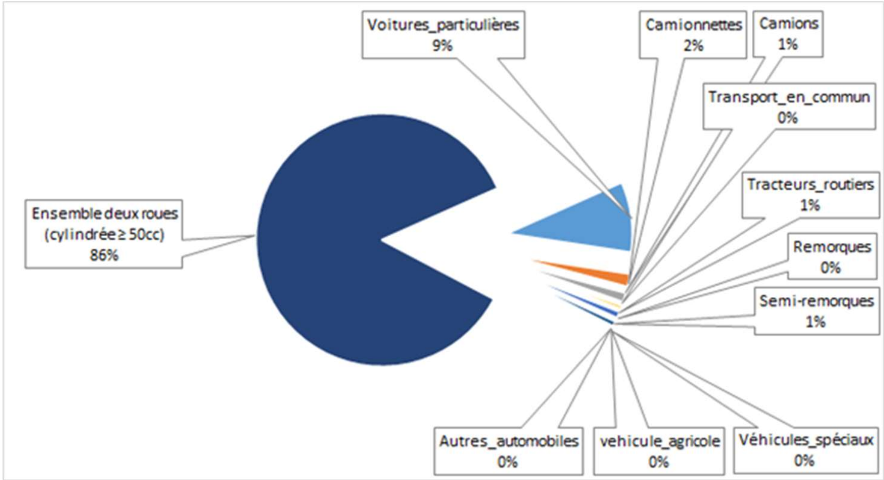

Figure 2: Distribution of different vehicles in 2016 (Source Cardoso et al., 2018)

If we can see an increase in the number of vehicles for all categories, we note that the increase in motorized two-wheelers is exponential. Figure 3 shows the evolution of the growth rate of four categories of vehicles with the year 2007 as a reference. If for personal vehicles and trucks there is a doubling of the rate of increase, the growth rate of motorized two-wheelers has been multiplied by 5.75!

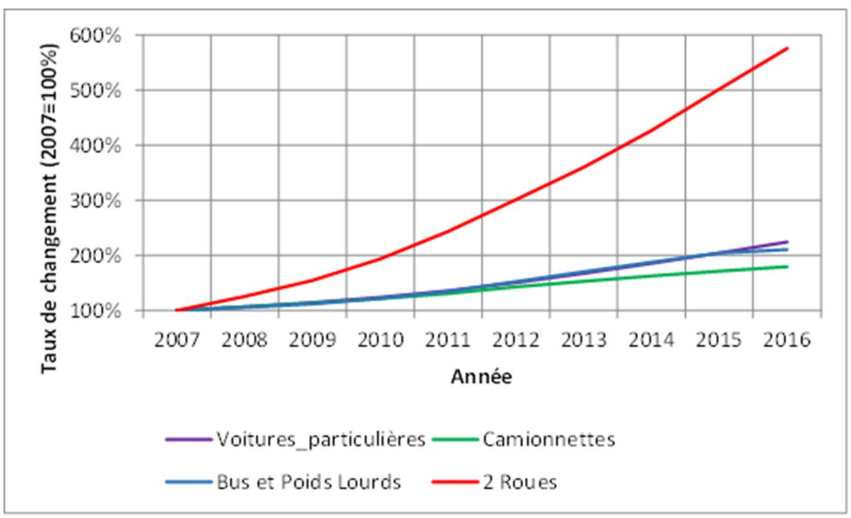

Figure 3: Evolution of the fleet of vehicles in Burkina Faso (Source: Cardoso, et al., 2018)

If the different figures presented above clearly show the importance of motorized two-wheelers in the Burkinabe traffic, it is important to specify that the real share of powered two-wheelers is even more important. Indeed, the figures only include motorized two-wheelers over 50cc and registered. But in reality, there are also many motorized two-wheelers of a lower or unlicensed cylinder capacity circulating in Burkina Faso. In the past years, a lot of these P2Ws with limited power (< 50cc) are brought into the country, especially from Chinese manufacturers. These vehicles do not meet all safety standards and should not be approved. The major risk of these vehicles is their speed: they can easily reach a speed of 120, and sometimes even 160 km/h.

For other four-wheeled motorized vehicles, it is important to note that they are essentially used vehicles. Thus unlike 2WDs, 80% of the 4WDs in circulation in Burkina Faso are vehicles coming mainly from Europe (they call them "France au-revoir" (France bye-bye)

The results of the capability inception report show that vehicles entering the fleet are coming from third countries since there is only a limited infrastructure to assemble two-wheelers. The report shows as well the only available legal framework is for vehicles in use: Joint Decree No. 2010-002/MT/MEF/DEF/SECU[3].

CCVA – *Centre de Contrôle des Véhicules Automobiles* or Inspection Centre for Road Vehicles – is responsible for vehicle inspection. They are also in charge of authorising the entry into circulation of vehicles.

Periodical inspection has a frequency between 3 and 12 months, depending on the category of the vehicle and missing the inspection is entitled to a fine and vehicle immobilisation.

As the main remark, most of the referenced documents are in paper and in some cases, they were not be properly updated.

2.2.2 Legislation on vehicles

Action Plan

One of the major road safety problems in Burkina Faso is certainly the poor condition of the vehicles in circulation. In March 2008, the Ministry of Transport put in its plan three axes to improve the technical state of the vehicles:

1. The reinforcement of the technical control;
2. Regulations concerning the importation of used vehicles;
3. Improving the professionalism of garage owners.

[3] *Arrêté conjoint Nº 2010-0002/MT/MEF/DEF/SECU modifiant le Raabo Nº 86-60/CNR/MTC/DTR du 23 juin 1986 portant instauration de la visite technique pour les véhicules automobiles au Burkina Faso*

Component 3: safer vehicles	3.1 reinforce the technical inspection	○ define a specification for the technical control of motor vehicles; ○ introduce mobile controls on national and secondary roads; ○ make compulsory the equipment of the carts in retro-reflectors;
	3.2 regulating the importation of Used vehicles	○ consider reducing customs duties and taxes on second-hand vehicles of acceptable age; ○ limit the import of used vehicles of advanced age to ten years; ○ to propose a draft joint decree on the conditions of imports of used vehicles; ○ propose a draft decree on the upgrading of motor vehicles; ○ to propose a specification for the importer of second-hand vehicles (subject to examination by the ministries responsible for transport and trade); ○ propose a specification of the automotive expert;
	3.3 improve the professionalism of garages	○ organize advanced training courses for garages in large urban centres; ○ Encourage garages to recycle periodically; ○ propose a draft decree on the organization of the garage profession; ○ propose a draft decree laying down the conditions for opening, operating and classifying garages; ○ certify the garage trade and control this certification; ○ encourage garages to put in place a mechanism for rapid technical assistance for vehicles that have broken down on the roads

Table 2: Component 'safe vehicles' of the National Road safety Plan of Burkina Faso (Source: ONASER)

Agencies responsible for the component 'safe vehicles'

The ***Directorate-general of Land and Maritime Transport*** (*La Direction-Générale des Transports Terrestres et Maritimes – DGTTM*), as part of the Ministry of Transport, Urban Mobility and Road Safety, has two divisions which are responsible for this component:

- The Directorate of Studies and Legislation (*La Direction des Etudes et de la Législation - DEL*), whose role is the development of regulations, the design and planning of projects and programs of the DGTTM;
- The Road Traffic and Standardization Department (*La Direction de la Circulation Routière et de la Normalisation- DCRN*) which is responsible for, among other things, technical control and driving licenses;

Since 2008, the ***National Office of Road Safety*** (ONASER) has taken over part of the missions and activities of the DGTTM. Concerning safe vehicles the following tasks are executed by ONASER. Concerning 'safer vehicles', ONASER controls trucks on major roads in order to avoid / limit damage to overweight roads. For these controls, ONASER works in collaboration with the police.

The technical control of vehicles is executed by the ***Motor Vehicle Control Centre (CCVA)***, which is a private company. The company is created in 1986 after the modification of the law on vehicle technical control. Before its creation, in the 1980's, the technical control consists only of visual control and concerned only public transport vehicles, vehicles for the transport of goods and taxis.

The legal framework

The legal frame instrument in Burkina Faso is the Traffic Act – *Code de la Route*. It specifies that all motor vehicles and trailers above 750 kg of GVW shall be submitted to approval before being used.

The Traffic Act describes some features of vehicles, but not performances. I.e. it describes the braking systems but it has not been possible to find performance requirements like those contained in UNECE Regulation 13 / 13 H[4].

Furthermore, whereas the Traffic Act defines type approval and individual approval, it is not clear which governmental agencies are in charge of that, which is the precise procedure to follow, which are the technical requirements in force, how those requirements shall be proven, and if requirements include either new or used vehicles entering the country.

It is important to mention that Burkina Faso is one of the countries forming the WAEMO – UEMOA. Therefore, WAEMO Directives apply. Section 3.6 of this document contains a more detailed approach to the WAEMO framework

Regarding in-use vehicles, Burkina Faso has set up the scheme to control vehicles in use by means of mandatory periodic technical inspection. The frequency of tests varies from 3 to 12 months, depending on the category of vehicles[5] and it includes two-wheelers:

- Taxis and public passenger transport vehicles: 3 months
- Utility and commercial vehicles less than 3.5 tons GVW: 6 months
- Goods transport vehicles of more than 3.5 tons GVW: 6 months
- Tricycles and light quadricycles: 6 months
- Motorcycles: 12 months
- Private vehicles: 12 months

CCVA is the company responsible for the inspections The Burkinabe Government owns 49% of its shares.

The main problem of periodical inspection in Burkina Faso appears to be the amount of vehicle missing the inspection, even if that is sanctioned with fines and immobilisation of the vehicles. That issue is particularly important with motorcycles.

Two-wheelers are the most popular vehicles, with ca. 1.500.000 in a fleet of around 1.750.000[6]. That presents an issue regarding mopeds, the small two-wheelers with limited maximum speed[7]. In many cases, mopeds are tampered to remove the speed limitation and reach speeds often higher than 100 km/h, whereas breaks and other components are not necessarily designed for those requirements.

The most relevant legal documents applicable in Burkina Faso in the field of vehicles requirements is the following one[8]:

- *Décret 73-308-PM-MTP du 31 décembre 1973 portant règlementation de l'usage des voies routières ouvertes à la circulation publique* ; on the use of public roads.
- *Le KITI N°86-136/CNR/PRES/MTC du 30 avril 1986 portant création du Centre de Contrôle des Véhicules Automobiles* ; on the implementation of the technical vehicle inspection centre.

[4] This link contains the complete list of UNECE Regulations: https://www.unece.org/fileadmin/DAM/trans/doc/2019/wp29/ECE-TRANS-WP.29-343-Rev.27.pdf

[5] Presentation of CCVA in the RAG Africa Meeting of CITA, Mrs Zalissa Koumare, 30.10.2018

[6] Data corresponding to 2015: presentation of CCVA in the World Bank, Mr Kanvaly Bamba, 08.03.2017

[7] The speed limit for mopeds in the European Union is 45 km/h

[8] Presentation of CCVA in the RAG Africa Meeting of CITA, Mrs Zalissa Koumare, 30.10.2018

- *ARRETE CONJOINT N° 2010-002/MT/MEF/DEF/SECU, modifiant le RAABO N°86-60/CNR/MTC/DTR du 23 juin 1986 portant instauration de la visite technique pour les véhicules automobiles au Burkina Faso* ; on the requirements for technical vehicle inspections.
- *DECRET N°2001-185/PRES/PM/MEE du 07 mai 2001, portant fixation des normes de rejets de polluants dans l'air, l'eau et le sol* ; fixing the requirements for pollutant emissions (to the air, on the water and on the ground).
- *DECRET N° 2012-559/PRES/PM/MTPEN/MEF/MICA/MATDS/MID portant conditions et modalités d'exploitation à titre onéreux et pour compte propre des vélomoteurs, motocyclettes, tricycles et quadricycles à moteur*; on the conditions and arrangements for the operation of motorcycles, motorcycles, tricycles and motor quadricycles.
- *CONVENTION N° A/P2/6/82 portant règlementation des transports routier INTER-ETAT de la COMMUNAUTÉ ECONOMIQUE DES ETATS DE L'AFRIQUE DE L'OUEST*; regulating international road transport in the UEMOA.
- *Le RÈGLEMENT N°14/2005/CM/UEMOA du 16 décembre 2005 relatif à l'harmonisation des normes et des procédures du contrôle du gabarit, du poids, et de la charge à l'essieu des véhicules lourds de transport de marchandises dans les Etats membres de l'UEMOA*; on the harmonisation of standards and procedures for the control of the dimensions, weight and axle load of heavy goods vehicles in the UEMOA.
- *La DIRECTIVE N°16/2009/CM/UEMOA relative au contrôle technique automobile dans les Etats membres de l'UEMOA*; on the technical control of vehicles in the UEMOA.

Conclusions

Although there is some legislation on vehicle safety standards and there is an obligation to go to the technical inspection, directives and laws are difficult to find. Mostly, the agencies refer to international documents.

The National Road Safety Plan has formulated very concrete and relevant actions, but it looks like that there was not enough progress since that time.

3 Assessment of Burkina Faso vehicle and road design standards and legislation

This section combines the analysis of the capacity review and inception reports of section 2 with additional information retrieved from each country. In the case of vehicles, it follows the same approach used in other sections: requirements for new vehicles, requirements for used imported vehicles and requirements for vehicles in use.

3.1 Road Infrastructure

3.1.1 Standards for road infrastructure

French road design standards are widely used for geometric alignment, drainage, and pavement design, as well as to select road restraint systems; the use of French technical documents is widespread for designing road signs (vertical signs and markings) and signals. However, due to the lack of adaptation to Burkinabe conditions, these standards are not mandatory. The road network of the country is therefore not completely homogeneous in its design and signing, hindering the establishment of an intuitive network (self-explaining). An intuitive network is, however, one of the essential requirements of a safe system.

One major obstacle to the effective adoption of French road design guidelines relates to the hierarchical classification of the Burkinabe road network. In fact, different criteria apply in France to each road category (e.g. interurban motorways, urban motorways, interurban roads, and departmental roads) and it is not clear which correspondence has been established between these road categories and the road network categorization established in Burkina Faso (e.g., the one adopted within the AU agreement on Trans-African Motorway Network).

During the road safety management capacity review it was not possible to verify the existence of national design guidelines for urban streets and road transport hubs, or to identify the use of a recommended document for this purpose in the city of Ouagadougou.

The absence of uniform rules for the establishment of adequate speed schemes (in the open countryside, medium-sized agglomerations and small agglomerations), the mixed nature of traffic on rural roads (especially in certain major route connections) and inadequate speed calming bumps are as much problems, related to the absence of official guides for the design of roads, mentioned during the interviews with the General Directorate of Road Infrastructures.

It is important to note that the development of new road construction standards is included in the national road safety plan. According to the information collected on the spot, it seems that a standard harmonization project within the West African Economic and Monetary Union (WAEMU-UEMOA) member countries also exists.

The specific documents, the Ministry of Land Transport is referring to are:

- *Aménagement des Routes Principales (ARP*), the French guidelines for the design of interurban trunk roads https://www.scribd.com/doc/220912955/amenagement-des-routes-principales-ARP-pdf
- *Instruction sur les Conditions Techniques d'Aménagement des Voies Rapides Urbaines (ICTAVRU)*, the French guidelines for designing high speed urban roads and motorways http://www.bv.transports.gouv.qc.ca/mono/1006799.pdf

- *Instruction sur les Conditions Techniques d'Aménagement des Autoroutes de Liaison (ICTAAL)*, the French guidelines for designing interurban motorways http://dtrf.setra.fr/pdf/pj/Dtrf/0002/Dtrf-0002540/DT2540.pdf
- *Instruction interministérielle sur la signalisation routière du 22 octobre 1963* (France), on road signing and signalling http://www.equipementsdelaroute.developpement-durable.gouv.fr/les-versions-actualisees-a-fevrier-2016-de-l-a442.html
- *Directive n°11/2009/CM/UEMOA*, on the harmonisation of road maintenance strategies in the UEMOA member states http://www.droit-afrique.com/upload/doc/uemoa/UEMOA-Directive-2009-11-harmonisation-strategie-entretien-routier.pdf
- *Règlement N°08/2009/CM/UEMOA*, on the adoption of the status of the UEMOA community road network, and corresponding management procedures, including three annexes, one defining technical characteristics http://www.uemoa.int/sites/default/files/bibliotheque/reglement_08_2009_cm_uemoa.pdf
- *Avant-projet d'Accord intergouvernemental pour l'harmonisation des normes et standards sur le réseau autoroutier transafricain*, on the intergovernmental agreement for the harmonization of standards on the Trans-African Highway Network (THAN) https://au.int/sites/default/files/newsevents/workingdocuments/29736-wd-f_-_projet_daccord_intergouvernemental_sur_les_normes_et_standards_des_ata.pdf , which includes five annexes , including:
    - Annexe II- General guidelines for the design, construction/reconstruction, rehabilitation and maintenance of the Trans-African Highway Network https://au.int/sites/default/files/newsevents/workingdocuments/29736-wd-f_-_ata_annexe_ii_directives_de_base_pour_la_classification_et_standards.pdf
- *Décret 2012-1111* (Burkina Faso) contains the conditions for installation and construction of speed bumps, as well as the standards to apply in their design and construction.

The mentioned French guidelines were published by SETRA, in France.

3.1.2 Methodology used for the assessment

The assessment of road design standards was based on the available documents that were gathered during the capacity review visits and a further search with the help of Casimir Sanon (HI) who has a big experience in Burkina Faso.

The different documents were analysed following the proposed tables from the Dutch study on road design standards, which followed the methodology used in the European Road Safety Federation INTERSAFE study (ERSF, 1996), where several geometric design elements were identified and used to define individual design features, categorised as basic assumptions (24 - 25 features), alignment (21 - 22 features), cross-section (22 -26 features) and intersections/interchanges (23 - 30 features). Originally, we only could indicate to what extent some of the issues mentioned in the table were also present in the different documents. Because the different documents that were made available to us were not from the Burkinabe government itself, we could not give a lot of details – even because for some design elements the standards were not detailed and in some cases they are even contradictory.

As mentioned previously, it was not possible to determine which road design guideline is currently used in the country for each road category. Therefore, a comparison was also made of the requirements from the UEMOA and AU strategic documents; and ARP for single carriageway roads, or ICTAAL for motorways. These French documents are in line with the Technical Guide on Road Safety for Interurban Roads developed within the European Road Safety Federation INTERSAFE study, for Europe (ERSF, 1996), in which several geometric design elements were identified and used to define individual design features that were categorised basic assumptions (25 -28 features), alignment (19 -21 features), cross-section (21 -25 features) and intersections/interchanges (21 -28 features.

It was intended that the relevance of the road design features for road safety in the Burkina Faso road network would be assessed by Burkinabe engineers. As such contribution was not possible, the assessment was based on the one obtained in Kenya (Schermers *et al.*, 2019) within SaferAfrica WP5, adapted taking into consideration the road safety management capacity review team experience with traffic operation in Ouagadougou and in other Western African countries. The results are presented in Appendix 10.1.

In a further phase, based on the different contacts with experts in Burkina Faso during and after the capacity review project, we tried to collect an impression of the level of application of these standards in road infrastructure planning, building and maintenance.

3.1.3 Analysis of the results

Two tables on 'the extent to which design items are covered in country-specific guidelines' were filled in, one for the UEMOA directives and the other according to the African Union's harmonized policy on road design of the TAHN roads. The first table concerns interurban single carriageway roads, which are assumed to correspond to road categories '*Classe II*' and '*Classe III*', of these documents. The second table concerns interurban dual carriageways or motorways, which are assumed to correspond to road categories '*Classe I*' and '*Routes Principales*' of the AU directive. One table was filled in for the French ARP (design of interurban trunk roads), concerning single carriageway roads; and one table was filled in for the French ICTAAL (design of interurban motorways), concerning dual carriageway roads.

These tables are presented in Appendix 7.1

Additionally, two tables on 'the extent to which design items are covered in country-specific guidelines' were filled in, which are presented in Appendix 7.2. In these tables, we only checked column 1 ("is this item present in the guidelines") and column 3 ("what is the assumed/adopted parameter values"). Column 3 only presents some details if they are mentioned in the document of the African Union.

Although the Burkinabe government stated that they use the directives from the African Union, their own classification of roads (Figure 1) is not referring to this on. It is clear that a lot of single carriageway roads of '*Classe II*' are not paved.

Road category	Number of lanes	Pavement type	Intersections	Maximum speed limit
'*Principale*' / Main, or Trunk	*Autoroutes* / Motorways, 2 x 2 or more	Bituminous or cement concrete	Interchanges only No at grade intersections Exit and entrance lanes on the right side	120 km/h
'Class I'	Dual carriageway, 2 x 2 or more, separated by a central barrier	Bituminous or cement concrete	At grade intersections must be limited.	100 km/h
Class II	Single carriageway 2 – one in each direction	Bituminous or cement concrete	At grade intersections	80 km/h
Class III	Single carriageway 2 (smaller) – one in each direction	Bituminous concrete or bituminous surface dressing (2 or 3 layers)	At grade intersections	60 km/h

Table 3: categorization of roads (Source: African Union)

As mentioned before, the Burkinabe government allows two different kinds of documents as directives for road construction and maintenance. None of these documents was originally developed or adapted to the country by Burkinabe experts, namely in what concerns drainage requirements and available construction materials. These documents are very different concerning the details on prescribed road design features. The French documents are very precise and detailed, but their effective use assumes that the French road network categorization is being applied. Also, while detailing some road elements (e.g. road restraint systems) reference has to be made to accompanying documents. The documents from the African Union and UEMOA cover only some aspects, their content is more general and less detailed than the French, and they provide a more literary description, rather than technical, of some relevant design features. These differences and the fact that the government has not issued an official documented design policy, leave to the civil engineer who is responsible for a certain road design scheme, the responsibility to make his own choice on which standards will be used in each road project.

3.1.3.1 Assessment of the relevance of design items for road safety

As mentioned before, the tables on 'Assessment of the relevance of design items for toad safety' were not filled in by Burkinabe experts, but simply based on the results from Kenyan experts combined with the Western Africa experience of elements of the Burkina Faso capacity review team. To fill in this form efficiently, profound knowledge of the actual situation of national road infrastructure and traffic operations is needed. However, it was assumed that broad safety issues are common in Kenya and Burkina Faso and that the most important local issues were dully detected by the capacity review team and considered in the assessment. Specific local issues include mixed cargo and overweight heavy vehicles, high vehicle gravity centre (leading to horizontal curve instability) and oversized vehicle dimensions in interurban roads, and the high PTW traffic volume (see Figure 4 and chapter 4.1).

Figure 4: local traffic characteristics impacting road design criteria

The first step in the assessment was to establish whether the road designers and specialists considered the various design items and elements important from a road safety perspective and necessary to include in the guidelines.

To start with, a qualitative assessment was made of these design items on three aspects: 1) the presumed road safety effect, 2) the degree in which the relation with safety has been validated, and 3) possibilities to further research the specific element there where the relationship is not fully developed (research-ability). Then the items were given a quantitative assessment based on a weighting and scoring procedure. Design was given a higher score – and higher research priority – where the amount of available knowledge was smaller and the road safety effect was greater.

In the following section the relevance and importance of the individual design items are summarised into the four main design elements considered (supporting criteria; alignment; cross-section and intersections).

Rural single carriageway roads

When rating the safety effect of the various design elements the assessors found that essentially all the design items were relevant for road safety in the Burkinabe situation with the majority (almost 88%) across all elements scoring as being highly relevant and no features being of little relevance (Table 4). A detailed reflection showing all the individual elements for rural single carriageway roads is included in Appendix 7.1.1.

Primary design element	Relevance for safety in guidelines/perceived effect on safety			
	Small	Average	High	Total
Supporting criteria	0	4	21	25
Alignment	0	2	19	21
Cross-section	0	3	18	21
Intersections	0	2	20	22
Total	0	11	78	89
Percentage	0	12	88	100

Table 4: Relevance of INTERSAFE design elements for road safety in Burkinabe interurban single carriageway road design guidelines

The next aspect determined to what extent the assessor found the design item to be acknowledged and described in (international) literature. This aspect assumes that if international literature describes the relationship quantitatively (the effect is known) that the relationship is fairly well understood and also important, whereas if it is only a descriptive relationship with safety is mentioned, the effect is less important or less understood. This assessment reveals that there were only 3 of the 88 items that according to the assessor were generally descriptive in the international guidelines whereas 56 items (64%) were through quantitative criteria (**Table 5**) and therefore, according to the assessor, deemed internationally as having an important relationship with road safety.

Primary design element	Type of coverage in international guideline/literature			
	Purely descriptive	Qualitative	Quantitative	Total
Supporting criteria	2	11	12	25
Alignment	1	4	16	21
Cross-section	0	11	10	21
Intersections	0	4	18	22
Total	3	30	56	89
Percentage	3	34	63	100

Table 5: Perceived relevance of elements as described in international Literature/guidelines for the Burkinabe situation – single carriageway roads

This result is somewhat different to an earlier study by SWOV in which selected European road authorities at a national level and a larger selection of Dutch road authorities (at all levels) were asked to rate the same criteria. European road authorities are of the opinion that 21% of the relationships are descriptive in nature, 38% qualitatively described and only 41% quantitatively described in current international guidelines. This difference between the Saferafrica and SWOV results may be ascribed to different interpretations of the guidelines or that the European assessors refer to different source guidelines. However, it is doubtful that guidelines generally quantitatively describe the relationship between the majority of design aspects and road safety; in several cases, however, bibliographical references mentioned in guidelines do provide quantitative relationships.

The third assessed aspect refers to the difficulty in researching the relationships between road safety and the various design features (**Table 6**). When assessing this issue from a Burkinabe perspective, the assessors found some 10% were difficult to research and 29% easy to research with the rest falling in between. In terms of specific items, the aspects covered under basis criteria were generally deemed easier to research whereas cross-sectional and alignment elements were perceived more difficult to research. These results show some compatibility with those from an earlier study in the Netherlands and Europe.

Primary design element	To what degree of difficulty is the design aspect researchable			
	Highly difficult	Moderately	Not difficult	Total
Supporting criteria	0	14	11	25
Alignment	4	11	6	21
Cross-section	4	13	4	21
Intersections	1	12	9	22
Total	9	50	30	89
Percentage	10	56	34	100

Table 6: The degree to which the relationship between geometric design elements for single carriageway rural roads and safety can be researched from a Burkinabe perspective

Interurban dual carriageway roads

Results from rating the safety effect of the various dual carriageway road design elements show that the assessors found that essentially all the design items were relevant for road safety in the Burkinabe situation with the majority (almost 79%) across all elements scoring as being highly relevant and no features being of little relevance (Table 7). A detailed reflection showing all the individual elements for rural single carriageway roads is included in Appendix 7.1.2.

Primary design element	Relevance for safety in guidelines/perceived effect on safety			
	Small	Average	High	Total
Supporting criteria	0	4	20	24
Alignment	0	1	20	21
Cross-section	0	3	23	26
Interchanges	0	13	17	30
Total	0	21	80	101
Percentage	0	21	79	100

Table 7: Relevance of INTERSAFE design elements for road safety in Burkinabe interurban dual carriageway road design guidelines

The perceived effect for safety of the primary design elements (and the relevance for guidelines) was rated higher for the Burkina Faso situation than in the earlier study reported in the Netherlands (Schermers *et al.*, 2013). In the European situation these elements were rated as having an average effect on safety (51%) and only 25% a high relevance. The difference in results could be attributed to the fact that generally the relationship of these items with safety in Europe is more common practice and is entrenched in the thinking, whereas in Africa this pattern is still emerging and therefore the effect and importance for guidelines are rated more highly than in Europe.

The relationships between the primary design elements and road safety were generally rated as being qualitatively or quantitatively described in (inter)national literature, suggesting that these effects could be relatively easily incorporated into current Burkinabe geometric design guidelines for rural dual carriageway roads (Table 8). This result is very similar to that found in Europe, where the need was expressed that roughly half of the design items and their relationship with safety should be quantitatively described.

Primary design element	Type of coverage in international guideline/literature			
	Purely descriptive	Qualitative	Quantitative	Total
Supporting criteria	1	10	13	24
Alignment	1	5	15	21
Cross-section	0	13	13	26
Interchanges	0	22	8	30
Total	2	50	49	101
Percentage	2	50	48	100

Table 8: Perceived relevance of elements as described in international Literature/guidelines for the Burkinabe situation – single carriageway roads

According to the assessment made, most items covered by the primary design elements for interurban dual carriageway roads are moderately (60%) to highly (21%) difficult to research (Table 9) and therefore not easy to implement quantitative relationships in the guidelines. This result is similar to that of the European study (Schermers *et al.*, 2013) although the proportion of the items that were deemed highly difficult to research and quantify was higher in the Dutch study (50%).

Primary design element	To what degree of difficulty is the design aspect researchable			
	Highly difficult	Moderately	Not difficult	Total
Supporting criteria	4	13	7	24
Alignment	4	10	7	21
Cross-section	8	14	4	26
Interchanges	5	24	1	30
Total	21	61	19	101
Percentage	21	60	19	100

Table 9: The degree to which the relationship between geometric design elements for single carriageway rural roads and safety can be researched from a Burkinabe perspective

3.1.3.2 Importance of design factors in design guidelines applied in Burkina Faso

The second part of the assessment related to the extent to which the selected benchmark (INTERSAFE) geometric design features were dealt with in the design guidelines applied in Burkina Faso road projects and whether their relationship with road safety was dealt with.

This assessment was performed using the African Union directive for TARN and the UEMOA directive for single and dual carriageway roads, the French ARP for single carriageway roads, and the French ICTAAL for dual carriageway roads.

Standards for single carriageways (Classe II and Classe III)

Table 10 shows an overview of the different design features analysed and how much of these elements are also mentioned in the documents used by the government of Burkina Faso. Most of the design elements are mentioned in one or more documents.

Design category	Mentioned in BF guidelines	Remarks
Basic assumptions	17/25	- Very few explanation about impact of speed (only speed limits are mentioned). - On eye position – we found no information
Alignments	20/21	- No information was found on 'emergency escape ramps'
Cross section	18/21	- Most elements are mentioned in the AU and French documents
Intersections	19/21	- Most elements are only mentioned in the AU and French documents

Table 10: Overview of the standards for single carriageways

Detailed filled in tables for single carriageway interurban roads are presented in Appendixes 7.2.1, 7.2.2, 7.2.5.

In the AU Directive, generally there is no mention to the safety effects of design elements, or to where those effects may be searched for in case a designer needs to evaluate the effects of deviations from standardized values.

In the UEMOA recommendations, too, there is no explicit mention to the safety effects of design elements, or to where those effects may be searched for in case a designer needs to evaluate the effects of deviations from standardized values. However there are qualitative descriptions of the safety effects of hard shoulders, as well as of surfacing, for both single and dual carriageway roads. Special mention to the positive impacts on safety of motor vehicles traffic conflict countermeasures and of satisfying crossing sight distance requirements at (high and low level) intersections are also mentioned.

The French ARP also do not have a special mention to the safety effects of the basic principles assumed for setting up the design elements criteria, nor to where those effects may be searched for in case a designer needs to evaluate the effects of deviations from assumed values. Qualitative explanations of safety effects of key horizontal alignment and vertical alignment issues are provided (e.g. horizontal curve design principles and recommended radii combinations, vertical alignment gradients and connecting curves, passing and climbing lanes), improvement of existing roads, cross section integrated design, provision of secondary lanes (cycle lanes, sidewalks and bus stops) and frontage roads. Safety effects are also mentioned regarding key intersection design issues: design principles and templates, application of motorised traffic conflict countermeasures, warrants for priority control mode and auxiliary turning lanes, and shape and layout of intersection (including roundabouts and bicycle facilities). Only one quantitative value is provided for the safety effects of design decisions, referring to the impact of traffic control mode (signalized or non-signalized) on the safety performance of intersections; the remainder references to safety effects are qualitative.

A similar evaluation in the Netherlands revealed that 25% of the items were not described in the guidelines although some 87% of those that were described did not mention any safety effects (Schermers *et al.*, 2013).

Concerning the basic assumptions, design speed is included in all three guidelines, but actual speed is only referred to in the French ARP. Reaction times and safety distances are defined only in ARP and stopping and overtaking sight distances are mentioned in ARP and AU directive. Most basic assumptions are not described in any of the three guidelines: driver and other traffic elements characteristics, such as reactions times, eye and object position, friction coefficients, design vehicle clearances, standard (default) vehicle acceleration and decelerations. Recommendations for mitigating barrier effect impacts of high-speed roads are absent of the documents, as well as road lighting (e.g. at interchange ramps).

As for alignment criteria, ARP and AU directive include project planning to improve existing roads (horizontal & vertical alignments), horizontal alignment principles (not UEMOA), rules for curve design, including minimum radius and superelevation, and for linking design elements, vertical alignment principles, including limiting values for gradient and connecting curves, provisions for climbing lanes, coordination of vertical and horizontal alignments (not UEMOA). Only the AU directive mentions explicitly design consistency, even though no specific method to address the issue is recommended. The AU and UEMOA documents do not mention internal defects of horizontal bends, recommendations for auxiliary lane suppression and warrants for emergency escape ramps.

Concerning cross-section features, the documents include integrated design (relations between design speed, curve radius and superelevation), dimensions for the main carriageway (UEMOA does not include crossfall features), main roadside characteristics (UEMOA does not include obstacle-free zones nor drainage channels), recommended cross-sections, warrants for access control (frontage roads) (not in UEMOA), auxiliary lanes (sidewalks and cycle lanes), and bus stops (not UEMOA). The documents do not include mention to the relation between lane width and design speed

References to intersection design features include the selection of intersection type (UEMOA does not include mention to traffic control nor vulnerable road users), priority controls, differentiation between distributor-local and distributor-distributor intersections (not in UEMOA), secondary arms channelization, roundabouts, crossing sight distance requirements (not in ARP). Only the AU document mentions bicycle facilities and the assessment of grade separation. Only ARP does have reference to design principles and templates, shape and layout, and the use of traffic safety records.

A comparison of the results obtained for each of the three documents reveals that there are differences in the explanatory power of safety consequences due to deviations from guidelines criteria, a shortcoming that adds to the disadvantages resulting from the absence of warrants to harmonize the selection of the applicable standard to a given road project.

This result suggests that Burkina Faso needs a proper guideline for rural single carriageway roads, an issue dully acknowledged in the National Road Safety plan. Also, there appears to be a clear need to incorporate in the future guidelines the safety effects associated with particular design elements and choices.

Standards for dual carriageway roads and motorways (‘Classe Principale’ and ‘Classe I’)

Table 11 overview of the different design features analysed and how much of these elements are also mentioned in the documents used by the government of Burkina Faso. Most of the design elements are mentioned in one or more documents.

Design category	Mentioned in BF guidelines	Remarks
Basic assumptions	16/24	- Very few explanations about impact of speed / only limits are mentioned. - On eye position – we found no information - Most elements are only mentioned in the French documents
Alignments	20/21	- No information was found on 'emergency escape ramps
Cross section	26/26	- Most elements are only mentioned in the French documents
Interchange	20/30	- Most elements are only mentioned in the French documents

Table 11: Overview of the standards for dual carriageway roads and motorways

Detailed filled in tables for dual carriageway interurban roads are presented in Appendixes 7.2.3, 7.2.4, and 7.2.6.

In the AU Directive, generally there is no mention to the safety effects of design elements, or to where those effects may be searched for in case a designer needs evaluate the effects of deviations from standardized values.

In the UEMOA recommendations there is no mention to the safety effects of design elements, nor to where those effects may be searched for in case a designer needs to evaluate the effects of deviations from standardized values. However there are qualitative mentions to the safety effects of hard shoulders, median separations and turnout safety zones, as well as surfacing, for both single and dual carriageway roads.

Even in the French ICTAAL there are few mentions to the safety effects of design elements basic principles, or to where those effects may be searched for in case a designer needs to evaluate the effects of deviations from these principles.

Qualitative explanations of safety effects of key horizontal alignment and vertical alignment issues are provided (e.g. minimum horizontal curve design radii and recommended radii combinations, internal defects to avoid, and vertical connecting radii). The safety role of median separation and hard shoulders are mentioned in ICTAAL; the importance of an integrated design approach is also stressed in ICTAAL. Concerning interchanges, the safety effects of interchange layout and decision sight distance requirements are explained; the same happens with the effects of traffic control at the secondary roads. Overall, the effects of deviations from the standard intervals are not explained, and then only qualitatively (e.g. horizontal curve radii not recommended, hard shoulders, central reservation, and interchange configurations and variations).

A similar study of geometric design guidelines in the Netherlands revealed that in the Netherlands 88% of the items covered in the INTERSAFE methodology had been described in Dutch guidelines for national motorways (Rijkswaterstaat, 2007; and Schermers *et al.*, 2013). However, although many design items were described, only some 10% of these descriptions included their safety effects. The study found that because of omitting good descriptions of the relationship between the design items and safety, road designers in the Netherlands and in other countries in Europe experienced problems during design and thereafter. Often these problems were associated with estimating the road safety effects of different design choices in the prioritisation process but also in the design optimisation process.

Concerning the basic assumptions, the design speed approach is considered in all documents but only ICTAAL contemplates the actual (operating) traffic speed. Safety distances are considered, as well, except for the AU directive. Recommendations for mitigating the barrier effect impacts of high-speed roads are only mentioned in ICTAAL. Several basic driver characteristics and traffic elements design parameters such as friction coefficients and design vehicle clearances are not explicitly referred in the guidelines; however, in ICTAAL mention is made to reaction times, eye and object position, standard vehicle acceleration and decelerations, as well as sight distances. Road lighting (e.g. at interchange ramps) is only mentioned in the UEMOA document.

Regarding horizontal and vertical alignment, rules for horizontal curve design (including the minimum radius and superelevation) and the coordination of vertical and horizontal alignments are presented in all documents. Project planning to improve existing roads (horizontal & vertical alignments), horizontal alignment principles, internal defects of horizontal bends, design consistency rules, vertical alignment (including limiting values for gradient and connecting curves), and provisions for climbing lanes are mentioned in ICTAAL and the AU directive. ICTAAL does not mention design consistency but includes rules for linking design elements. The Au and the UEMOA directives do not include recommendations for auxiliary lane suppression or no warrants for emergency escape ramps.

Concerning cross-section features, the documents include the dimensions for the main carriageway, surfacing type (which is assumed in ICTAAL) and main roadside characteristics (even though UEMOA does not include obstacle-free zone nor drainage channels). The UEMOA recommendations do not include the relations between design speed, curve radius and superelevation, typical cross-sections and central reservation features, access control (in ICTAAL this is assumed), nor climbing lanes. Only the AU directive contains lane width vs. design speed recommendations. Shoulder characteristics are only discussed in ICTAAL, and rest and service areas are suggested in UEMOA and ICTAAL.

All documents consider a categorization of interchanges in two classes, the system interchanges (connecting main motorways) and the service interchanges (connecting main motorways with distributor highways). The importance of an appropriate array of interchange configurations is also stated, and appropriate length dimensions for ramps are also defined. The design speed of ramps is defined only in ICTAAL. Requirements for interchange spacing, for the alignment characteristics in the approach to interchanges, for consistency in design and completeness of directional traffic movements, and for weaving sections are also set up only in ICTAAL. None of the documents discusses requirements for cross road design (e.g. transitions and sidewalks).

3.2 Vehicles

3.2.1 Standards and legislation for vehicles

UEMOA – *Union Economique et Monétaire Ouest Africaine* – or WAEMU – West African Economic and Monetary Union – is the grouping of African countries selected to analyse one example of regional dimension, though it does not include Kenya. UEMOA gathers eight French-speaking countries of West Africa: Benin, Burkina Faso, Ivory Coast, Guinea Bissau, Mali, Niger, Senegal, and Togo.

The Commission of UEMOA has the Department of land planning and transport. Among its duties, that department is in charge of the infrastructures and transport systems, to facilitate transport services and the promotion of the transport industry.

The regional approach makes a lot of sense in West Africa since country borders are porous to road traffic as one of the essential pillars of economies. At one side, the Lagos – Abidjan corridor, linking the coast of UEMOA and other countries and, on the other, the exports of land-locked countries require international management of road transport that harmonise the sector and guarantees road safety and environmental protection.

UEMOA's most relevant regulatory texts related to road transport are listed below:

- Regulation n°14/2005/CM/UEMOA on the harmonisation of standards and procedures for the control of the dimensions, weight, and load per axle of heavy goods vehicles in the Member states of the West African Economic and Monetary Union;
- Directive n°12/2009/CM/UEMOA establishing a harmonised approach for the management of the road safety in the West African Economic and Monetary Union; and
- Directive n°16/2009/CM/UEMOA on the periodical inspection of vehicles in the Member states of the West African Economic and Monetary Union.

Directive 16/2009/CM/UEMOA is an excellent example of cooperation between neighbour countries aiming for a common road transport policy. It sets the frame for vehicle inspection in UEMOA countries and the most relevant items it covers are:

- It applies to:
    - Light vehicles: passenger vehicles with up to 8 seats plus driver's one or goods vehicles up to 3,5 T;
    - Heavy-duty vehicles: vehicles or ensemble of vehicles of more than 3,5 T; and
    - Motorcycles with an engine displacement above 125 cm^3.
- The inspection of vehicles is regulated by authorities.
- The inspection is undertaken by public or private organisations duly appointed.
- The proof of inspection is defined by UEMOA and shall contain anti-tampering measures.
- It establishes a list of items to control. The assessment of defects will be detailed in a UEMOA's decision.
- It sets the list of equipment.

In summary, the Directive 16/2009/ CM/UEMOA is the first framing act towards a vehicle inspection standard. To increase the efficiency of the common regulatory text, it is necessary to define provisions for the following subjects:

- Precise descriptions of methods of inspection, reasons for failures and assessment of defects;
- Definition of the requirements for inspectors;
- Definition of the requirements for equipment, including calibration;
- Definition of data management;
- Definition of the quality assurance system.

The development of the Directive can be done at the UEMOA level, which requires the consensus of Members; or at a national level, in which case it may be easier to manage but would lose the benefit of international harmonization.

Another example of regional arrangements can be found at CEMAC – *Communauté Economique et Monétaire de l'Afrique Centrale* or Economic and Monetary Union of Central Africa. CEMAC has issued a joint Road Traffic Act[9] for all its country members, which also defines up the legal frame

[9] http://droit-afrique.com/upload/doc/cemac/CEMAC-Reglement-2001-04-Code-de-la-route.pdf

defining the requirements for vehicles. This CEMAC Road Traffic Act contains two parts: Part I, with general provisions and defining its scope; and Part II, with the regulations on driving licence and driving instruction (Title I), technical rules relating to vehicles and their equipment (Title II), protection of the public road domain (Title III), administrative rules for the use of motor vehicles (Title IV), traffic regulations (Title V), immobilisation, withdrawal from circulation, and seizure of vehicles (Title VI), road signs and signals (Title VII), and final provisions (Title VIII). Further details on the CEMAC's Road Traffic Act scope and its impact on vehicle regulations may be found in the analysis made for Cameroon within this SaferAfrica Workpackage 5 (Usami *et al.*, 2019).

4 Comparison with international standards and recommendations for improvement

4.1 Road infrastructure

4.1.1 General remarks

Burkina Faso has fairly comprehensive legislation and an elaborate national program but in practice the means for implementing the plan and the legislation are lacking. One of the main reasons is certainly the absence of a national fund for road safety but also the segmentation of the policy to fight against road safety despite the existence of the CNSR (road safety lead agency). Another factor hindering the implementation of the road safety plan concerns the question of integration and adaptation of existing regulations. Regulations and agreements developed elsewhere lack their dully adaptation to the specific needs and problems of the country.

Developing standards and regulations for road infrastructure in a specific African country like Burkina Faso is not only be a matter of copying European standards. The reality, especially in the sub-Saharan region is so different from the one in most European countries that standards must be adapted to reality. These differences include road user familiarity with the road transport system, particularities of the vehicle park and traffic operations, legislation and its enforcement, meteorological conditions as well as available construction materials. This is the reason why the African Union has developed some proper 'General Directives' and countries like Mozambique have started developing a complete review of their Design Standards for Roads. Also, the government of Burkina Faso has planned its own reviewing process on the French documents. Unfortunately, it is still a plan and not yet in action.

This does not mean that the European Standards must be put aside. They have been built on a long experience and evaluation, and they were adapted several times, due to changing European traffic conditions and to improved knowledge and insight. These standards are not always directly applicable ton African countries but may constitute a good basis for further development and adaptation to different national contexts. Road categorization seems to be very different in African countries in comparison with the European classification. Resources for constructing roads and associated infrastructural elements are not always available and available materials are in some areas quite different (e.g. laterite). Maintenance is probably more difficult view the vastness of the country and the climate conditions.

4.1.2 Typical issues for road design standards.

For Burkina Faso, besides these general remarks, there are three types of issues that could have an impact on the definition of infrastructural standards: 1) typical traffic situation, 2) specific cultural aspects, and 3) capacity or knowledge gaps.

4.1.2.1 Traffic operation features

The high P2W traffic volumes

The spectacular amount of powered two-wheelers traffic volumes, especially in urban areas, needs special attention in designing the road infrastructure and has to be dealt with in the standards and official directives. These high traffic volumes reflect in the percentages of crashes involving P2W vehicles: in 80% of all accidents in urban regions, a P2W was involved; outside urban areas, P2W are involved in 53% of all accidents.

In the past, in the city of Ouagadougou, several main streets have been constructed with a specific separated path for the P2W's. However, due to the enormous growth in P2W's traffic volumes, these provisions are no longer adequate to accommodate traffic operations in a safe way.

Freight traffic on the main trunk roads

As mentioned before, there is a lot of freight traffic on the Burkinabe roads. Road transport is an important economic activity in the country, due to the low penetration of rail transport. A lot of heavy trucks are found on national roads and international corridors. A study carried out in 2009 on the impacts of load reduction for heavy goods vehicles made it possible to detect very high levels of overload of heavy goods vehicles on the main Burkinabe roads (Table 12). More than 40% of the trucks tested on the various roads were overloaded and instead of a permissible maximum total weight of 51 t, heavy goods vehicles generally carried more than 100 t, the maximum value reaching 142 t. Axle loads have also been observed to exceed the permitted loads by large amounts (for ex: 30 t instead of 11.5 t). In addition to shortening the lifetime of pavements, from 15 years to 3 years, these overloaded charges originate a degradation of traffic operation service levels and an increase in road crashes on roads connecting Burkina Faso to external transoceanic ports.

	Overloaded trucks	Average overload	Maximum axle weight (t)	Maximum total weight (t)	Type of vehicle	Payload
RN 5	84%	52%	30	142	Vehicle with 6 or more axes	Plates
RN 1	47%	41%	28	141	Vehicle with 6 or more axes	Iron
RN 4	74%	38%	27	104	Vehicle with 6 or more axes	Cron
RN 8	58%	43%	22	94	Vehicles with 4 axes	Fish

Table 12: Heavy truck overload on major Burkinabe roads (Source: Adolehaume et al., 2009)

4.1.2.2 Socio-cultural aspects

Unregulated use of roadside sidewalks

The separation of vulnerable road users, especially pedestrians, from the motorized traffic is an overall problem, especially complex due to the mixed type of motorized vehicles (P2Ws, tricycles, cars, and trucks). In rural areas, even on national roads, there are no sidewalks or protection by means of safety barriers or safe crossings. Inside cities and in suburban areas, sidewalks are sometimes provided, but their effective use by pedestrians is not always possible. There is a general absence of maintenance and frequently several private commercial activities take possession of the surfaced sidewalk space, forcing pedestrians to use the main carriageway. So, it is not only a question of making improvements to the road infrastructure, providing space for safe walking, but also of raising awareness on the good use of the infrastructure, regulating roadside occupation and enforcing sidewalk protection.

Belief that all problems have to do with disobedience

In the road safety capacity review interviews, several agencies and organizations publicly shared an almost resigned belief that road safety is a problem generated by widespread road user noncompliance with traffic laws. This may be a barrier to give proper consideration to the safe system principles while developing standards for road infrastructure. Besides the pure technical negative aspects, this resigned approach to road user behaviour may also inhibit developing confidence in the practical application of the concepts of self-explaining and forgiving roads.

On the other hand, in Burkina Faso, there is indeed a big resistance to obey traffic laws. The 2014 popular uprising had consequences for the current policy, which remains very (if not too much) conservative and averse to proposing road user behavioural changes. There is a widespread belief that people would not hesitate to go down the streets, in case of dissatisfaction or disagreement with new policies.

In fact, it's a vicious circle: people are not eager to obey laws, and lack of obedience is perceived as the cause of all safety problems. And because the government members are convinced that all problems are related to disobedience or irresponsible behaviour, they don't see the importance of working on safety standards nor do they perceive the power of properly applied safe system infrastructure principles to nudge road user to progressively adopt safer traffic behaviour.

Spirits and demons

Local actors have repeatedly pointed out the important role of spiritual and sociological aspects to take into account when identifying places and selecting road safety interventions (including in protected areas). For example, some 'black spots' are considered to be places where 'bad spirits' are present. So, prevention of accidents will not be easy.

4.1.2.3 Knowledge and capacity gaps

Civil engineers are in general well trained and some of them attended higher education in other countries (e.g. European or African). In their curricula, major emphasis was placed in construction and planning issues and little is mentioned on road safety insights. Road Safety Audits and Inspections are only mentioned in a minor way and issues discussed are mostly focused on technical issues: placement of the traffic signs, drainage, dimensions of the road and the curves, etc.

A more holistic view, referring to the Safe System approach, taking into account the self-explaining and forgiving design concepts and the traffic flow for each road user category, is not a substantial part of their usual training.

4.1.3 Prioritising road design elements for guidelines for interurban roads in Burkina Faso

In Chapter 3.1 the Burkinabe road design practices were assessed using the design items adopted in the INTERSAFE project (ERSF, 1996) which, although somewhat dated, still provides a very comprehensive reference framework. The assessment was conducted at two levels which intend to reveal the status quo of road design practices in Burkina Faso, and more specifically to what extent road safety is integrated into the applied philosophy. As mentioned, the execution of this task was compromised by the diversity of design standard documents applicable in the country and by the absence of clearly stated warrants for the selection of the applicable document to a specific road scheme.

In the first place the assessment focussed on the perceived importance and relevance of the various design aspects covered by INTERSAFE for the Burkinabe situation and in the second on the extent to which these items were described in the alternative geometric design guidelines. The first level assessment was done using effect, relevance, and researchability as criteria; whereas the second level used inclusion in the three alternative guidelines and the relationship with safety as parameters for describing the situation.

In this chapter, the result of the assessment is combined by applying a scoring for each design feature and then calculating a total per assessment by multiplying the various dimension scores (see Appendix 7.1 and 7.3). This first dimension (perceived relevance for guidelines) scored a maximum of 27 points whereas the second dimension (degree of inclusion in applied guidelines) scored a maximum of 12. A total score based on a weighted average of the two dimensions produced a total score per design item and a total for each of the four primary design elements (supporting criteria; alignment; cross-section and intersections/interchanges). For this project it was decided to select the three highest-scoring elements in each one of the primary design element categories (provided the score was higher than 70[10]). It is also possible to produce a prioritisation based on all items irrespective of the primary category they fall in. However, the results in Chapter 3 made clear that many INTERSAFE items are deemed important for the Burkinabe situation and many are not included in the used guidelines and if they are, the relationship with road safety is not adequately addressed. The adopted scoring and prioritisation process was designed to ensure that exactly those design features/elements that are perceived relevant, have not been included or are badly described score high on the priority lists.

4.1.3.1 Guidelines for single carriageway rural roads

Table 13 shows the top three scoring items per primary design element which, according to the assessment of the African union Directive and the French ARP, require inclusion, amendment or updating for inclusion in future Burkinabe design guidelines.

In the section dealing with the supporting or basic assumptions and criteria of the design guidelines there is a high perceived need to better describe the aspects dealing with the relationship between safety and design vehicle characteristics, including deceleration and acceleration capabilities, sight distances (stopping, overtaking and meeting), friction coefficients, speed limit and actual (operating) speed approaches, and eye and object characteristics.

In terms of alignment, auxiliary (passing or climbing) lanes and design consistency were rated the highest priority to be addressed in revised guidelines. For cross-sectional elements, the relation between lane width and speed, warrants for the provision of pedestrian sidewalks and cycle lanes, and shoulder characteristics were deemed as being the most important for reviewing in the future guidelines.

[10] Corresponding to a qualitative scoring of “TOP” or HIGH” priority.

In the final section dealing with design elements for intersections, local speed limits, warrants for roundabouts and bicycle and pedestrian facilities were the single most important features that should be well considered in the new guidelines for single carriageway roads.

		ARP		African Union	
		Weighted rating	Priority ranking	Weighted rating	Priority ranking
BASIC ASSUMPTIONS					
1.8	Design vehicle characteristics	100.00	TOP	75.00	HIGH
1.1.2	Speed limit approach	83.33	HIGH	83.33	HIGH
1.4.1	Longitudinal friction coefficient	83.33	HIGH	83.33	HIGH
1.4.2	Side friction coefficient	83.33	HIGH	83.33	HIGH
1.5.1	Deceleration	83.33	HIGH	83.33	HIGH
1.9.1	Dimensions	83.33	HIGH	83.33	HIGH
1.9.2	Swept path	83.33	HIGH	83.33	HIGH
1.7.1	Stopping sight distance	75.00	HIGH	75.00	HIGH
1.7.2	Meeting sight distance	75.00	HIGH	75.00	HIGH
1.7.3	Overtaking sight distance	75.00	HIGH	75.00	HIGH
1.2	Reaction time	-	-	83.33	HIGH
1.1.3	Actual speed approach	-	-	83.33	HIGH
1.9.4	Safety distances	-	-	83.33	HIGH
1.3.1	Eye height	-	-	72.22	HIGH
1.3.2	Lateral eye position	-	-	72.22	HIGH
1.3.3	Object height	-	-	72.22	HIGH
1.3.4	Lateral object position	-	-	72.22	HIGH
ALIGNMENT					
2.2.4.5	Design consistency	83.33	HIGH	-	-
2.2.4.3	Transition curves	75.00	HIGH	-	-
2.3.3.2	Auxiliary (climbing or passing) lane suppression: type and length of drop	75.00	HIGH	100.0	TOP
2.3.5.2	Type and length	75.00	HIGH	100.0	TOP
2.3.5.1	Warrants and spacing	-	-	83.33	HIGH
2.2.4.3	Transition curves	-	-	75.00	HIGH
2.3.1	Gradient	-	-	75.00	HIGH
2.3.2.1	Convex curves	-	-	75.00	HIGH
2.3.3.1	Passing/Climbing lanes (old 3.2.4)	-	-	75.00	HIGH
CROSS-SECTION					
3.2.2.1	Lane width vs design speed	83.33	HIGH	83.33	HIGH
3.2.4.1	Shoulder width suitable for emergency lane	72.22	HIGH	72.22	HIGH
3.3.2	Type of Obstacle	72.22	HIGH	-	-
3.3.4	Slopes	72.22	HIGH	-	-
3.4.1	Cycle lane	-	-	75.00	HIGH
3.4.3	Pedestrian sidewalk	-	-	75.00	HIGH
3.3.3	Soft shoulders	-	-	72.22	HIGH
INTERSECTIONS					
4.5.6	Bicycle and pedestrian facilities	100.00	TOP	75.00	HIGH
4.5.7	Local speed limits	100.00	TOP	100.00	TOP
4.1.4	Traffic conflict countermeasures for vulnerable road users	83.33	HIGH	75.00	HIGH
4.6.2.1	Roundabout Expected Use	83.33	HIGH	100.00	TOP
4.6.2.3	Crossing sight distance requirements	83.33	HIGH	-	-
4.6.4	Grade separation	83.33	HIGH	-	-
4.5.2	Priority control mode	75.00	HIGH	75.00	HIGH
4.2	Use of design templates		-	83.33	HIGH
4.3	Design principles		-	83.33	HIGH
4.1.2	Traffic control mode		-	75.00	HIGH
4.5.4	Major road left turn lanes		-	75.00	HIGH

Table 13: Priority road design aspects requiring attention in Burkinabe guidelines for interurban single carriageway roads

4.1.3.2 Guidelines for dual carriageway rural roads

Following the same procedure as with single carriageway roads, the three design items with the highest overall score in each primary design element category were selected as those needing to be included in the future Burkinabe geometric design guidelines. The results are shown in Table 14.

		ICTAAL		African Union	
		Weighted rating	Priority ranking	Weighted rating	Priority ranking
BASIC ASSUMPTIONS					
1.8	Design vehicle characteristics	100.00	TOP	100.00	TOP
1.7.1	Stopping sight distance	100.00	TOP	100.00	TOP
1.2	Reaction time	83.33	HIGH	83.33	HIGH
1.1.3	Actual speed approach	83.33	HIGH	83.33	HIGH
1.4.1	Longitudinal friction coefficient	83.33	HIGH	83.33	HIGH
1.4.2	Side friction coefficient	83.33	HIGH	83.33	HIGH
1.5.1	Deceleration	83.33	HIGH	83.33	HIGH
1.6.1	Stopping distance	83.33	HIGH	83.33	HIGH
1.9.1	Dimensions	83.33	HIGH	83.33	HIGH
1.9.2	Swept path	83.33	HIGH	83.33	HIGH
1.9.3	Overhead and lateral clearances	83.33	HIGH	83.33	HIGH
1.9.5	Dynamic lateral clearance	83.33	HIGH	83.33	HIGH
1.1.1	Design speed approach	75.00	HIGH	75.00	HIGH
1.1.2	Speed limit approach	-	-	83.33	HIGH
1.9.4	Safety distances	-	-	83.33	HIGH
1.11	Recommendations for mitigating barrier effect impacts.	-	-	83.33	HIGH
ALIGNMENT					
2.2.4.5	Design consistency	83.33	HIGH	100.00	TOP
2.2.4.3	Transition curves	75.00	HIGH	75.00	HIGH
2.3.1	Gradient	75.00	HIGH	75.00	HIGH
2.3.2.1	Convex curves	75.00	HIGH	75.00	HIGH
2.3.5.2	Type and length	75.00	HIGH	-	-
2.3.3.2	Auxiliary (climbing or passing) lane suppression: type and length of drop	-	-	83.33	HIGH
2.3.5.1	Warrants and spacing	-	-	83.33	HIGH
2.2.3.3	Minimum radius	-	-	75.00	HIGH
CROSS-SECTION					
3.6	Access control	100.00	TOP	75.00	HIGH
3.4	Auxiliary lanes (e.g. bus lanes)	83.33	HIGH	-	-
3.2.2.1	Lane width vs. design speed	83.33	HIGH	-	-
3.2.9	Surfacing	83.33	HIGH	-	-
3.3.5	Drainage channels	83.33	HIGH	-	-
3.8.1	General	83.33	HIGH	83.33	HIGH
3.8.2	Frontage roads	83.33	HIGH	-	-
3.2.4.1	Outside shoulder width suitable for emergency lane	-	-	100.00	TOP
INTERCHANGE					
4.5.4.5	Intersection sight distance	100.00	TOP	100.00	TOP
4.5.1	Sidewalks and bicyclist facilities provided along the interchange crossroad.	72.22	HIGH	72.22	HIGH
4.5.2	Length of access control along the crossroad beyond the interchange, to ensure its integrity	72.22	HIGH	72.22	HIGH
4.5.3	Land development and access management measures are in place at the interchange area (Y or N)	72.22	HIGH	72.22	HIGH
4.5.4.2	Capacity	72.22	HIGH	72.22	HIGH
4.5.4.3	Traffic control	72.22	HIGH	72.22	HIGH
4.5.4.4	Channelization	72.22	HIGH	72.22	HIGH
4.2.2	Minimum value for horizontal curvature throughout the interchange area	-	-	83.33	HIGH
4.2.3	Sight distance requirement in advance of each exit (desirably decision sight distance)	-	-	83.33	HIGH
4.3.2.1	Requirements for consistency in exit pattern with other nearby interchanges	-	-	72.22	HIGH
4.3.4	Mandatory installation of all exits and entrances on the right side of the freeway mainline?	-	-	72.22	HIGH
4.3.5	Provisions for weaving section design?	-	-	72.22	HIGH
4.3.7.1	Priority route is the through facility	-	-	72.22	HIGH
4.5.1.1	Traffic control at the crossings at interchange ramps (Y or N)	-	-	72.22	HIGH

Table 14: Priority road design aspects requiring attention in Burkinabe guidelines for interurban dual carriageway roads

In this case the highest-scoring supporting or basic assumptions criteria were the features dealing with the relationship between safety and design vehicle characteristics, including deceleration and acceleration capabilities, stopping (sight) distances, friction coefficients, speed limit and actual (operating) speed approaches, and mitigating the safety impacts of due to the barrier effect of high-speed roads (pedestrian safety).

In what concerns alignment criteria, design consistency and auxiliary (passing or climbing) lanes were rated the highest priority to be addressed in revised guidelines. For cross-sectional elements, the aspects dealing with access control, shoulder widths, particularly in combination with provisions for emergency lanes, surfacing, and the relation between lane width and speed, were deemed as being the most important for reviewing in the future guideline.

The most important interchange features include sight distances, maximum horizontal curvatures (minimum radii), and several characteristics of the transition area, in the vicinity of the interchanges.

4.1.3.3 Recommendations

The most important recommendation in this matter is the request to finally start with action point 4.1 of the Burkinabe Road Safety Action Plan (developed in 2008), namely "The definition of norms and standards for road design and construction". In the original plan, this action must have been realized in 2012.

As mentioned in Table 1, this action point consists of four interrelated activities:

- developing standards for the technical conditions of road infrastructures;
- developing standards on the use of natural materials in the construction of road infrastructure;
- developing regulatory and technical documents for road signing;
- developing and application of documents relating to the safety assessment of road projects and the inspection of existing road infrastructures.

To realize this, the government has estimated a budget of 100 million CFA, which is approximately 150.000 euros.

Instead of taking over the European standards as a whole with the knowledge that a lot of these are not applicable in most roads, by insufficient resources, we advise starting with a more detailed description of the functionality of existing roads in the country. This classification could be linked afterwards with design standards that are more realistic. The classification of roads proposed by the African Union and discussed in chapter 3, is already a good start, but in our opinion incomplete, especially due to its limitation to interurban road environments. It is also important to adjust standard, or to develop specific standards to 'adapt' infrastructure to road users which occur very frequently on Burkinabe roads. First of all we already put some emphasis on P2W which are the most common road users. But there are other road users that are rather exceptional in European countries, like tricycles, carts pulled by animals, groups of cattle, etc. In which way infrastructure design has to be adapted to these users? Even on major rural roads this issue has to be dealt with because roads of this category are sometimes the 'only existing' surfaced road in the area.

Besides the development of these standards, it is also important to train road engineers on specific road safety skills, so that the vison of a safe system, based on the sub-Saharan reality can be developed and taken into account to develop standards for road design and maintenance.

4.2 Vehicles

4.2.1 General remarks

The natural benchmark at international level for the comparison of the standardisation schemes for vehicles is the Agreement of the United Nations Economic Commission for Europe UNECE. Although the name refers to Europe, any UN country may participate in them as it is already the case.

The WP.29, belonging to UNECE, manages three different agreements:

- Agreement of 1958[11]: Agreement concerning the Adoption of Harmonized Technical United Nations Regulations for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these United Nations Regulations.
- Agreement of 1998[12]: Global technical regulations for wheeled vehicles, equipment and parts which can be fitted and/or be used on wheeled vehicles.
- Agreements of 1997[13]: Agreement Concerning the Adoption of Uniform Conditions for Periodical Technical Inspections of Wheeled Vehicles and the Reciprocal Recognition of Such Inspections.

The two first agreements, 1958 and 1998, define the standards for new vehicles. The analysis of the differences between them is out of the scope of this document, but both set a scheme for vehicle approval and mutual recognition of the approvals between countries.

The third agreement, that one of 1997, defines the standards to apply to vehicles in use to ensure their roadworthiness both from the safety and the emissions point of view. It also contains provisions for the mutual recognition that may be used in Africa, in particular in those regions with significant volumes of international traffic, like the corridors or the roads from land-locked countries to harbours.

UNECE agreements are and already-available out-of-the-shelve solution for vehicle standardisation. Even the European Union refers to its whole scheme for vehicle approval to them. Here is a list of the main advantages of the system:

- Already available enormous compendium of vehicle standards, covering all aspects of vehicles: 147 regulations according to the agreement of 1958, 20 Global Technical Regulations (GTR) according to the agreement of 1998 and 4 rules according to the agreement of 1997.
- A group of experts working in the field since the late 50s of the last century.
- Unique worldwide forum of vehicle regulations in which any UN country can be influential by voting.
- Agreements can be formally ratified, with all the implications of international law, or just recognised at the country level.

[11] https://www.unece.org/fileadmin/DAM/trans/main/wp29/wp29regs/2017/E-ECE-TRANS-505-Rev.3e.pdf

[12] https://www.unece.org/fileadmin/DAM/trans/main/wp29/wp29wgs/wp29gen/wp29glob/tran132.pdf

[13] https://www.unece.org/trans/main/wp29/wp29wgs/wp29gen/wp291997.html

- Agreements can be adapted.
- Countries keep their sovereignty in any case.
- Vehicle manufacturers already know how to produce according to those standards.
- Using non-common standards require tailored designs, and therefore, vehicles become more expensive.
- Countries do not need to develop testing facilities; they can use the tests already done in other parts of the world.

In the case of Burkina Faso, there is already a relatively acceptable framework: the Traffic Act. The country may decide to develop all the precise technical details by itself, to wait for regional development or to take off-the-shelf all the existing international material.

Although we could not lay our hands on the different decrees and documents concerning vehicle standards, the discussions we had with different Burkinabe experts and agencies have led us to the same general remark as in the part on road infrastructure. There is a clear regulation but divided in several different documents, not bundled in one file.

The application of this legislation is a big problem. Technical vehicle control is mandatory and the number and also the size of the inspection centres (mobile and fixed) have increased. But not all vehicles are attending such a control. According to a simple estimate based on the figures of the technical checks carried out, it seems that about 80% of the 4WD and transport vehicles (e.g. private cars, vans, and trucks) have been checked. At the level of two-wheelers, the percentage of vehicles that are in order with the technical control is terribly low. It is estimated that only 1% of motorized two-wheelers in circulation annually pass the technical control! But by passing a technical control, the evaluation on roadworthiness is not as strict as the regulations would define.

In addition to the vehicle technology check, the technical control centres (*Centre de Contrôle des Véhicules Automobiles – CCVA*) also verifies if all import certificates and papers are in order and valid (as a reminder 80% of 4WDs are occasions imported from Europe). At the time of importation, a particular car cannot be older than 15 years old. The same rule applies for trucks and coaches whose total permissible laden weight is greater than or equal to 3.5 tons. For other coaches, the maximum import age is 10 years. Unfortunately, the rules relating to the importation of vehicles are not always respected. During the month of February 2018, the inspection stations processed nearly 3100 new or used vehicles to check compliance. According to these figures, only 68% of these vehicles met official standards.

4.2.2 Typical issues for vehicle legislation

For Burkina Faso, besides these general remarks, there are four types of issues that could have an impact on the definition and application of technical vehicle standards: 1) problems with P2W, 2) lack of enforcement, 3) lack of repairs, and 4) a knowledge gap.

4.2.2.1 Problems with P2W

P2W with limited power (< 50cc), especially from Chinese manufacturers do not meet all safety standards. The major risk of these vehicles is their speed: they can easily reach a speed of 120, and sometimes even 160 km/h. These P2W are not submitted to a technical control, or speed limitation. This must be considered as an important issue.

4.2.2.2 Enforcement

Technical control of vehicles, at the moment of importation and during his lifetime is mandatory. But if people don't come to technical control, there is no reaction from the government. In general it's up to the police forces to do periodic administrative controls on all vehicle. But it is rarely done for P2W and 'camion du bois'.

Even if there is a control, the effectivity is put in question for two reasons:

- Some police officers are unfamiliar with the various documents required for legal conduct (technical control, registration certificate, permit, etc.);
- Fines are expensive (about 25,000 CFA, about 38 euros) and arrangements between the driver and the police / gendarme are common. Thus, it is common to see the policeman accept a small amount (1,000 or 2,000 CFA, about 3 euros) to let the person pass.

4.2.2.3 Lack of repairs

Even with a good will to put his vehicle in order, the Burkinabe cannot always find a solution for:

- spare parts are not always available because import procedures are slow or because the vehicle is too old;
- The training of garage owners is not always at the level of a professional mechanic, especially for the electrical and electronic aspects.

In an optimistic way, we can say that garages are excellent in creativity and the art of doing well. They always find solutions, often non-compliant, allowing the vehicle to continue driving.

4.2.2.4 By the general public

There is also a low rate of literacy and comprehension of French, which makes it difficult to understand legislation written in French only.

4.2.3 Recommendations

Technical standards for P2W, especially for the lower power vehicles (<50cc) must be developed. Probably the most effective standard has to take a speed limitation into consideration.

The final evaluation criteria that are applied in the technical control centres have to be defined in a more formal way. They probably don't reflect the official technical standards as proposed by the international convention. But it's always better to create standards in between in a formal way than to give the impression to applicate the universal criteria and to do 'something' else that is not clear for everyone.

Besides this more technical point, enforcement must ensure that every vehicle, at the different levels of their lifecycle has to get the necessary technical controls. This is easier said than done, knowing that compliance with rules and enforcement are a big problem in Burkina Faso.

5 Development of strategies for Burkina Faso

5.1 Geometric design standards

The overall conclusion for road geometric design guidelines in Burkina Faso is that a national set of road design guidelines is required. This set should make provision for developing separate geometric design guidelines for urban roads, rural single carriageway road and dual carriageway roads.

However, the assessment has revealed that purely an adaptation of commonly applied documents will not be particularly valuable for the safety progression unless an explicit attempt is made to develop and describe the relationship between design elements and road safety and that the concept of the safe systems approach is firmly entrenched in the philosophy of the guidelines. The prioritisation process has identified several items that have both a high relevance for design practices (and therefore guidelines) for being poorly described in the currently used guidelines in BF. In chapter 4 the three highest-scoring items in each of the main design elements (Basic elements; alignment; cross-section and intersection/interchanges) were selected as priority items. For further developing the guidelines this chapter proposes detailed investigation and research of the top items across the four main design elements. This serves to illustrate the process which the Burkinabe road authorities should adopt in the revision of the guidelines. Such revision may entail desk-top type research based on international literature, detailed local field research to account for unique local conditions (such as the design vehicle; design human, etc.) or simply adopting recognised international standards and values. However, it is of importance that the new guidelines be developed considering the specific research questions developed in this process.

5.1.1 Single carriageway rural roads

Table 15 provides an overview of the highest-scoring design features from the four primary categories discussed in Chapter 4. Only design features scoring higher ratings ('TOP' or 'HIGH') in both design documents (AU directive and French ARP) or those features scoring 'TOP' priority in at least one document were retained.

In total, there are 10 basic assumption features, two alignment features, two cross-section features and five intersection design features. Each of these design features needs to be analysed and adapted upon during a structural and systematic drafting of design guidelines for single carriageway rural roads in Burkina Faso. There is a need to adapt the basic assumptions to the Burkinabe traffic system, as well as to develop and describe the relationship of these design elements with road safety and to make clear the effects of deviations from the recommended values. This will enable designers to gain insights into the relationships and of the consequences should they wish to deviate from the recommended values prescribed in the guidelines.

Design feature	Element	ARP		African Union	
		Weighted rating	Priority ranking	Weighted rating	Priority ranking
Local speed limits	Intersection	100.00	TOP	100.00	TOP
Roundabout Expected Use	Intersection	83.33	HIGH	100.00	TOP
Design vehicle characteristics	Basic assumptions	100.00	TOP	75.00	HIGH
Auxiliary (climbing or passing) lane suppression: type and length of drop	Alignment	75.00	HIGH	100.00	TOP
Type and length	Alignment	75.00	HIGH	100.00	TOP
Bicycle and pedestrian facilities	Intersection	100.00	TOP	75.00	HIGH
Speed limit approach	Basic assumptions	83.33	HIGH	83.33	HIGH
Longitudinal friction coefficient	Basic assumptions	83.33	HIGH	83.33	HIGH
Side friction coefficient	Basic assumptions	83.33	HIGH	83.33	HIGH
Deceleration	Basic assumptions	83.33	HIGH	83.33	HIGH
Dimensions	Basic assumptions	83.33	HIGH	83.33	HIGH
Swept path	Basic assumptions	83.33	HIGH	83.33	HIGH
Lane width vs design speed	Cross section	83.33	HIGH	83.33	HIGH
Traffic conflict countermeasures for vulnerable road users	Intersection	83.33	HIGH	75.00	HIGH
Stopping sight distance	Basic assumptions	75.00	HIGH	75.00	HIGH
Meeting sight distance	Basic assumptions	75.00	HIGH	75.00	HIGH
Overtaking sight distance	Basic assumptions	75.00	HIGH	75.00	HIGH
Priority control mode	Intersection	75.00	HIGH	75.00	HIGH
Shoulder width suitable for emergency lane	Cross section	72.22	HIGH	72.22	HIGH

Table 15: Top priority items for investigation and inclusion of geometric design standards for single carriageway roads in Burkina Faso

For each of the prioritised design items described in Table 15, research questions were developed which serve as the basis input for the team responsible for drafting the new geometric design guidelines for single carriageway rural roads in Burkina Faso. These are shown in Table 16 to Table 27. In several cases, the research questions are similar to those described for Kenya, in a companion SaferAfrica WP5 report (Schermers *et al.*, 2019).

Basic assumptions	Deceleration	Priority scoring (max 100) ARP: HIGH ; AU: HIGH
Background	The physical dimensions of vehicles, their performance and operational characteristics have a significant impact on the physical space provided and it is essential that these impacts are carefully considered during geometric and operational design. Acceleration and deceleration rates of heavy goods vehicles are significantly different to that of for example passenger cars.	
Underlying research questions	What are the accepted acceleration and deceleration rates of different vehicle types given both the best and worst driver type? What coefficients of deceleration are relevant for sealed and unsealed roads for different vehicle types? What is the relationship between SSD, deceleration rate and safety? What is the relationship between deceleration rates and road safety given different vehicle, driver and road surface types?	

Table 16: Research item 01: Deceleration aspects in design of single carriageway rural roads in BF

Basic criteria	Speed limit approach to road design	Priority scoring (max 100) ARP: HIGH ; AU: HIGH
Background	Speed is a key variable in determining several road design characteristics, being used at the planning and design stages of a road scheme, which lead to the development of several concepts related to speed. At the design stage the reference speed has implications on the establishment of critical criteria for several safety related parameters, such as manoeuvres sight distances (e.g. stopping, overtaking, decision), and horizontal and vertical curvatures. When selecting a value for the design speed that may be compatible with the road functional category, it is important that this value is in line with the expected driver behaviour choices and matches the non-impeded traffic speed.	
Underlying research questions	What are most sensible reference speed values for the different road categories and type of surfacing? Are there empirically based values already established for other African countries that may be reasonably adopted for Burkina Faso?? How can reference be estimated for Burkina Faso, based on on-site measurements?	

Table 17: Research item 02: Design speed in design of single carriageway rural roads in BF

Basic criteria	Longitudinal and side friction coefficient	Priority scoring (max 100) ARP: HIGH ; AU: HIGH
Background	Since vehicle tyres are the only part that vehicle body that are in contact with the road, information about the tyre-road friction is critical to vehicle's longitudinal, lateral and roll dynamics and control. Longitudinal friction coefficient is the basis for delivering critical parameters of road design, such as stopping distance and acceleration rates in manoeuvres at intersections, but also determines the speed limits on curves and influences superelevation criteria. Maximum longitudinal and side frictions are related as a vector in Cartesian space.	
Underlying research questions	How can longitudinal friction coefficient measurements be incorporated into the road design guidelines? What kind of pavements (e.g. concrete, bituminous, and unsealed) should be assessed for longitudinal friction coefficient? What are the safety consequences related to longitudinal friction coefficients? What is the impact of runoff water on unsealed road pavement friction? What about dirt roads? What is the impact of soil contamination from unsealed access roads? For how long should a secondary road be sealed, in ordered to prevent contamination in the main road? To what extent will the longitudinal friction coefficient impact the stopping sight distance?	

Table 18: Research item 03: Friction coefficients in design of single carriageway rural roads in BF

Basic criteria	Deceleration	Priority scoring (max 100) ARP: HIGH ; AU: HIGH
Background	The physical dimensions of vehicles, their performance and operational characteristics have a significant impact on the physical space provided and it is essential that these impacts are carefully considered during geometric and operational design. Acceleration and deceleration rates of heavy goods vehicles are significantly different to that of for example passenger cars.	
Underlying research questions	What are reasonable deceleration capabilities of current Burkinabe PTW, cars, tricycles, buses and heavy goods vehicles, given their overall maintenance condition and actual reference load? What are the accepted acceleration and deceleration rates of different vehicle types given both the best and worst type driver? What coefficients of deceleration are relevant for sealed and unsealed roads for different vehicle types? What is the relationship between stopping sight distance, deceleration rate and safety? How does the relationship between deceleration rates and road safety vary with vehicle, driver and road surface types?	

Table 19: Research item 04: Deceleration rates in design of single carriageway rural roads in BF

Basic criteria	Sight distances (stopping, meeting and overtaking)	Priority scoring (max 100): ARP: HIGH ; AU: HIGH
Background	Stopping distance is the result of the reaction time distance and the braking distance. It is dependent on the reaction time of the driver, the braking ability of the vehicle and the coefficient of friction between the tyres and the road surface. It is an integral input in the determination of stopping sight distances and the underlying parameters for coefficients of friction, driver reaction and perception times etc. are vital in its determination. In geometric design sight distance requirements, the overtaking process is a major safety issue. The locations with passing zones strongly depend on the provision of at least the minimum sight distance [passing sight distance (PSD)]. Safety during the passing process can be violated by many means. Besides operational constraints imposed from traffic volumes and/or traffic composition, the impact of short passing zones, although not extensively validated by accident data seems to be very important in terms of smooth vs violent return of the passing vehicle to the through lane. Vehicle acceleration data are vital to determine passing distances.	
Underlying research questions	What are parameter values for driver perception and reaction times, vehicle braking capabilities and deceleration rates and road friction coefficients in establishing stopping (sight) distance? What is the relationship between different parameter values and road safety? Are the parameter values established by international studies such as EU Sight (Hogema, Stuiver, Kroon, Broeren, & Barrell, 2015; Weber; et al., 2016) relevant for Burkina Faso road design guidelines? Since vehicles in Burkina Faso are mostly used, how can an acceleration rate be determined? How does the passing process interact with posted speed limits? What are the safety impacts given ranges of overtaking distances (PSD) and design speeds? How does traffic impact the overtaking process? Can passing lanes be adopted in heavy traffic areas in Burkina Faso?	

Table 20: Research item 05: Sight distances in design of single carriageway rural roads in BF

Basic criteria	Design vehicle characteristics, dimensions, overhead and lateral clearances, dynamic clearances	Priority scoring (max 100) ARP: TOP/HIGH ; AU: TOP/HIGH
Background	Design vehicle characteristics determine their static and dynamic requirements and capabilities, impacting safety. Furthermore, local customary stowage of cargo and overload of vehicles may alter their dynamic response (e.g. higher centre of gravity, lower power to weight ratio, and greater axle loads). Safety distances as well as overhead and lateral clearances are essential in the design of underpasses, bridges and other structures over or under roads. Guidelines need to be regularly updated to ensure that the design vehicles adopted represent the actual population of vehicle using roads. Furthermore, these provisions must provide a minimum and acceptable level of comfort and not negatively affect roadway capacity by introducing uncertainty among drivers of vehicles. Specific attention needs to be provided to remedial treatments of sub-standard structures. Also, the provision of these distances should be in accordance to speed.	
Underlying research questions	Are data available to derive representative design vehicle templates for road design in Burkina Faso? Are international design vehicles appropriate for determining applicable values for safety distances and vertical - lateral clearances in Burkinabe guidelines? Are international design vehicles appropriate for determining applicable values for approach and departure sight triangles at intersections) and for critical grade assessments in Burkinabe guidelines? Assess current structures on dual carriageway roads in Burkina Faso and establish compliance with norms for safety distances - lateral and vertical clearances? Develop and adopt standard mitigation measures and incident management procedures for dealing with incidents related to safety distances and vertical - lateral clearances at structures over or under roads? How does the quality of pavement and especially how do dirt and unsealed roads impact safety distances?	

Table 21: Research item 06: Design vehicle characteristics in design of single carriageway rural roads in BF

Alignment	Auxiliary (climbing or passing) lane suppression: type and length of drop	Priority scoring (max 100) ARP: HIGH ; AU: TOP
Background	Long and steep gradients reduce the speed of heavy goods vehicles, an effect that depends on the vehicle initial speed and its power/weight ratio. Old buses and coaches (common in Burkinabe roads) also have lower traveling speeds on these gradients. Since cars usually do not have their speed reduced, the resulting speed differences impact safety negatively, as it is difficult for drivers to properly assess these speed differentials. Auxiliary lanes are generally short lane located immediately adjacent to the basic or through lane to accommodate some or other special circumstance such as acceleration to or deceleration from the speeds prevailing on the travelled way or heavy vehicles reduced to crawling speeds on a steep upgrade. They may also be used between closely spaced interchanges to support weaving.	
Underlying research questions	What speed boundaries define fast and slow traffic and at which point is a passing lane warranted? What are the warrants applied internationally in the provision of passing and or climbing lanes (including optimal safe lengths of passing lanes and design parameters for merge and diverge areas)? What are the critical lengths for the customary Burkinabe heavy goods and bus design vehicles How drivers are made aware of starting and ending of auxiliary lanes? What are the safety impacts of passing and climbing lanes, particularly speed and overtaking behaviour? How are shoulders managed at starting points of auxiliary lanes? How should an auxiliary lane be introduced and supressed?	

Table 22: Research item 07: Auxiliary lanes in design of single carriageway rural roads in BF

Cross-section	Lane width vs. design speed	Priority scoring (max 100) ARP: HIGH ; AU: HIGH
Background	Lane width, in combination with other cross-sectional and design elements, has a significant impact on actual vehicle speeds and therefore also with crashes when these occur. Although wider lanes allow for more lateral room to manoeuvre in, they may also lead to higher average driving speeds. Most lane widths in design guidelines are associated with specific design speeds, in principle the higher the design speed, the wider the lane. The assumption in this is that design speeds generally are higher than maximum posted limits and thereby introduce a certain safety margin for error. However, it may well be that exactly this added measure leads to wider lanes with higher speeds and more crashes.	
Underlying research questions	Does international literature support the theory that wider lanes with higher design speeds lead to higher levels of safety? Is lane width the predominant determinant of driven vehicle speed? Are narrower lanes with narrow shoulders less safe than narrower lanes with wide shoulder or than wider lanes with narrow shoulder or wide lanes with wide shoulders? Is the relationship between lane width and design speed logical and can the safety effects be made explicit?	

Table 23: Research item 08: Lane width and reference speed in design of single carriageway rural roads in BF

Cross-section	Shoulder width suitable for emergency lane	Priority scoring (max 100) ARP: HIGH ; AU: HIGH
Background	The shoulder of a road, generally on the outside of the driven lane can be paved or unpaved. The shoulder provides space for emergencies such as broken-down vehicles. Not all countries have adopted load bearing shoulders. In some countries where paved shoulder are provided these are used by pedestrian, cyclists and even informal traders. Wide shoulders may also be illegally used as travel lanes whereas narrow shoulders may result in vehicles stopping and encroaching onto the travelled lane. Vehicles stopping on the emergency lane constitute a hazard for fast moving traffic, especially at night and if not quickly removed.	
Underlying research questions	What is the optimum width of a (paved) shoulder? What are the internationally known safety effects of shoulders (speed, crashes; overtaking etc.)? What measures are necessary to prevent the unintended use of shoulders? What are the safety advantages of paved shoulders over emergency turnouts? What are the basic safety assumptions underlying the provision and use of shoulders alongside tow-lane rural roads	

Table 24: Research item 09: Shoulder width in design of single carriageway rural roads in BF

Intersections	Vulnerable road users traffic conflicts countermeasures for	Priority scoring (max 100) ARP: HIGH ; AU: HIGH
Background	Based on the laws of physics and speed and crash severity relationships, pedestrians and vulnerable road users stand the lowest chance of injury when vehicle speeds are kept below 30km/h. It stands to reason that pedestrians and other vulnerable road users such as cyclists should not be allowed access to roads with high speed traffic and especially not roads with speeds more than 50km/h. Rural roads with speed limits of 80km/h and more are designated to be used by high speed traffic only and mixed use with slow and vulnerable traffic should be actively dissuaded. This places extra demands on road designers to ensure that provisions for vulnerable road users are integrated into the plan and design process.	
Underlying research questions	Which measures have internationally been adopted to segregate vulnerable road users form fast and heavy motorised traffic? What measures have been effective to reduce crash severity at at-grade intersections where a mix of vulnerable road users and motorised traffic use the intersection? Which mitigation measures can be adopted in situations with mixed traffic alongside high-speed roads?	

Table 25: Research item 10: Vulnerable road users safety in design of single carriageway rural roads in BF

Intersections	Priority control mode	Priority scoring (max 100) ARP: HIGH ; AU: HIGH
Background	Intersections can be controlled in several ways and the form of the control has a direct impact on the traffic and safety performance of the intersection. Uncontrolled intersections have low capacity and can be unsafe whereas generally signalised provide the best capacity solution for complex situations but not always the safest. Insight into both the traffic (capacity, stops, delays) and safety performance (risk per road users' category, crashes, injuries) of intersections is important in guidelines and warrants for the different type of control and will aid designers in selecting the best alternative for a given traffic situation.	
Underlying research questions	What are the traffic and safety performance characteristics of the different intersection control types? What are operational warrants for different intersection control types? What are the positive and negative safety consequences for all road users related to the control types?	

Table 26: Research item 11: Intersection priority control mode in design of single carriageway rural roads in BF

Intersections	Bicycle facilities on roundabouts and roundabout expected use	Priority scoring (max 100) ARP: TOP/HIGH ; AU: HIGH/TOP
Background	Bicyclists should always have their own cycle path at roundabouts. However, in some countries cyclists share the (urban) roundabout for traffic volumes below 15000 vehicle per day and speeds lower than 50km/h. Bicycle paths should never be designed at the outer edge of roundabouts. Not only does this increase vehicle speeds through the roundabout but also increases the risk of crashes between cyclists and motorised traffic. For higher traffic volumes the bicyclists should be accommodated together with pedestrians. Bicyclists should not enter rural roundabouts.	
Underlying research questions	What are the safety impacts related to cycling facilities, specifically lanes, at roundabouts? What is the optimal width of shared pedestrian and bicycle crossings? How are cycle lanes on shared roadways accommodated at roundabout approach areas? How can data from bicycle travel demand analysis be utilized in the roundabout planning process? What are the criteria for accommodating bicycles when conventional intersections are reformed to roundabouts?	

Table 27: Research item 12: Bicycle facilities on roundabouts in design of single carriageway rural roads in BF

5.1.2 Dual carriageway roads

Table 28 presents the most critical design features for dual carriageway roads. Only design features scoring higher ratings in both design documents (AU directive and French ARP) or those features scoring TOP priority in at least one document were retained.

Design feature	Element	ARP		African Union	
		Weighted rating	Priority ranking	Weighted rating	Priority ranking
Design vehicle characteristics	Basic assumptions	100.00	TOP	100.00	TOP
Stopping sight distance	Basic assumptions	100.00	TOP	100.00	TOP
Intersection sight distance	Interchanges	100.00	TOP	100.00	TOP
Design consistency	Alignment	83.33	HIGH	100.00	TOP
Access control	Cross section	100.00	TOP	75.00	HIGH
Outside shoulder width suitable for emergency lane	Cross section	-	-	100.00	TOP
Reaction time	Basic assumptions	83.33	HIGH	83.33	HIGH
Actual speed approach	Basic assumptions	83.33	HIGH	83.33	HIGH
Longitudinal friction coefficient	Basic assumptions	83.33	HIGH	83.33	HIGH
Side friction coefficient	Basic assumptions	83.33	HIGH	83.33	HIGH
Deceleration	Basic assumptions	83.33	HIGH	83.33	HIGH
Stopping distance	Basic assumptions	83.33	HIGH	83.33	HIGH
Dimensions	Basic assumptions	83.33	HIGH	83.33	HIGH
Swept path	Basic assumptions	83.33	HIGH	83.33	HIGH
Overhead and lateral clearances	Basic assumptions	83.33	HIGH	83.33	HIGH
Dynamic lateral clearance	Basic assumptions	83.33	HIGH	83.33	HIGH
General	Cross section	83.33	HIGH	83.33	HIGH
Design speed approach	Basic assumptions	75.00	HIGH	75.00	HIGH
Transition curves	Alignment	75.00	HIGH	75.00	HIGH
Gradient	Alignment	75.00	HIGH	75.00	HIGH
Convex curves	Alignment	75.00	HIGH	75.00	HIGH
Sidewalks and bicyclist facilities provided along the interchange crossroad.	Interchanges	72.22	HIGH	72.22	HIGH
Length of access control along the crossroad beyond the interchange, to ensure its integrity	Interchanges	72.22	HIGH	72.22	HIGH
Land development and access management measures are in place for the interchange area (Y or N)	Interchanges	72.22	HIGH	72.22	HIGH
Capacity	Interchanges	72.22	HIGH	72.22	HIGH
Traffic control	Interchanges	72.22	HIGH	72.22	HIGH
Channelization	Interchanges	72.22	HIGH	72.22	HIGH

Table 28: Top priority items for investigation and inclusion of geometric design standards for dual carriageway roads in Burkina Faso

In total, there are 13 basic assumption features, four alignment features, three cross-section features and seven intersection design features. Many of these items relate to basic requirements, suggesting that road safety in these sections is poorly incorporated or adapted to the Burkinabe situation, and the importance of safety in the design process undermined. Several of the prioritised items for dual carriageways are the same as for single carriageway roads (See 5.2.1); this is not surprising as many of these are fundamental for geometric design and for road safety and common to both types of road.

As mentioned and recommended, new geometric guidelines for rural dual carriageway roads should be developed and these should include the design items described by the assessment described in this report. From a road safety perspective, it is important to make a direct link between the design elements and the safety consequences and effects. Also, guidelines should adopt a safe systems approach (prevent crashes and minimise crash severity).

For each of the prioritised design items described in Table 28, research questions were developed which serve as the basis input for the team responsible for drafting the new geometric design guidelines for dual carriageway rural roads in Burkina Faso. These are shown in Table 29 to Table 39. In several cases, the research questions are similar to those described for Kenya, in a companion SaferAfrica WP5 report (Schermers *et al.*, 2019).

Basic criteria	Design speed and actual speed approach to road design	Priority scoring (max 100) ICTAAL: HIGH ; AU: HIGH
Background	Speed is a key variable in determining several road design characteristics, being used at the planning and design stages of a road scheme, which lead to the development of several concepts related to speed. At the design stage the reference speed has implications on the establishment of critical criteria for several safety related parameters, such as manoeuvres sight distances (e.g. stopping, overtaking, decision), and horizontal and vertical curvatures. When selecting a value for the design speed that may be compatible with the road functional category, it is important that this value is in line with the expected driver behaviour choices and matches the non-impeded traffic speed.	
Underlying research questions	What are most sensible reference speed values for the different road categories and type of surfacing? Are there empirically based values already established for other African countries that may be reasonably adopted for Burkina Faso?? How can reference be estimated for Burkina Faso, based on on-site measurements?	

Table 29: Research item 13 : Reference speed concepts in design of dual carriageway rural roads in BF

Basic criteria	Reaction time, stopping distance, stopping sight distance	Priority scoring (max 100) ICTAAL: TOP/HIGH ; AU: TOP/HIGH
Background	Stopping distance is the result of the reaction time distance and the braking distance. It is dependent on the reaction time of the driver, the braking ability of the vehicle and the coefficient of friction between the tyres and the road surface. It is an integral input in the determination of stopping sight distances and the underlying parameters for coefficients of friction, driver reaction and perception times are vital in its determination	
Underlying research questions	What are parameter values for driver perception and reaction times, vehicle braking capabilities and deceleration rates and road friction coefficients in establishing stopping (sight) distance? What is the relationship between different parameter values and road safety? Are the parameter values established by international studies such as EU Sight (Hogema *et al.*, 2015) relevant for Burkina Faso road design guidelines?	

Table 30: Research item 14: Reaction time and sight distances in design of dual carriageway rural roads in BF

Basic criteria	Longitudinal and side friction coefficient	Priority scoring (max 100) ICTAAL: HIGH ; AU: HIGH
Background	Since vehicle tyres are the only part that vehicle body that are in contact with the road, information about the tyre-road friction is critical to vehicle's longitudinal, lateral and roll dynamics and control. Longitudinal friction coefficient is the basis for delivering critical parameters of road design, such as stopping distance and acceleration rates in manoeuvres at intersections, but also determines the speed limits on curves and influences superelevation criteria. Maximum longitudinal and side frictions are related as a vector in Cartesian space.	
Underlying research questions	How can longitudinal friction coefficient measurements be incorporated into the road design guidelines? What kind of pavements (e.g. concrete, bituminous, and unsealed) should be assessed for longitudinal friction coefficient? What is the impact of runoff water on unsealed road pavement friction? What about dirt roads? What is the impact of soil contamination from unsealed access roads? For how long should a secondary road be sealed, in ordered to prevent contamination in the main road? To what extent will the longitudinal friction coefficient impact the stopping sight distance?	

Table 31: Research item 15: Friction coefficients in design of dual carriageway rural roads in BF

Basic criteria	Deceleration	Priority scoring (max 100) ICTAAL: HIGH ; AU: HIGH
Background	The physical dimensions of vehicles, their performance and operational characteristics have a significant impact on the physical space provided and it is essential that these impacts are carefully considered during geometric and operational design. Acceleration and deceleration rates of heavy goods vehicles are significantly different to that of for example passenger cars.	
Underlying research questions	What are reasonable deceleration capabilities of current Burkinabe P2W, cars, tricycles, buses and heavy goods vehicles, given their overall maintenance condition and actual reference load? What are the accepted acceleration and deceleration rates of different vehicle types given both the best and worst type driver? What coefficients of deceleration are relevant for sealed and unsealed roads for different vehicle types? What is the relationship between stopping sight distance, deceleration rate and safety? What is the relationship between deceleration rates and road safety given different vehicle, driver and road surface types?	

Table 32: Research item 16: Deceleration rates in design of dual carriageway rural roads in BF

Basic criteria	Design vehicle characteristics, dimensions, overhead and lateral clearances, dynamic clearances	Priority scoring (max 100) ICTAAL: TOP/HIGH ; AU: TOP/HIGH
Background	Design vehicle characteristics determine their static and dynamic requirements and capabilities, impacting safety. Furthermore, local customary stowage of cargo and overload of vehicles may alter their dynamic response (e.g. higher centre of gravity, lower power to weight ratio, and greater axle loads). Safety distances as well as overhead and lateral clearances are essential in the design of underpasses, bridges and other structures over or under roads. Guidelines need to be regularly updated to ensure that the design vehicles adopted represent the actual population of vehicle using roads. Furthermore, these provisions must provide a minimum and acceptable level of comfort and not negatively affect roadway capacity by introducing uncertainty among drivers of vehicles. Specific attention needs to be provided to remedial treatments of sub-standard structures. Also, the provision of these distances should be in accordance to speed.	
Underlying research questions	Are data available to derive representative design vehicle templates for road design in Burkina Faso? Are international design vehicles appropriate for determining applicable values for safety distances and vertical - lateral clearances in Burkinabe guidelines? Are international design vehicles appropriate for determining applicable values for approach and departure sight triangles at intersections) and for critical grade assessments in Burkinabe guidelines? Assess current structures on dual carriageway roads in Burkina Faso and establish compliance with norms for safety distances - lateral and vertical clearances? Develop and adopt standard mitigation measures and incident management procedures for dealing with incidents related to safety distances and vertical - lateral clearances at structures over or under roads? How does the quality of pavement and especially how do dirt and unsealed roads impact safety distances?	

Table 33: Research item 17: Design vehicles characteristics in design of dual carriageway rural roads in BF

Alignment Cross-section	Maximum gradients, convex curves and auxiliary lanes	Priority scoring (max 100) ICTAAL: HIGH ; AU: HIGH
Background	Long and steep gradients reduce the speed of heavy goods vehicles, an effect that depends on the vehicle initial speed and its power/weight ratio. Old buses and coaches (common in Burkinabe roads) also have lower traveling speeds on these gradients. Since cars usually do not have their speed reduced, the resulting speed differences impact safety negatively, as it is difficult for drivers to properly assess these speed differentials. Auxiliary lanes are generally short lane located immediately adjacent to the basic or through lane to accommodate some or other special circumstance such as acceleration to or deceleration from the speeds prevailing on the travelled way or heavy vehicles reduced to crawling speeds on a steep upgrade. They may also be used between closely spaced interchanges to support weaving.	
Underlying research questions	What are the critical lengths for the customary Burkinabe heavy goods and bus design vehicles How drivers are made aware of starting and ending of auxiliary lanes? What are the safety impacts of auxiliary lanes? How are shoulders managed at starting points of auxiliary lanes? How should an auxiliary lane be introduced and supressed? What is the relation between HOV lanes and auxiliary lanes?	

Table 34: Research item 18: Auxiliary climbing lanes in design of dual carriageway rural roads in BF

Alignment Cross-section	Access control and frontage roads	Priority scoring (max 100) ICTAAL: TOP ; AU: HIGH
Background	Preventing conflicts involving big differences in speed, direction, mass and size is a major principle in safe system design. Therefore, access to high speed roads should be allowed only at designated places, where road the layout is designed to prevent conflicts with those characteristics. Access to these roads has to be fully controlled. Frontage roads are roads adjacent and parallel to but separated from the highway for service to abutting properties and for control of access. Sometimes frontage roads are also referred to as a service road.	
Underlying research questions	What are the criteria for introducing frontage roads? What are the criteria for connecting the frontage roads with the protected main highway? What is the optimum distance between a frontage road and through lanes at an intersection area? How is access management accommodated through frontage roads? What is the impact of frontage roads to impact corridor operations, land values, and development patterns? What is the impact of frontage roads and the connection they establish between the two sides of the high speed highway in mitigating the barrier effect and its impact on local safety of vulnerable road users	

Table 35: Research item 19: Access control in design of dual carriageway rural roads in BF

Cross-section	Outside shoulder width suitable for emergency lane	Priority scoring (max 100) ICTAAL: HIGH ; AU: TOP
Background	The shoulder of a road, generally on the outside of the driven lane can be paved or unpaved. The shoulder provides space for emergencies such as broken-down vehicles. Not all countries have adopted load bearing shoulders. In some countries where paved shoulder are provided these are used by pedestrian, cyclists and even informal traders. Wide shoulders may also be illegally used as travel lanes whereas narrow shoulders may result in vehicles stopping and encroaching onto the travelled lane. Vehicles stopping on the emergency lane constitute a hazard for fast moving traffic, especially at night and if not quickly removed.	
Underlying research questions	What is the optimum width of a (paved) shoulder? What are the internationally known safety effects of shoulders (speed, crashes; overtaking etc.)? What measures are necessary to prevent the unintended use of shoulders? What are the safety advantages of paved shoulders over emergency turnouts? What are the basic safety assumptions underlying the provision and use of shoulders alongside tow-lane rural roads	

Table 36: Research item 20: Shoulder characteristics in design of dual carriageway rural roads in BF

Cross-section	Secondary lanes	Priority scoring (max 100) ICTAAL: HIGH ; AU: HIGH
Background	Secondary lanes are short lanes located immediately adjacent to the basic or through lane to accommodate some or other special circumstance such as a turning movement to right or to left, acceleration to or deceleration from the speeds prevailing on the travelled way.	
Underlying research questions	How does design speed and traffic volume impact the length of secondary lanes? How are access requirements accommodated through secondary lanes? How are the beginning and ending areas of secondary lanes designed to house cycle lanes or bus lanes? What is the design vehicle on secondary lanes?	

Table 37: Research item 21: Secondary lanes in design of dual carriageway rural roads in BF

Interchanges	Design criteria for ramps and cross-road intersections	Priority scoring (max 100) ICTAAL: TOP/HIGH ; AU: TOP/HIGH
Background	Interchanges are transition areas where exiting long distance high speed traffic drivers have to adapt their driving behaviour to new low speed and mixed traffic conditions; entering drivers also have to change their behaviour. Safety approaches on the main highway include the accommodation of slower vehicles until they reach throughway speeds. On the local area, exiting drivers have to be nudged to reduce their speeds and to start noticing and accommodating conflicts with pedestrians, bicyclists and in general to navigate through a more complex network. This Research item deals specifically with the design of the throughway of the high speed road and the exit and entrance ramps, their capacity, traffic controls (e.g. ramp metering), sight distances and movement channelization.	
Underlying research questions	What is the desirable length for exiting and entrance ramps, to allow proper speed adjustment? What are the safety consequences of various weaving lengths? What combinations of horizontal curvature and gradient are permissible for safe deceleration and effective acceleration? What is the proper combination of number and width of lanes on an exit ramp, to ensure proper levels of safety and volume of service?	

Table 38: Research item 22: Interchange ramps criteria in design of dual carriageway rural roads in BF

Interchanges	Characteristics of the transition area; sidewalks and bicyclist facilities, length of access control, land development management	Priority scoring (max 100) ICTAAL: HIGH ; AU: HIGH
Background	Interchanges are transition areas where exiting long distance high speed traffic drivers have to adapt their driving behaviour to new low speed and mixed traffic conditions; entering drivers also have to change their behaviour. Safety approaches on the main highway include the accommodation of slower vehicles until they reach throughway speeds. On the local area, exiting drivers have to be nudged to reduce their speeds and to start noticing and accommodating conflicts with pedestrians, bicyclists and in general to navigate through a more complex network. This research item deals specifically with issues arising in the area outside of the main high speed dual carriageway road. From a land use perspective, the surrounding area of interchanges needs to have special restrictive rules, to support access control to the high speed road and allow future capacity improvements.	
Underlying research questions	What are the safety impacts of pedestrian and cycling facilities at the end-of ramps in crossroads? What is the optimal sight distance to be provided at the end of exiting ramps? What is the preferable traffic control system at the end of exiting ramps? What is the impact of interchange area land use restrictions on corridor operations, land values, and development patterns?	

Table 39: Research item 23: Interchange area land use restrictions in design of dual carriageway rural roads in BF

5.2 Vehicle design standards

5.2.1 Forward

As in many other countries in the continent, Burkina Faso has a relatively well defined Traffic Act. However, it is still necessary some development to achieve the systems to ensure acceptable vehicles as long as they are on the road.

The main drivers to improve the system correspond to the three levels considered along with the project SaferAfrica: Institutional, organisational and operational level. Any detailed conclusion requires undertaking the diagnosis approach described in section 6 of this document.

Institutional level

Burkina Faso government created ONASER[14] within the Directorate General of Land and Maritime Transport, which at its time depends on the Ministry of Transport, Urban Mobility and Road Safety. The setting up of ONASR as an identifiable governmental agency to manage vehicle standardisation is an appropriate step in the right direction.

Organisational level

ONASER is already taking care of some activities linked to vehicle compliance, mainly as agency controlling the CCVA, which is the public-private organization undertaking vehicle inspection in Burkina Faso.

Because of lack of data, it is not clear whether the activity of controlling technical requirements during the registration process, both new and used, is within the scope of ONASER. In any case, that activity shall be clearly identified and properly executed.

Burkinabe's Traffic Act defines general requirements for vehicles but does not contain a precise degree of detail that allows efficient enforcement.

Regarding vehicle inspection, it has not been possible to find detailed information about the content of the inspection, quality and fraud control, inspectors' skill management, equipment management, data management, inspection facility requirements and other essential aspects of the service.

Operational level

Operations regarding vehicle inspections are introduced in Burkina Faso, although still a significant amount of vehicles are not yet controlled. Anyhow, it is necessary to address issues in the institutional and organisational level prior or at the same time than redefining the operations side.

There is no evidence of operational activity regarding the control of vehicles' technical features when registering.

[14] Office Nationale de Sécurité Routière – National Road Safety Office

5.2.2 Enabling projects

The enabling project plan for Burkina Faso includes mainly two activities: diagnosis and support project. At this point, it is only possible to define with detail the diagnosis part.

5.2.2.1 Diagnosis

The Global Road Safety Facility – GRSF of the World Bank – WB has started a series of diagnosis project in some Sub Saharan countries in order to precisely assess the needs regarding the regulatory framework of the process. Projects are called Assessment of Vehicle Inspection Schemes – AVIS, and focus on three main aspects:

- Capacity building
- Entering vehicles, regarding if they are new or used
- Already existing vehicles

The first report was made on Togo[15] and it is the result of a detailed working plan that can be used in any country.

The precise definition of the project is the following one[16]:

The Objectives of the AVIS study is to review current practices in vehicle inspection regimes in defined countries, to make context-specific recommendations for each of them. The aim is to improve the way these inspection programs contribute to the countries' overall ability to manage the motorisation process and improve road safety outcomes and other public policy objectives. It also recommends an overall program of capacity building toward implementing the recommendations.

The scope of the assessment shall include two regimes for the country, one covering the inspection of in-use vehicles, and the other covering certification of vehicles entering the registered vehicle fleet for the first time, whether through manufacture or import and a program of capacity building.

Scope A: In-use vehicle inspections:

A. The consultant shall:
B. Document current practice with respect to in-use vehicle inspections in the country, both as related to road safety and vehicle emissions
C. Identify key vehicle safety practices / aspects that should be incorporated into periodic technical inspections, where they are not already practiced
D. Propose and recommend a plausible structure for carrying out in-use vehicle inspections going forward, taking into account the need to incorporate not only road safety but also pollutant emissions, in the control tests. The recommended structure should take the following into account:
    a. Assume that whatever pollution control regime will be adopted, it would likely involve control of PM and non-methane hydrocarbon emissions from gasoline and diesel vehicles in the short run, and would need to include NOx control in the medium to long run, in accordance with the requirements set for new and used vehicles being registered in the country.

[15] https://citainsp.org/wp-content/uploads/2018/07/TogoReportFinalEN.Final_.pdf

[16] Extract of Term of Reference for GRSF's AVIS projects

b. The current and anticipated future size and age of the vehicle fleet should be taken into account both for the country as a whole and the major metropolitan areas within the country
c. Dimensions and business-case of the inspection operations should be considered and factored into the recommendations, taking into account needed investments, institutional development and strengthening at all levels (national, regional, local), facilities development, data management, communication and awareness campaigns, on-road and administrative enforcement, fraud control and training

Scope B: Certification of vehicles entering the registered vehicle fleet for the first time

Many countries are dependent primarily on vehicle imports to grow their vehicle fleets. Scope B is intended to evaluate and make recommendations on the process by which entering vehicles (that is, vehicles being imported, including locally assembled vehicles based on imported kits) are considered eligible for first-time registration. The consultant shall:

A. Document and describe current practice with respect to import vehicle inspection, as related to structural integrity / crash-worthiness of the vehicle, crash avoidance and mitigation features of the vehicles, and emissions control and performance. Such documentation would include identification and description of the relevant international agreements, if any, to which the country formally adheres or voluntarily submits to.
B. Identify key weaknesses in the current import certification process, with reference to international best practice
C. Propose and recommend one or more plausible scenarios for modifying the vehicle import certification process in line with public policy aims of improving in-built crash avoidance and crashworthiness characteristics of the vehicle fleet over time, as well as emissions characteristics. The considered scenarios should include considerations of needed investments, institutional capacity to administer the system, institutional strengthening at all levels (national, regional, local, and private), facilities development, data management, communication and awareness, fraud control and training.

Scope C: Capacity building

The consultant shall:

A. Propose needed national, regional and local training for administrative and technical nationals via an action plan. This proposal shall consider all different department and levels within the authorities and relevant stakeholders.

   The proposed training should be relevant to the anticipate roles of the different stakeholders and shall include the governmental departments taking care of new and in-use vehicle standards, registration of vehicles, management of vehicle workshops, police, customs and transports.

   Regarding the private side, the stakeholders to be considered are individual vehicle owners, drivers, big fleet managers, repair workshops, vehicle importers and manufacturers, parts importers and manufacturers, and inspection services, as relevant.
B. Propose a layout for a standard vehicle inspection station, in terms of equipment, facilities, staffing, as input for the Government
C. Propose and conduct study tours in partner countries (industrialized and emerging/developing countries), with the aim of sharing implementation approaches from countries with best practices.

The assignment will be conducted by a team of two individual consultants.

Deliverables

The expected deliverables from the team of individual consultants are as follows:

1. An inception report prepared before the first field visit that will list the main information collected from the desk review, and identify the issues to clarify during the field visit as listed under the Scope of Work section of the present project description. This note will notably include a review of the current status of the vehicle legal framework of the country, including the requirements for new vehicles, in-use vehicles and used imported vehicles. That shall comprise as well a description of the arrangements that the country authorities have set up to manage the legal framework related to road vehicles. Regulations will be analysed from the perspective of individual use and commercial use whenever the distinction is relevant.
2. A field visit report that will include the clarifications on the issues listed in the inception report, relevant information collected during the field visit, program and contact details for stakeholders met.
3. A proposal of specific and realistic implementable frameworks for road vehicle control, with respect to both in-use vehicles, and vehicles newly entering the fleet for first time registration, taking into account already existing international approaches like the 1997 Vienna Agreement of the UN ECE adapted to the country, including the concepts listed in "Objectives and Scope of the Work" of these Terms of Reference. This could be phased approach, or different solutions depending on the purpose of the vehicle, personal or commercial
4. A template business plan for inspection facilities that will recommend and financially evaluate needed investments inter alia: facilities to conduct used vehicles' inspections and supplies of needed technical equipment, e-systems to manage data as needed, communication and awareness campaigns, etc.

Timing of the Assessment

The forecast of resources allocation for the Assessment of Vehicle Inspection Schemes (AVIS) assessment is presented in Table 40:

Activities	Scheduled time
1. Preparation of the assessment	5 working days
2. Field work in the country	10 working days
3. Assessment and report writing	5 working days

Table 40: Estimated resources allocation for the AVIS assessment in BF

The two consultants will jointly produce all deliverables. The estimated level of effort is maximum 20 days each.

The detailed schedule is presented in Table 41, including additional activities to undertake. Dates are related to the actual date of signature of the contract:

	Week number										
	1	2	3	4	5	6	7	8	9	10	11
Kick of meeting		◆									
Preparation of assessment			◆	◆							
Mission					◆	◆					
Presentation of mission outcome							◆				
Draft report								◆	◆		
Final mission report										◆	◆

Table 41: Expected timetable for the AVIS assessment in BF

Required Assessments Resources

The selection of consultants should avoid conflicts of interest with personal or professional affiliations relevant to the assignment.

Consultants to conduct the assessment should be expert with extensive international experience in vehicle inspection and/or road transportation in general.

The consultant's team should be technically sound, and not have an implicit or explicit interest in the study's outcomes. The confidence of the clients that they are getting the best technical advice is of paramount importance.

Travel expenses are budgeted for ten days stay in the country.

5.2.2.2 Support project

The specific support project for Burkina Faso only can be defined after conducting the AVIS project, or similar, defined before. In order to provide an order of magnitude, the support project undertaken after the diagnosis of Togo involves five consultants for 30 months (not full time).

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7 Appendixes

7.1 SaferAfrica assessment of the relevance for safety of INTERSAFE design features to Burkina Faso design guidelines

7.1.1 Relevance ratings of road design features for interurban single carriageway roads adopted from the INTERSAFE project

	BASIC ASSUMPTIONS	A Relevant to safety (small to large: (1-3)	B Relevance covered in literature (Qualitative/descriptive to numerical: (1-3)	C Researchable in regards to safety (1-3)	D Final score Priority D=AxBxC Very low to very high D=AxBxC (Max=27)
1.1	General approach				
1.1.1	Design speed approach	3	3	2	18
1.1.2	Speed limit approach	2	3	3	18
1.1.3	Actual speed approach	3	2	3	18
1.2	Reaction time	3	3	2	18
1.3	Eye position and object position				
1.3.1	Eye height	3	2	2	12
1.3.2	Lateral eye position	3	2	2	12
1.3.3	Object height	3	2	2	12
1.3.4	Lateral object position	3	2	2	12
1.4	Friction coefficient				
1.4.1	Longitudinal friction coefficient	3	2	3	18
1.4.2	Side friction coefficient	3	2	3	18
1.5	Vehicle deceleration and acceleration				
1.5.1	Deceleration	3	3	2	18
1.5.2	Acceleration	2	2	2	8
1.6	Action distances				
1.6.1	Stopping distance	3	2	3	18
1.6.2	Overtaking distance	3	2	3	18
1.7	Sight distance				
1.7.1	Stopping sight distance	3	3	3	27
1.7.2	Meeting sight distance	3	3	3	27
1.7.3	Overtaking sight distance	3	3	3	27
1.7.4	Abort overtaking sight distance	2	1	3	6
1.7.5	Crossing sight distance	2	2	2	8

	BASIC ASSUMPTIONS	A Relevant to safety (small to large: (1-3)	B Relevance covered in literature (Qualitative/descriptive to numerical: (1-3)	C Researchable in regards to safety (1-3)	D Final score Priority D=AxBxC Very low to very high D=AxBxC (Max=27)
1.8	Design vehicle characteristics	3	3	3	27
1.9	Clearances				
1.9.1	Dimensions	3	3	2	18
1.9.2	Swept path	3	3	2	18
1.9.3	Overhead and lateral clearances	3	3	2	18
1.9.4	Safety distances	3	3	2	18
Annex	Road lighting	3	1	2	6

	ALIGNMENT	A Relevant to safety (small to large: 1-3)	B Relevance covered in literature (Qualitative/descriptive to numerical: 1-3)	C Researchable in regards to safety (1-3)	D Final score Priority D=AxBxC Very low to very high
2.2	**Horizontal alignment**				
2.2.1	Principles	3	3	2	18
2.2.2	Straight sections and large radius curves	3	3	2	18
2.2.3	Curves				
2.2.3.1	Radii not recommended	3	3	2	18
2.2.3.2	Super elevation	3	3	2	18
2.2.3.3	Minimum radius	3	3	2	18
2.2.4	Rules for linking alignment elements				
2.2.4.1	Curve following a straight section	3	3	2	18
2.2.4.2	Compatibility of two successive curves	3	3	2	18
2.2.4.3	Transition curves	3	3	3	27
2.2.4.4	Internal defects of a bend	2	2	2	8
2.2.4.5	Design consistency	3	3	2	18
2.2.5	Project planning to improve existing roads	3	2	1	6
2.3	**Vertical alignment**				
2.3.1	Gradient	3	3	3	27
2.3.2	Vertical connecting curves				
2.3.2.1	Convex curves	3	3	3	27
2.3.2.2	Concave curves	3	3	2	18
2.3.3	Climbing lanes				
2.3.3.1	Passing/Climbing lanes (old 3.2.4)	3	3	3	27
2.3.3.2	Auxiliary (climbing or passing) lane suppression: type and length of drop	3	3	3	27
2.3.4	Improvement of existing roads	3	2	1	6
2.3.5	Emergency escape ramps				
2.3.5.1	Warrants and spacing	3	3	2	18
2.3.5.2	Type and length	3	3	3	27
2.3.5.3	Stop areas for brake checking	2	1	1	2
2.4	Coordination of horizontal and vertical alignments	3	2	1	6

	CROSS-SECTION	A Relevant to safety (small to large: 1-3)	B Relevance covered in literature (Qualitative/descriptive to numerical: 1-3)	C Researchable in regards to safety (1-3)	D Final score Priority D=AxBxC Very low to very high
3.1.3	Integrated design	3	2	1	6
3.2	Main carriageway				
3.2.1	Road Width	3	3	2	18
3.2.2	Running lanes				
3.2.2.1	Lane width vs design speed	3	3	2	18
3.2.3	Crossfall	2	3	1	6
3.2.4	Hard shoulders	3	2	2	12
3.2.4.1	Shoulder width suitable for emergency lane	2	2	3	12
3.2.5	Inner shoulder				
3.2.6	Median separation				
3.2.7	Turnouts, safety zones	3	2	1	6
3.2.8	Surfacing	3	2	2	12
3.2.9	Road markings	3	2	2	12
3.3	Roadside				
3.3.1	Obstacle-free zones	3	3	2	18
3.3.2	Type of Obstacle	3	2	2	12
3.3.3	Soft shoulders	3	2	2	12
3.3.4	Slopes	3	2	2	12
3.3.5	Drainage channels	2	3	2	12
3.4	Secondary lanes				
3.4.1	Cycle lane	3	3	3	27
3.4.2	General	3	3	2	18
3.4.3	Pedestrian sidewalk	3	3	3	27
3.4.4	Bus stops bays	3	2	2	12
3.5	Access control	3	3	3	27
3.5.1	Frontage roads	3	3	2	18
3.6	Tunnels	3	3	1	9

	INTERSECTIONS	A Relevant to safety (small to large: 1-3)	B Relevance covered in literature (Qualitative/descriptive to numerical: 1-3)	C Researchable in regards to safety (1-3)	D Final score Priority D=AxBxC Very low to very high
4.1	Intersection types				
4.1.1	Number of arms	3	3	2	18
4.1.2	Traffic control mode	3	3	3	27
4.1.3	Traffic conflict countermeasures for motor vehicles	3	3	2	18
4.1.4	Traffic conflict countermeasures for vulnerable road users	3	3	3	27
4.2	Use of design templates	3	3	2	18
4.3	Design principles	3	3	2	18
4.4	Traffic safety records for intersection types	3	2	2	12
4.5	Intersection between a distributor (high level) and a local road				
4.5.1	3- and 4-way	3	2	2	12
4.5.2	Priority control mode	3	3	3	27
4.5.3	Minor road channelization	3	3	2	18
4.5.4	Major road left turn lanes	3	3	3	27
4.5.5	Right turn lanes	3	3	2	18
4.5.6	Bicycle and pedestrian facilities	3	3	3	27
4.5.7	Local speed limits	3	3	3	27
4.5.8	Crossing sight distance requirements	3	3	2	18
4.6	Intersection between two distributor (high level) roads				0
4.6.1	X or Y intersection	3	2	3	18
4.6.2	Roundabout				
4.6.2.1	Expected Use	3	3	3	27
4.6.2.2	Shape and layout (refers to whather it is a traditional t or X or some deviation)	2	3	1	6
4.6.2.3	Crossing sight distance requirements	3	3	2	18
4.6.2.4	Bicycle facilities	3	3	2	18
4.6.3	Traffic signals	2	2	3	12
4.6.4	Grade separation	3	3	2	18

7.1.2 Relevance ratings of road design features for interurban dual carriageway roads adopted from the INTERSAFE project

	BASIC ASSUMPTIONS	A Relevant to safety (small to large: (1-3)	B Relevance covered in literature (Qualitative/descriptive to numerical: (1-3)	C Researchable in regards to safety (1-3)	D Final score Priority D=AxBxC Very low to very high D=AxBxC (Max=27)
1.1	**General approach**				
1.1.1	Design speed approach	3	3	3	27
1.1.2	Speed limit approach	2	3	3	18
1.1.3	Actual speed approach	3	3	2	18
1.2	Reaction time	3	3	2	18
1.3	Eye position and object position				
1.3.1	Eye height	3	2	2	12
1.3.2	Lateral eye position	3	2	1	6
1.3.3	Object height	3	2	1	6
1.3.4	Lateral object position	3	2	1	6
1.4	Friction coefficient				
1.4.1	Longitudinal friction coefficient	3	2	3	18
1.4.2	Side friction coefficient	3	2	3	18
1.5	Vehicle deceleration and acceleration				
1.5.1	Deceleration	3	3	2	18
1.5.2	Acceleration	2	2	2	8
1.6	Action distances				
1.6.1	Stopping distance	3	2	3	18
1.6.2	Overtaking distance	-	-	-	
1.7	Sight distance				
1.7.1	Stopping sight distance	3	3	3	27
1.7.2	Meeting sight distance	-	-	-	
1.7.3	Overtaking sight distance	-	-	-	
1.7.4	Abort overtaking sight distance	-	-	-	
1.7.5	Crossing sight distance	2	2	2	8
1.8	Design vehicle characteristics	3	3	3	27
1.9	Clearances				
1.9.1	Dimensions	3	3	2	18
1.9.2	Swept path	3	3	2	18
1.9.3	Overhead and lateral clearances	3	3	2	18
1.9.4	Safety distances	3	3	2	18
1.9.5	Dynamic lateral clearance	3	3	2	18
1.10	Road image (Rhol=2to7*RBol)	2	2	1	4

	BASIC ASSUMPTIONS	A Relevant to safety (small to large: (1-3)	B Relevance covered in literature (Qualitative/descriptive to numerical: (1-3)	C Researchable in regards to safety (1-3)	D Final score Priority D=AxBxC Very low to very high D=AxBxC (Max=27)
1.11	Recommendations for mitigating barrier effect impacts.	3	3	2	18
Annex	Road lighting	3	1	2	6

	ALIGNMENT	A Relevant to safety (small to large: 1-3)	B Relevance covered in literature (Qualitative/descriptive to numerical: 1-3)	C Researchable in regards to safety (1-3)	D Final score Priority D=AxBxC Very low to very high
2.2	**Horizontal alignment**				
2.2.1	Principles	3	3	2	18
2.2.2	Straight sections and large radius curves	3	3	2	18
2.2.3	Curves				
2.2.3.1	Radii not recommended	3	3	2	18
2.2.3.2	Super elevation	3	3	2	18
2.2.3.3	Minimum radius	3	3	3	27
2.2.4	Rules for linking alignment elements				
2.2.4.1	Curve following a straight section	3	3	2	18
2.2.4.2	Compatibility of two successive curves	3	3	2	18
2.2.4.3	Transition curves	3	3	3	27
2.2.4.4	Internal defects of a bend	3	2	3	18
2.2.4.5	Design consistency	3	3	2	18
2.2.5	Project planning to improve existing roads	3	2	1	6
2.3	**Vertical alignment**				
2.3.1	Gradient	3	3	3	27
2.3.2	Vertical connecting curves				
2.3.2.1	Convex curves	3	3	3	27
2.3.2.2	Concave curves	3	3	2	18
2.3.3	Climbing lanes				
2.3.3.1	Passing/Climbing lanes (old 3.2.4)	3	2	3	18
2.3.3.2	Auxiliary (climbing or passing) lane suppression: type and length of drop	3	3	2	18
2.3.4	Improvement of existing roads	3	2	1	6
2.3.5	Emergency escape ramps				
2.3.5.1	Warrants and spacing	3	3	2	18
2.3.5.2	Type and length	3	3	3	27
2.3.5.3	Stop areas for brake checking	2	1	1	2
2.4	Coordination of horizontal and vertical alignments	3	2	1	6

	CROSS-SECTION	A Relevant to safety (small to large: 1-3)	B Relevance covered in literature (Qualitative/descriptive to numerical: 1-3)	C Researchable in regards to safety (1-3)	D Final score Priority D=AxBxC Very low to very high
3.1.1	Relationship curve radius / superlevation / speed	3	3	1	9
3.1.2	Superelevation (transition type / length)	2	2	1	4
3.1.3	Integrated design	3	2	1	6
3.2	Main carriageway				
3.2.1	Road Width	3	3	2	18
3.2.2	Running lanes				
3.2.2.1	Lane width vs. design speed	3	3	2	18
3.2.3	Crossfall	2	3	1	6
3.2.4	Hard shoulders	3	2	2	12
3.2.4.1	Outside shoulder width suitable for emergency lane	3	3	3	27
3.2.5	Inner shoulder	3	2	2	12
3.2.6	Central reservation	3	2	1	6
3.2.7	Median separation	3	2	3	18
3.2.8	Turnouts, safety zones	3	2	1	6
3.2.9	Surfacing	3	2	3	18
3.2.10	Road markings	3	2	2	12
3.3	Roadside				
3.3.1	Obstacle-free zones	3	3	2	18
3.3.2	Type of Obstacle	3	2	2	12
3.3.3	Soft shoulders	3	2	2	12
3.3.4	Slopes	3	2	2	12
3.3.5	Drainage channels	3	3	2	18
3.4	Auxiliary lanes (e.g. bus lanes)	3	3	2	18
3.5	Recommended cross-sections	3	3	2	18
3.6	Access control	3	3	3	27
3.7	Tunnels	3	3	1	9
3.8	Secondary lanes				
3.8.1	General	3	3	2	18
3.8.2	Frontage roads	3	3	2	18
3.8.3	Rest and service areas	2	2	1	4

	INTERCHANGE	A Relevant to safety (small to large: 1-3)	B Relevance covered in literature (Qualitative/descriptive to numerical: 1-3)	C Researchable in regards to safety (1-3)	D Final score Priority D=AxBxC Very low to very high
4.1	Interchange and Ramp Spacing				
4.1.1	Minimum value for spacing distance?	2	2	2	8
4.1.2	Minimum value for distance between successive entrances and exits?	2	2	2	8
4.2	Approach Alignment to Interchange				
4.2.1	Maximum absolute value for the grade of the freeway through the interchange area	2	2	2	8
4.2.2	Minimum value for horizontal curvature throughout the interchange area	3	3	2	18
4.2.3	Sight distance requirement in advance of each exit (desirably decision sight distance)	3	3	2	18
4.3	Interchange Configurations				
4.3.1	Differenciation between "service interchange" (between motorway and other road) and "system interchange" (between motorways)	2	3	2	12
4.3.1.1	An appropriate array of interchange configurations and variations must be evaluated in the design study phase	2	3	2	12
4.3.2	Interchange configuration appropriate for the operational needs, fits the topography and potential site conditions and constraints,	2	2	2	8
4.3.2.1	Requirements for consistency in exit pattern with other nearby interchanges	3	2	2	12
4.3.3	Requirement for completeness of directional traffic movements provision	2	2	2	8
4.3.4	Mandatory installation of all exits and entrances on the right side of the freeway mainline?	3	2	2	12
4.3.5	Provisions for weaving section design?	3	2	2	12
4.3.5.1	Distance between the physical merge and exit nose?	2	2	1	4
4.3.6	Location of crossroad in the interchange	2	2	1	4

	INTERCHANGE	A Relevant to safety (small to large: 1-3)	B Relevance covered in literature (Qualitative/descriptive to numerical: 1-3)	C Researchable in regards to safety (1-3)	D Final score Priority D=AxBxC Very low to very high
4.3.6.1	Over the freeway	2	2	1	4
4.3.7	Route Continuity	2	2	2	8
4.3.7.1	Priority route is the through facility	3	2	2	12
4.4	Ramp Design				
4.4.1	Design speed of the ramp ≥50% of the mainline design speed	2	2	1	4
4.4.2	Length for acceleration at entrance ramps	3	3	2	18
4.4.3	Length for deceleration at exit ramps?	3	3	2	18
4.4.4	Balanced number of exit and entrance?	2	2	2	8
4.5	Crossroad Design				
4.5.1	Sidewalks and bicyclist facilities provided along the interchange crossroad.	3	2	2	12
4.5.1.1	Traffic control at the crossings at interchange ramps (Y or N)	3	2	2	12
4.5.2	Length of access control along the crossroad beyond the interchange, to ensure its integrity	3	2	2	12
4.5.3	Land development and access management measures are in place for the interchange area (Y or N)	3	2	2	12
4.5.4	Design criteria for ramp/crossroad intersection				
4.5.4.1	Turning radii for design vehicle	3	3	1	9
4.5.4.2	Capacity	3	2	2	12
4.5.4.3	Traffic control	3	2	2	12
4.5.4.4	Channelization	3	2	2	12
4.5.4.5	Intersection sight distance	3	3	3	27

7.2 SaferAfrica assessment of coverage of design features in guidelines used in Burkina Faso

7.2.1 Table set 1: Interurban single carriageway roads: Items mentioned and rating in African Union Directive

Extent to which design items are covered in country specific guidelines

Rating team: João Cardoso; Carlos Roque. Country: Burkina Faso Guidelines assessed: Avant-projet Accord intergouvernemental pour l'harmonisation des normes et standards sur le réseau autoroutier transafricain. Union Africaine.

1	BASISCRITERIA	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter values	Are the effects of deviating from the norm on safety mentioned /described	Describe the nature of the motivation describing the relationship	Source (if relevant)
1.1	General approach						
1.1.1	Design speed approach	Yes	No	Class (km/h): Principal: 120 to 60 Class I: 100 50 Class II: 80 to 40 Class III: 60 to 30	No	Design speeds are selected as a function of the road class and type of terrain. • 60km/h – 120km/h flat terrain • 50km/h – 100km/h rolling terrain • 40km/h – 80km/h mountainous terrain • 30km/h – 60km/h very hilly terrain	UA
1.1.2	Speed limit approach	No				• Not clearly mentioned	UA
1.1.3	Actual speed approach	No					UA
1.2	Reaction time	No					
1.3	Eye position and object position						
1.3.1	Eye height	No					

1	BASISCRITERIA	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter values	Are the effects of deviating from the norm on safety mentioned /described	Describe the nature of the motivation describing the relationship	Source (if relevant)
1.3.2	Lateral eye position	No					
1.3.3	Object height						
1.3.4	Lateral object position	No					
1.4	Friction coefficient						
1.4.1	Longitudinal friction coefficient	No					
1.4.2	Side friction coefficient	No					
1.5	Vehicle deceleration and acceleration						
1.5.1	Deceleration	No					
1.5.2	Acceleration	No					
1.6	Action distances	YES					
1.6.1	Stopping distance	YES	No		No		UA
1.6.2	Overtaking distance	No					UA
1.7	Sight distance						
1.7.1	Stopping sight distance	Yes	No	Table based on design speed	No	• Available sight distance should be checked throughout the road length in early design stages • Given through tables (minimum) • Desired at every point along the road • Impact of grade described through grade values • No mention to obstructions to sight distance on horizontal curves	UA
1.7.2	Meeting sight distance	Yes	No	Table based on design speed	No		UA

1	BASISCRITERIA	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter values	Are the effects of deviating from the norm on safety mentioned /described	Describe the nature of the motivation describing the relationship	Source (if relevant)
1.7.3	Overtaking sight distance	Yes	No	Table based on design speed	No		UA
1.7.4	Abort overtaking sight distance	YES	No	Table based on design speed	No	-	UA
1.7.5	Crossing sight distance	No					UA
1.8	Design vehicle characteristics	Yes	No	• Class P: no pedestrian, cyclist or horse drawn charrette allowed.	No	High speed traffic	
1.9	Clearances						
1.9.1	Dimensions	No					
1.9.2	Swept path	No					
1.9.3	Overhead and lateral clearances	Yes	No	4.6 m	No		UA
1.9.4	Safety distances	No					
Annex	Road lighting	Yes		-			UA

2	ALIGNMENT	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned/ described	Describe the nature of the motivation describing the relationship	Source
2.2	**Horizontal alignment**						
2.2.1	Principles	Yes	No	Directional and consistent Avoid short curves between tangents Avoid R_{min} Design consistency Upper limit for tangent length (1.6km) Two curves at the same direction with 150m tangent between Avoid compound curves Fit design in landscape	No	Design process • Selection of elements to be incorporated in the design; • Sizing of the selected elements • Linking the elements into a 3D sequence	UA
2.2.2	Straight sections and large radius curves	Yes	No	Minimum length: 200 m	No	• Combine grade and E-W bearing, to control dazzling	UA
2.2.3	Curves						
2.2.3.1	Radii not recommended	Yes	No	Rmin based on point mass (table)	No	• Avoid skidding due to centrifugal force • Superelevation to assist friction as well	UA
2.2.3.2	Superelevation	Yes	No	Max superelevation rate 10%	No	• Counteract centrifugal force • Road drainage	UA
2.2.3.3	Minimum radius	Yes	No	Rmin based road class and terrain type	No	• Avoid skidding due to centrifugal force • Superelevation to assist friction as well	UA
2.2.4	Rules for linking alignment elements						
2.2.4.1	Curve following a straight section	Yes	No		No	• Avoid sharp curves between long tangents	UA

2	ALIGNMENT	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned/ described	Describe the nature of the motivation describing the relationship	Source
2.2.4.2	Compatibility of two successive curves	Yes	No	• Reverse curves are to be avoided, and must include a link tangent • Vertex curves are not desirable, and must have a link tangent with at least 150 m long with a single transverse slope • Compound curves are accepted	No	• Driver acceptability and vehicle roll limiting	UA
2.2.4.3	Transition curves	Yes	No	Table for using max radii in spiral transition curves as a function of design speed	No	• Utilization of spiral curves ✓ to gradually counterbalance centrifugal force ✓ accommodate superelevation run-off ✓ provide a smooth aesthetic alignment which will blend the terrain	UA
2.2.4.4	Internal defects of a bend	No	No				UA
2.2.4.5	Design consistency	Yes	Yes	• Combining the reference speed and the elements of the horizontal alignment and the elements of the longitudinal profile.	No		UA
2.2.5	Project planning to improve existing roads	Yes			-	Harmonisation within 10 years of publication	UA
2.3	**Vertical alignment**						
2.3.1	Gradient	Yes	No	• Max gradients depend on terrain type • Min gradient 0.5%	No	• Critical length of grade criterion applies • Special care for heavy vehicles (speed over length) • Drainage provision	UA

2	ALIGNMENT	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned/ described	Describe the nature of the motivation describing the relationship	Source
2.3.2	Vertical connecting curves						
2.3.2.1	Convex curves	Yes	No	Crest vertical curves through graph with stopping sight distance, design speed	No	• stopping sight distance provision (minimum)	UA
2.3.2.2	Concave curves	Yes	No	Sag vertical curves through graph with stopping sight distance, design speed	No	• stopping sight distance requirements • vehicle headlights • vertical clearance • comfort drainage provision	UA
2.3.3	Climbing lanes						
2.3.3.1	Passing/overtaking lanes	Yes	No	-	Yes	Class P and Class I: Critical length of grade depend length and grade, as per road class and type of terrain	UA
2.3.3.2	Auxiliary (climbing or passing) lane suppression: type and length of drop	No	No	-			UA
2.3.4	Improvement of existing roads	Yes	No	Geometrical, operational amendments	No	Harmonization within 10 years of publication	UA
2.3.5	Emergency escape ramps	No					UA
2.3.5.1	Warrants and spacing	No					UA
2.3.5.2	Type and length	No					UA
2.3.5.3	Stop areas for brake checking	No					UA

2	ALIGNMENT	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned/ described	Describe the nature of the motivation describing the relationship	Source
2.4	Coordination of horizontal and vertical alignments	Yes	No	• Combining the reference speed and the elements of the horizontal alignment and the elements of the longitudinal profile	No		UA

3	CROSS-SECTION	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned/described	Describe the nature of the motivation describing the relationship	Source
3.1.3	Integrated design	Yes	No	The horizontal alignment layout follows as closely as possible the terrain topography	No	Integration with the environment	UA
3.2	Main carriageway						
3.2.1	Road Width	Yes	No	Class P: 50 m Class I, II & III: 40 m	No		UA
3.2.2	Running lanes	Yes	No	Class P, I & II: 3.50 m Class III: 3.25m	No		UA
3.2.2.1	Lane width vs design speed	No	No	-	-	-	UA
3.2.3	Crossfall	Yes	No	Class P: 2% Class I & II: 2% Class III: 2~5%	No	-	UA
3.2.4	Hard shoulders	Yes	No	Width depends on road class	No	Reserved for pedestrians and emergency stop of stranded vehicles	UA
3.2.4.1	Shoulder width suitable for emergency lane	No	No				UA
3.2.5	Inner shoulder	-					UA
3.2.6	Median separation	-		-			UA
3.2.7	Turnouts, safety zones	Yes		-			UA
3.2.8	Surfacing	Yes		-			UA

3	CROSS-SECTION	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned/described	Describe the nature of the motivation describing the relationship	Source
3.2.9	Road markings	Yes		-			UA
3.3	Roadside						
3.3.1	Obstacle-free zones	Yes	No	No desirable values stated	No		UA
3.3.2	Type of Obstacle	YES	No	-	-		UA
3.3.3	Soft shoulders	No					UA
3.3.4	Slopes	Yes	No				UA
3.3.5	Drainage channels	Yes	No				UA
3.4	Secondary lanes						
3.4.1	Cycle lane	Yes	No	No	No		UA
3.4.2	General	Yes	No	General use	No	Need for protection between main and secondary road [outer separators, boulevards (sidewalk protection)]	UA
3.4.3	Pedestrian sidewalk	Yes	No	>1.2m	No	Special care for pedestrians with disabilities, visual impaired, etc. in designing kerbs, ramps, etc.	UA
3.4.4	Bus stops bays	Yes	No	List of required elements	No	The following elements must be considered: • a deceleration lane for buses; • a stopping platform with a waiting area far, eliminating visibility distance problems; • a bus re-entry lane into road traffic.	UA
3.5	Access control						
3.5.1	Frontage roads	Yes	No	Class P & I with full access control	No	The road should ensure unimpeded traffic.	UA

3	CROSS-SECTION	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned/described	Describe the nature of the motivation describing the relationship	Source
3.6	Tunnels	No					UA

4	INTERSECTIONS	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned/ described	Describe the nature of the motivation describing the relationship	Source
4.1	Intersection types						
4.1.1	Number of arms	Yes	No		No	• Class P: No • Class I: Possible • Class II & III: all intersections are level crossings	UA
4.1.2	Traffic control mode	Yes	No	Signalized Unsignalized	No		UA
4.1.3	Traffic conflict countermeasures for motor vehicles	Yes	No	General rules for layout design	No	The main purpose of intersection layout design is to ensure efficient use of the road network and to reduce potential conflicts between vehicles and between vehicles and pedestrians or cyclists..	UA
4.1.4	Traffic conflict countermeasures for vulnerable road users	Yes	No	Channelizing islands	No	To avoid conflicts with motorized vehicles	UA
4.2	Use of design templates	No					UA
4.3	Design principles	No					UA
4.4	Traffic safety records for intersection types	No		-	-	-	UA
4.5	Intersection between a distributor (high level) and a local road.						
4.5.1	3- and 4-way	No		-			UA
4.5.2	Priority control mode	Yes	No	Stop, yield, signalization	No	-	UA
4.5.3	Minor road channelization	Yes	No		No		UA
4.5.4	Major road left turn lanes	Yes	No		No		UA
4.5.5	Right turn lanes	Yes	No		No	-	UA

4	INTERSECTIONS	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned/ described	Describe the nature of the motivation describing the relationship	Source
4.5.6	Bicycle and pedestrian facilities	Yes	No	Bicycle paths built when the number of two-wheeled vehicles on the road is around 20 to 70 at any time of the day.	No		UA
4.5.7	Local speed limits	No					UA
4.5.8	Crossing sight distance requirements	Yes	Yes, high	Sight triangles	Yes	Provision of stopping sight distance for intersection crossing	UA
4.6	Intersection between two distributor (high level) roads						
4.6.1	X or Y intersection	Yes		-	-	-	UA
4.6.2	Roundabout	Yes					UA
4.6.2.1	Use						
4.6.2.2	Shape and layout (refers to whether it is a traditional or an X or some deviation)	No	No				
4.6.2.3	Crossing sight distance requirements	Yes	No	-	No	Mostly based on decision sight distance for intersections	UA
4.6.2.4	Bicycle facilities	Yes	No	-	No	-	UA
4.6.3	Traffic signals	No	No	-	-	-	UA
4.6.4	Grade separation	Yes	No	-	No	• Class P: Interchange • Class I: At grade crossing possible, exceptionally • Class II & III: At grade crossings	UA

7.2.2 Table set 2: Interurban single carriageway roads: Items mentioned and rating in the French ARP

Extent to which design items are covered in country specific guidelines

Rating team: João Cardoso; Carlos Roque. Country: Burkina Faso Guidelines assessed: *Recommandations techniques pour la conception générale et la géométrie de la route. Aménagement des routes principales; SETRA, France.*

1	BASIC CRITERIA	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter values	Are the effects of deviating from the norm on safety mentioned /described	Describe the nature of the motivation describing the relationship	Source (if relevant)
1.1	General approach						
1.1.1	Design speed approach	Yes	No			Particular emphasis has been placed on road safety, by taking into account the following principles: - the definition of technically coherent road classes that may be clearly identifiable by the user, - "road readability", as the clear perception and understanding of the road and the traffic movements that may occur on it, - the importance given to safe facilities, - the recognition that users may err, in particular through the development of shoulders and safe roadsides, - a priority given to safety objectives for the redesign of existing roads	
1.1.2	Speed limit approach	No			No		
1.1.3	Actual speed approach	Yes	No	V_{85}	No		
1.2	Reaction time	Yes		2s	No		
1.3	Eye position and object position						

1	BASIC CRITERIA	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter values	Are the effects of deviating from the norm on safety mentioned /described	Describe the nature of the motivation describing the relationship	Source (if relevant)
1.3.1	Eye height	Yes		1.0 m	No		
1.3.2	Lateral eye position	Yes		2.0 m from right edge	No		
1.3.3	Object height	Yes		Curve:0.0 m Obstacle: 0.35 m	No		
1.3.4	Lateral object position	Yes		Carriageway axis	No		
1.4	Friction coefficient						
1.4.1	Longitudinal friction coefficient	No					
1.4.2	Side friction coefficient	No					
1.5	Vehicle deceleration and acceleration						
1.5.1	Deceleration	No			No		
1.5.2	Acceleration	No			No		
1.6	Action distances						
1.6.1	Stopping distance	Yes			No		
1.6.2	Overtaking distance	Yes	No	Minimum: 500 m on more than 25% of road length	No		
1.7	Sight distance						
1.7.1	Stopping sight distance	Yes	No		No		
1.7.2	Meeting sight distance	Yes	No		No		
1.7.3	Overtaking sight distance	Yes	No		No		
1.7.4	Abort overtaking sight distance	No			No		

1	BASIC CRITERIA	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter values	Are the effects of deviating from the norm on safety mentioned /described	Describe the nature of the motivation describing the relationship	Source (if relevant)
1.7.5	Crossing sight distance	No			No		
1.8	Design vehicle characteristics	No			No		
1.9	Clearances						
1.9.1	Dimensions	No			No		
1.9.2	Swept path	No			No		
1.9.3	Overhead and lateral clearances	Yes	No	4.50 m	No		
1.9.4	Safety distances	Yes	No	1.00 m	No		
Annex	Road lighting	Yes	No	No lighting	No		

2	ALIGNMENT	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned/described	Describe the nature of the motivation describing the relationship	Source
2.2	**Horizontal alignment**						
2.2.1	Principles	Yes	Yes		No	The rules for designing the horizontal and vertical alignment are intended to ensure: - relatively homogeneous comfort conditions along a route, and adapted to each category of road, in particular by setting minimum characteristics; - good safety conditions, in particular by means of principles for linking the various elements of the route and principles relating to visibility. Coordination of the horizontal and vertical alignments, and the location of interchange points is necessary, in respect of - visibility - perception conditions.	
2.2.2	Straight sections and large radius curves	Yes	Yes		No	See 2.2.1	
2.2.3	Curves						
2.2.3.1	Radii not recommended	Yes	Yes	Minimum radii and set of rules for linking horizontal alignment elements	Yes	Minimum radii are set to limit discomfort of the user, depending on the road category. The frequent or systematic use of large radii of curvature can be harmful (e.g. intersections) on single carriageway roads by: - limiting the possibilities of safe overtaking; - encouraging users to practice a continuously high speed. - producing speed habituation - reducing vigilance. Small radius curves can surprise drivers; warrants must exist to regarding the linking of the horizontal alignment elements	
2.2.3.2	Superelevation	Yes	No	Depending on road class and type. Maximum: 7%	No	Table with minimum radii for introducing superelevation (R_{dm}). Linear interpolation as a function of 1/R between 2.5% (R_{dm}) and 7% (R_{min})	
2.2.3.3	Minimum radius	Yes	No	Table Minimum radius (m) (m) | R60 | T80 / R80 | T100 R_{min} | 120 | 240 | 425	No		

2	ALIGNMENT	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned/described	Describe the nature of the motivation describing the relationship	Source
2.2.4	Rules for linking alignment elements	Yes	No		No		
2.2.4.1	Curve following a straight section	Yes	No		No		
2.2.4.2	Compatibility of two successive curves	Yes	No		No		
2.2.4.3	Transition curves	Yes	No	Criteria depending on class and type of road	No		
2.2.4.4	Internal defects of a bend	Yes	Yes		No	The following cases introduce variations in curvature likely to surprise the user or to make it difficult to assess the curvature and degrade safety: - arcs of contiguous circles of different radii; - circular curves of the same direction connected by one or more arcs of clothoid; - two clothoid arcs connecting two straight alignments.	
2.2.4.5	Design consistency	No				Covered by 2.2.4	
2.2.5	Project planning to improve existing roads	Yes	Yes	Improvement of existing roads and phased upgrading	Yes	Prevent inconsistencies in the road network	ARP
2.3	**Vertical alignment**						
2.3.1	Gradient	Yes	Yes	Maximum gradient (%) (%) | R60 | T80 / R80 | T100 G | 7 | 6 | 5	No	Maximum gradient and transition curves are limited due to dynamic comfort and visual comfort reasons. Visibility issues may impose other values.	
2.3.2	Vertical connecting curves	Yes	Yes		No		
2.3.2.1	Convex curves	Yes	Yes	Minimum radii (km) (%) | R60 | T80 / R80 | T100 R_{min} | 1.5 | 3.0 | 6.0	No	Maximum gradient and transition curves are limited due to dynamic comfort and visual comfort reasons. Visibility issues may impose other values.	
2.3.2.2	Concave curves	Yes	Yes	Minimu radii (km) (%) | R60 | T80 / R80 | T100 R_{min} | 1.5 | 2.2 | 3.0	No	Maximum gradient and transition curves are limited due to dynamic comfort and visual comfort reasons. Visibility issues may impose other values.	
2.3.3	Climbing lanes						
2.3.3.1	Passing/overtaking lanes	Yes	Yes	Minimum spacing: - 4 to 5 km Optimal for lengths: - 400 to 600 m hilly terrain - 1250 m for flat terrain).	Yes	To avoid creating a damaging ambiguity about the type of road,	ARP

2	ALIGNMENT	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned/described	Describe the nature of the motivation describing the relationship	Source
2.3.3.2	Auxiliary (climbing or passing) lane suppression: type and length of drop	Yes	No	Introduction: 234 m Suppression: 156 m	No	Depends on V85 Introduce passing lane if less than 75% of road length has visibility distance ≥500 m	ARP
2.3.4	Improvement of existing roads	Yes	Yes	-	No	Longitudinal profile changes aimed at improving safety must be justified by a "safety diagnosis study", including the analysis of accident data and speeds in the vicinity of the site.	
2.3.5	Emergency escape ramps						
2.3.5.1	Warrants and spacing	Yes	No		No	Special study is required for long (≥1 km) and steep (≥4%) grade sections	
2.3.5.2	Type and length	Yes	No		No		
2.3.5.3	Stop areas for brake checking	No			No		
2.4	Coordination of horizontal and vertical alignments	Yes	No		No	Several rules for ensuring: - good general visibility conditions - visual comfort by avoiding giving the alignment a too broken or discontinuous appearance - no coincidence of curve beginning with high point - intersections and accesses must not coincide with horizontal curves or areas of reduced visibility.	

3	CROSS-SECTION	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned/described	Describe the nature of the motivation describing the relationship	Source
3.1.3	Integrated design	Yes	Yes	Improvement of existing roads and phased upgrading	Yes	Prevent inconsistencies in the road network	ARP
3.2	Main carriageway						
3.2.1	Road Width	Yes	No	Normal:3.5 m Class R: abs. min. 3.0 m	No	Reductions depending on traffic and type of terrain	
3.2.2	Running lanes	Yes	No				
3.2.2.1	Lane width vs design speed	No					
3.2.3	Crossfall	Yes	No	-2.5%	No	Drainage	
3.2.4	Hard shoulders	Yes	Yes	2.0 m	No	To provide space for vehicle control recovery	
3.2.4.1	Shoulder width suitable for emergency lane	No					
3.2.5	Inner shoulder	-	-	-	-	-	
3.2.6	Median separation	-	-	-	-	-	
3.2.7	Turnouts, safety zones	-	-	-	-		
3.2.8	Surfacing	Yes	No		No		
3.2.9	Road markings	Yes	No		No		
3.3	Roadside						
3.3.1	Obstacle-free zones	Yes	No	7 m			
3.3.2	Type of Obstacle	No					
3.3.3	Soft shoulders	Yes	No		No		

3	CROSS-SECTION	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned/described	Describe the nature of the motivation describing the relationship	Source
3.3.4	Slopes	No					
3.3.5	Drainage channels	Yes	Yes	Very shallow gutters, covered or shallow ditches (depth ≤20 cm)	No	Solutions should be preferred where devices in mainline cross-section (flat gutters, covered ditches, etc.) can be crossed to access adjacent areas without any special structure.	
3.4	Secondary lanes						
3.4.1	Cycle lane	Yes	Yes		No	Separation of traffic	
3.4.2	General	Yes	Yes		No		
3.4.3	Pedestrian sidewalk	Yes	Yes		No	Provision of separated space	
3.4.4	Bus stops bays	Yes	Yes		No	Safe stops and pedestrian access to bus stop area	
3.5	Access control						
3.5.1	Frontage roads	Yes	Yes		No		
3.6	Tunnels	No			No		

4	INTERSECTIONS	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned/ described	Describe the nature of the motivation describing the relationship	Source
4.1	Intersection types						
4.1.1	Number of arms	Yes			No		
4.1.2	Traffic control mode	Yes			No		
4.1.3	Traffic conflict countermeasures for motor vehicles	Yes	Yes		No	Channelizing islands	
4.1.4	Traffic conflict countermeasures for vulnerable road users	No			No	Pedestrian traffic assumed as very low on rural roads	
4.2	Use of design templates	Yes	Yes		No		
4.3	Design principles	Yes	Yes		No	Selection of type of intersection is a two-step approach: - identification of possible layouts, based on route characteristics - selection of type of intersection, for a given layout, according to site characteristics (traffic, safety, environment, etc.) through multi-criteria analysis. Design principles are: - Visibility and perception: ensure the visibility necessary for the perception of the intersection and the reciprocal perception of users. - Simplicity: only few simple and proven types of crossroads are used, which can be quickly identified and whose operation is well understood by users. - Consistency: the geometry of the crossroads must be consistent with the behaviour expected of the user.	
4.4	Traffic safety records for intersection types	Yes	Yes		No	On existing road remodelling	

4	INTERSECTIONS	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned/ described	Describe the nature of the motivation describing the relationship	Source
4.5	Intersection between a distributor (high level) and a local road.						
4.5.1	3- and 4-way	Yes	No		No		
4.5.2	Priority control mode	No	Yes		No	Road users may misunderstand which road has priority, due to mismatch between road hierarchy and default priority rules	
4.5.3	Minor road channelization	Yes	No		No		
4.5.4	Major road left turn lanes	Yes	Yes	Not needed if Paved shoulder and left turn AADT ≤100~200 vehicles	No		
4.5.5	Right turn lanes	Yes	Yes	Avoid this type of lane	Yes		
4.5.6	Bicycle and pedestrian facilities	No			No		
4.5.7	Local speed limits	No			No		
4.5.8	Crossing sight distance requirements	Yes	No	No	No		
4.6	Intersection between two distributor (high level) roads						
4.6.1	X or Y intersection	Yes	No	No	No		
4.6.2	Roundabout	Yes	Yes	No	No		
4.6.2.1	Use						
4.6.2.2	Shape and layout (refers to whether it is a traditional or an X or some deviation)	Yes	Yes	No	No	See 4.3	
4.6.2.3	Crossing sight distance requirements	No			No		
4.6.2.4	Bicycle facilities	Yes	Yes	No	No	In a chapter on roads through small villages	

4	INTERSECTIONS	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned/ described	Describe the nature of the motivation describing the relationship	Source
4.6.3	Traffic signals	No			No		
4.6.4	Grade separation	No			No		

7.2.3 Table set 3: Interurban dual carriageway roads: Items mentioned and rating in African Union Directive

Extent to which design items are covered in country specific guidelines

Rating team: João Cardoso; Carlos Roque. Country: Burkina Faso Guidelines assessed: *Avant-projet Accord intergouvernemental pour l'harmonisation des normes et standards sur le réseau autoroutier transafricain* (African Union)

1	BASIC ASSUMPTIONS	In guidelines?	Safety effect mentioned? If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned/described	Describe the nature of the motivation describing the relationship	Source
1.1	General approach						
1.1.1	Design speed approach	Yes	No	Class (km/h): Principal: 120 to 60 Class I: 100 50 Class II: 80 to 40 Class III: 60 to 30	No	Design speeds are selected as a function of the road class and type of terrain. • 60km/h – 120km/h flat terrain • 50km/h – 100km/h rolling terrain • 40km/h – 80km/h mountainous terrain 30km/h – 60km/h very hilly terrain	UA
1.1.2	Speed limit approach	No				• Not clearly mentioned	UA
1.1.3	Actual speed approach	No					UA
1.2	Reaction time	No					
1.3	*Eye position and object position*						
1.3.1	Eye height	No					UA
1.3.2	Lateral eye position	No					UA
1.3.3	Object height	No					UA

1	BASIC ASSUMPTIONS	In guidelines?	Safety effect mentioned? If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned/described	Describe the nature of the motivation describing the relationship	Source
1.3.4	Lateral object position	No					UA
1.4	*Friction coefficient*						
1.4.1	Longitudinal friction coefficient	No					UA
1.4.2	Side friction coefficient	No					UA
1.5	*Vehicle deceleration and acceleration*						
1.5.1	Deceleration	No					UA
1.5.2	Acceleration	No					UA
1.6	*Action distances*						
1.6.1	Stopping distance	Yes	Yes, high	Formula given	Yes	• Impact of grade described through grade values • Variation for trucks	UA
1.7	*Sight distance*						
1.7.1	Stopping sight distance	Yes	No	Table based on design speed	No	• Available sight distance should be checked throughout the road length in early design stages • Given through tables (minimum) • Desired at every point along the road • Impact of grade described through grade values • No mention to obstructions to sight distance on horizontal curves	UA
1.7.2	Meeting sight distance	Yes	No	Table based on design speed	No		UA
1.7.3	Overtaking sight distance	Yes	No	Table based on design speed	No		UA
1.7.4	Abort overtaking sight distance	YES	No	Table based on design speed	No	-	UA
1.7.5	Crossing sight distance	No					UA

1	BASIC ASSUMPTIONS	In guidelines?	Safety effect mentioned? If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned/described	Describe the nature of the motivation describing the relationship	Source
1.8	Design vehicle characteristics	Yes	No	• Class P: no pedestrian, cyclist or horse drawn charrette allowed.	No	High speed traffic	UA
1.9	*Clearances*						
1.9.1	Dimensions	No					UA
1.9.2	Swept path	No					UA
1.9.3	Overhead and lateral clearances	Yes	No	4.6 m	No		UA
1.9.4	Safety distances (Clear zone)	No					UA
1.9.5	Dynamic lateral clearance	No					UA
1.10	Road image (Rhol=2to7*RBol)	No					UA
1.11	Recommendations for mitigating barrier effect impacts.	Yes	No	Footbridge/underpass width: 2.10 ~ 3.0 m, depending on the length	No	Footbridge/Underpass should be installed where: • pedestrians tend to cross the road in one direction • the distance is significant (more than 1 km) from other road crossing facilities • there is history of pedestrian/vehicle accidents history • topography reasons	UA
Annex	Road lighting	No				•	UA

2	ALIGNMENT	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned /described	Describe the nature of the motivation describing the relationship	Source
2.2	*Horizontal alignment*						
2.2.1	Principles	Yes	No	Directional and consistent Avoid short curves between tangents Avoid R_{min} Design consistency Upper limit for tangent length (1.6km) Two curves at the same direction with 150m tangent between Avoid compound curves Fit design in landscape	No	Design process • Selection of elements to be incorporated in the design; • Sizing of the selected elements • Linking the elements into a 3D sequence	UA
2.2.2	Straight sections and large radius curves	Yes	No	Minimum length: 200 m	No	• Combine grade and E-W bearing, to control dazzling	UA
2.2.3	Curves						
2.2.3.1	Radii not recommended	Yes	No	Rmin based on point mass (table)	No	• Avoid skidding due to centrifugal force • Superelevation to assist friction as well	UA
2.2.3.2	Super elevation	Yes	No	Max superelevation rate 10%	No	• Counteract centrifugal force • Road drainage	UA
2.2.3.3	Minimum radius	Yes	No	Rmin based road class and terrain type	No	• Avoid skidding due to centrifugal force Superelevation to assist friction as well	UA
2.2.4	Rules for linking alignment elements						
2.2.4.1	Curve following a straight section	Yes	No		No	• Avoid sharp curves between long tangents	UA

2	ALIGNMENT	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned /described	Describe the nature of the motivation describing the relationship	Source
2.2.4.2	Compatibility of two successive curves	Yes	No	• Reverse curves are to be avoided, and must include a link tangent • Vertex curves are not desirable, and must have a link tangent with at least 150 m long with a single transverse slope Compound curves are accepted	No	• Driver acceptability and vehicle roll limiting	UA
2.2.4.3	Transition curves	Yes	No	Table for using max radii in spiral transition curves as a function of design speed	No	Utilization of spiral curves: • to gradually counterbalance centrifugal force • accommodate superelevation run-off • provide a smooth aesthetic alignment which will blend the terrain	UA
2.2.4.4	Internal defects of a bend	No	No				UA
2.2.4.5	Design consistency	Yes	Yes	Combining the reference speed and the elements of the horizontal alignment and the elements of the longitudinal profile.	No		UA
2.2.5	Project planning to improve existing roads	Yes			-	Harmonization within 10 years of publication	UA
2.3	***Vertical alignment***						

2	ALIGNMENT	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned /described	Describe the nature of the motivation describing the relationship	Source
2.3.1	Gradient	Yes	No	• Max gradients depend on terrain type Min gradient 0.5%	No	• Critical length of grade criterion applies • Special care for heavy vehicles (speed over length) Drainage provision	UA
2.3.2	Vertical connecting curves						
2.3.2.1	Convex curves	Yes	No	Crest vertical curves through graph with stopping sight distance, design speed	No	• stopping sight distance provision (minimum)	UA
2.3.2.2	Concave curves	Yes	No	Sag vertical curves through graph with stopping sight distance, design speed	No	• *stopping* sight distance requirements • vehicle headlights • vertical clearance • comfort • drainage provision	UA
2.3.3	Climbing lanes						
2.3.3.1	Passing/Climbing lanes	Yes	No	-	Yes	Class P and Class I: Critical length of grade depend length and grade, as per road class and type of terrain	UA
2.3.3.2	Auxiliary (climbing or passing) lane suppression: type and length of drop	No					UA
2.3.4	Improvement of existing roads	Yes	No	Geometrical, operational amendments	No	Harmonization within 10 years of publication	UA
2.3.5	Emergency escape ramps	No					UA
2.3.5.1	Warrants and spacing	No					UA
2.3.5.2	Type and length	No					UA

2	ALIGNMENT	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned /described	Describe the nature of the motivation describing the relationship	Source
2.3.5.3	Stop areas for brake checking	No					UA
2.4	Coordination of horizontal and vertical alignments	Yes	No	• Combining the reference speed and the elements of the horizontal alignment and the elements of the longitudinal profile	No		UA

3	CROSS-SECTION	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned/described	Describe the nature of the motivation describing the relationship	Source
3.1.1	Relationship curve radius / superelevation / speed	Yes	No	Relation depends on class of road and type of terrain	No	Ensure comfort and safety	UA
3.1.2	Superelevation (transition type / length)	Yes	No	Not specified	No	Qualitative recommendation: "the appearance of the transition largely governs its length".	UA
3.1.3	Integrated design	Yes	No	The horizontal alignment layout follows as closely as possible the terrain topography	No	Integration with the environment	UA
3.2	Main carriageway						
3.2.1	Road Width	Yes	No	Class P: 50 m Class I, II & III: 40 m	No		UA
3.2.2	Running lanes	Yes	No	Class P, I & II: 3.50 m Class III: 3.25m	No		UA
3.2.2.1	Lane width vs. design speed	No	No	-	-	-	UA
3.2.3	Crossfall	Yes	No	Class P: 2% Class I & II: 2% Class III: 2~5%	No	-	UA
3.2.4	Hard shoulders	Yes	No	Width depends on road class	No	Reserved for pedestrians and emergency stop of stranded vehicles	UA
3.2.4.1	Outside shoulder width suitable for emergency lane	No					UA
3.2.5	Inner shoulder	No					UA
3.2.6	Central reservation	Yes	No	Class P: 3 - 4 m Class I & II: 3 - 2.5m	No		UA
3.2.7	Median separation	Yes	No	-	No		UA
3.2.8	Turnouts, safety zones	Yes	No	-	No		UA
3.2.9	Surfacing	Yes	No	-	No		UA

3	CROSS-SECTION	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned/described	Describe the nature of the motivation describing the relationship	Source
3.2.10	Road markings	Yes	No	Class P: 50 m Class I, II & III: 40 m	No		UA
3.3	*Roadside*						
3.3.1	Obstacle-free zones	Yes	No	No desirable values stated	No		UA
3.3.2	Type of Obstacle	Yes	No	-	-		UA
3.3.3	Soft shoulders	No					UA
3.3.4	Slopes	Yes	No				UA
3.3.5	Drainage channels	Yes	No				UA
3.4	Auxiliary lanes (e.g. bus lanes)	Yes	No	No	No		UA
3.5	Recommended cross-sections	Yes	No		No	No clear status for inner shoulder	UA
3.6	Access control	Yes	No	Class P & I with full access control	No	The road should ensure unimpeded traffic.	UA
3.7	Tunnels	No					
3.8	Secondary lanes						
3.8.1	General	No					
3.8.2	Frontage roads	Yes	No	Class P & I with full access control	No	The road should ensure unimpeded traffic.	UA
3.8.3	Rest and service areas	no					

4	INTERCHANGE	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned/described	Describe the nature of the motivation describing the relationship	Source
4.1	Interchange and Ramp Spacing						
4.1.1	Minimum value for spacing distance?	No					
4.1.2	Minimum value for distance between successive entrances and exits?	No					
4.2	Approach Alignment to Interchange						
4.2.1	Maximum absolute value for the grade of the freeway through the interchange area	No					
4.2.2	Minimum value for horizontal curvature throughout the interchange area	No					
4.2.3	Sight distance requirement in advance of each exit (desirably decision sight distance)	No					
4.3	Interchange Configurations						
4.3.1	Differentiation between "service interchange" (between motorway and other road) and "system interchange" (between motorways)	Yes	No		No	There are two types of interchanges: • "access interchanges", which are located between expressways and secondary roads serving local areas • "system interchanges", which are nodes of the main road network. The latter have ramps with free flowing traffic at both ends.	UA
4.3.1.1	An appropriate array of interchange configurations and variations must be evaluated in the design study phase	Yes	No	-	No	Assessment of alternative configurations While the selection of the most appropriate type and configuration of interchange may vary between sites, it is important to provide consistent operating conditions in order to match driver expectations.	UA
4.3.2	Interchange configuration appropriate for the operational needs, fits the topography and potential site conditions and constraints	Yes	No		No	Satisfaction of capacity requirements, operational needs, economical aspects, geometric standards	UA
4.3.2.1	Requirements for consistency in exit pattern with other nearby interchanges	No					UA
4.3.3	Requirement for completeness of directional traffic movements provision	No					UA
4.3.4	Mandatory installation of all exits and entrances on the right side of the freeway mainline?	No					UA

4	INTERCHANGE	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned/described	Describe the nature of the motivation describing the relationship	Source
4.3.5	Provisions for weaving section design?	No					UA
4.3.5.1	Distance between the physical merge and exit nose?	No					UA
4.3.6	Location of crossroad in the interchange	No					UA
4.3.6.1	Over the freeway	Yes	No	Advantages - disadvantages	No	-	UA
4.3.7	Route Continuity	No					UA
4.3.7.1	Priority route is the through facility	No					UA
4.4	Ramp Design	No					UA
4.4.1	Design speed of the ramp ≥50% of the mainline design speed	No					UA
4.4.2	Length for acceleration at entrance ramps	Yes		No length specified			UA
4.4.3	Length for deceleration at exit ramps?	Yes		No length specified			UA
4.4.4	Balanced number of exit and entrance?	No					UA
4.5	Crossroad Design	No					UA
4.5.1	Sidewalks and bicyclist facilities provided on the interchange crossroad. (Pedestrians and bicyclists are particularly vulnerable to high speed approach vehicles turning at ramp terminals).	No					UA
4.5.1.1	Traffic control at the crossings at interchange ramps (Y or N)	No					UA
4.5.2	Length of access control along the crossroad beyond the interchange, to ensure its integrity (A minimum of 30m in urban areas and 100m in rural areas is usually insufficient where additional development is likely).	No					UA
4.5.3	Land development and access management measures are in place for the interchange area (Y or N)	No					UA
4.5.4	Design criteria for ramp/crossroad intersection	No					UA
4.5.4.1	Turning radii for design vehicle	No					UA

4	INTERCHANGE	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned/described	Describe the nature of the motivation describing the relationship	Source
4.5.4.2	Capacity	No					UA
4.5.4.3	Traffic control	No					UA
4.5.4.4	Channelization	No					UA
4.5.4.5	Intersection sight distance	No					UA

7.2.4 Table set 4: Interurban dual carriageway roads: Items mentioned and rating in the French ICTAAL

Extent to which design items are covered in country specific guidelines

Rating team: João Cardoso; Carlos Roque. Country: Burkina Faso Guidelines assessed: *ICTAAL - Instruction sur les conditions techniques d'aménagement des autoroutes de liaison; SETRA, France.*

1	BASIC CRITERIA	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter values	Are the effects of deviating from the norm on safety mentioned/described	Describe the nature of the motivation describing the relationship	Source (if relevant)
1.1	General approach						
1.1.1	Design speed approach	Yes	No		No		ICTAAL
1.1.2	Speed limit approach	Yes	No	L1=130 km/h; L2=110 km/h; Difficult relief section = 90 km/h.	No	Type of terrain: Category L1, appropriate for flat or hilly areas where relief constraints are moderate. Category L2 better adapted to more difficult relief sites, taking into account the economic impacts	ICTAAL
1.1.3	Actual speed approach	Yes	No	V_{85}	No		ICTAAL
1.2	Reaction time	Yes	No	2.0 sec	No		ICTAAL
1.3	Eye position and object position						
1.3.1	Eye height	Yes	No	1.00m passenger cars	No	To be used in sight distance assessments	ICTAAL
1.3.2	Lateral eye position	Yes	No	2.00 m from the right edge of its lane	No	To be used in sight distance assessments	ICTAAL
1.3.3	Object height	Yes	No	0.60m vehicle tail light	No	To be used in sight distance assessments	ICTAAL
1.3.4	Lateral object position	Yes	No	In the case of a vehicle, the point observed is the least constraining of the two rear lights, positioned at 1.00 m and 2.50 m from the right edge of the lane in question, respectively	No	To be used in sight distance assessments	ICTAAL
1.4	Friction coefficient						
1.4.1	Longitudinal friction coefficient	No	No		No		
1.4.2	Side friction coefficient	No	No		No		
1.5	Vehicle deceleration and acceleration						

1	BASIC CRITERIA	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter values	Are the effects of deviating from the norm on safety mentioned/described	Describe the nature of the motivation describing the relationship	Source (if relevant)
1.5.1	Deceleration	Yes	No	1.5 m/sec²	No	To define the deceleration section of an existing lane	ICTAAL
1.5.2	Acceleration	Yes	No	1.0 m/sec²	No	To define the acceleration section of a merging lane	ICTAAL
1.6	Action distances						
1.6.1	Stopping distance	Yes	No		No	Impact of grade described through grade values	ICTAAL
1.6.2	Overtaking distance	No	No		No		
1.7	Sight distance						
1.7.1	Stopping sight distance	Yes	No		No		
1.7.2	Meeting sight distance	No	No		No		
1.7.3	Overtaking sight distance	No	No		No		
1.7.4	Abort overtaking sight distance	No	No		No		
1.7.5	Crossing sight distance	No	No		No		
1.8	Design vehicle characteristics	No	No		No		
1.9	Clearances						
1.9.1	Dimensions	No	No		No		
1.9.2	Swept path	No	No		No		
1.9.3	Overhead and lateral clearances	No	No		No		
1.9.4	Safety distances	No	No		No		
1.9.5	Dynamic lateral clearance	No	No		No		
1.10	Road image (Rhol=2to7*RBol)	No	No		No		
1.11	Recommendations for mitigating barrier effect impacts.	Yes	No	A national road shall be restored in accordance with the technical instructions in force, taking into account its long-term development component.	No		ICTAAL
Annex	Road lighting	Yes	No	Lighting provided at toll stations and in tunnels.	No	It may also be appropriate in the case where the motorway crosses or surrounds an area whose lighting may obstruct traffic on the motorway (activity area, airport, etc.).	ICTAAL

2	ALIGNMENT	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned/described	Describe the nature of the motivation describing the relationship	Source
2.2	**Horizontal alignment**						
2.2.1	Principles	Yes	Yes		No	The geometric design rules for horizontal and vertical alignment are intended to guarantee good safety and comfort conditions adapted to each category of motorway.	ICTAAL
2.2.2	Straight sections and large radius curves	Yes	Yes		No	Separate two successive curves by a straight alignment of at least 200 m, except for two opposite direction curves introduced by progressive connections.	ICTAAL
2.2.3	Curves						
2.2.3.1	Radii not recommended	Yes	Yes	Minimum radii and set of rules for linking horizontal alignment elements	Qualitative	Minimum radii are set to limit the discomfort of the user and to guarantee visibility.	ICTAAL
2.2.3.2	Superelevation	Yes	No	Depending on curve radius. Maximum: 7%	No		
2.2.3.3	Minimum radius	Yes	Yes	Category L1 Minimum radius (Rm) 600 m Minimum radius without superelevation (Rnd) 1 000 m Category L2 Minimum radius (Rm) 400 m Minimum radius without superelevation (Rnd) 650 m	No		ICTAAL
2.2.4	Rules for linking alignment elements	Yes	No		No		
2.2.4.1	Curve following a straight section	Yes	No		No		
2.2.4.2	Compatibility of two successive curves	Yes	No	Separate two successive curves by a straight alignment of at least 200 m, except for two opposite direction curves introduced by progressive connections.	No		ICTAAL
2.2.4.3	Transition curves	Yes	No	Curves with radii less than 1.5 Rnd are introduced by progressive connections (clothoids).	No		ICTAAL

2	ALIGNMENT	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned/described	Describe the nature of the motivation describing the relationship	Source
2.2.4.4	Internal defects of a bend	Yes	Yes	Circular curves of moderate radius (<1.5 Rnd) can only be used if the following rules for linking the plan layout are observed: 1. introduce such curves over a length of 500 to 1,000 m using curves with a larger radius. 2. separate two successive curves by a straight line of at least 200 m, except for two opposite direction curves introduced by progressive connections.	No	Recommendation 1 is imperative in a high-risk section, such as after a long descent, when approaching an interchange, an area or a frequent ice zone.	ICTAAL
2.2.4.5	Design consistency	No	No		No		
2.2.5	Project planning to improve existing roads	Yes	Yes	The transformation project must comply with the rules formulated for new motorways.	No		ICTAAL
2.3	**Vertical alignment**						
2.3.1	Gradient	Yes	No	L1=5%; L2=6%	No		ICTAAL
2.3.2	Vertical connecting curves	Yes	Yes		No		ICTAAL
2.3.2.1	Convex curves	Yes	No	L1=12500 m; L2=6000 m; Difficult relief section = 2700 m.	No		ICTAAL
2.3.2.2	Concave curves	Yes	No	L1=4200 m; L2=3000 m; Difficult relief section = 1900 m	No		ICTAAL
2.3.3	Climbing lanes						
2.3.3.1	Passing/overtaking lanes	Yes	No	The opportunity of a climbing lane is assessed by considering the levels of traffic.	No	The installation of a climbing lane for heavy vehicles is recommended when its length and gradient are such that the speed of slow vehicles is reduced to less than 50 km/h over a minimum length of 500 m.	ICTAAL

2	ALIGNMENT	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned/described	Describe the nature of the motivation describing the relationship	Source
2.3.3.2	Auxiliary (climbing or passing) lane suppression: type and length of drop	Yes	No	The climbing lane then remains over the entire section where the speed of the vehicles slow remains below 50 km/h.	No	An auxiliary lane cannot be interrupted. However, at the end of the descent, it can be shortened to avoid engaging a non-common structure or a tunnel.	ICTAAL
2.3.4	Improvement of existing roads	Yes	No	the limit values of category L2 must always be respected, except in the case of a difficult raised section.	No	As soon as good conditions of visibility and perception are offered, the principles of coordination of horizontal and vertical alignment do not, in themselves, justify modifying the existing layout.	ICTAAL
2.3.5	Emergency escape ramps						
2.3.5.1	Warrants and spacing	Yes	No	A stop bed is recommended upstream of a single point (interchange, area, non-current structure, tunnel...) located on a descent, after a difference in altitude D greater than 130 m.	No		ICTAAL
2.3.5.2	Type and length	Yes	No	Its installation and layout must facilitate its use: good visibility conditions on the arrestor bed entrance point, and at the end of the platform, and specific signage.	No		ICTAAL
2.3.5.3	Stop areas for brake checking	No	No		No		ICTAAL
2.4	Coordination of horizontal and vertical alignments	Yes	No		No	The coordination of horizontal and vertical alignments must be the subject of an overall study, in order to ensure proper integration into the site, compliance with the rules of visibility and, as far as possible, a certain visual comfort.	ICTAAL

3	CROSS-SECTION	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned/described	Describe the nature of the motivation describing the relationship	Source
3.1.3	Integrated design	Yes	Yes	Improvement of existing roads	No	Prevent inconsistencies in the road network	ICTAAL
3.2	Main carriageway						
3.2.1	Road Width	Yes	No		No		ICTAAL
3.2.2	Running lanes						
3.2.2.1	Lane width vs design speed	No	No		No		ICTAAL
3.2.3	Crossfall	Yes	No	-2.5%	No	Drainage	ICTAAL
3.2.4	Hard shoulders	Yes	Yes	minimum = 1.0	Qualitative	Hard shoulder is part of the safety zone	ICTAAL
3.2.4.1	Outside shoulder width suitable for emergency lane	Yes	No	2.5 m (3.0 m, when heavy goods vehicle traffic exceeds 2,000 vehicles per day, both directions combined).	Qualitative	The emergency stop strip (part of the safety zone) facilitates the emergency off-road stopping of a vehicle, the recovery of a vehicle deviating from its trajectory, the avoidance of an obstacle on the road, the intervention of emergency services, maintenance and operation.	ICTAAL
3.2.5	Inner shoulder	Yes	No	1.0 m	Qualitative	It is designed to allow slight trajectory deviations and to avoid a wall effect related to safety barriers. It contributes to the respect of visibility rules in the left curves.	ICTAAL
3.2.6	Central reservation	Yes	No	Its width depends, as a minimum, on the elements installed there.	Qualitative	It is used to physically separate the two directions of traffic, to install certain equipment (safety barriers, signalling supports, water collection and drainage structures) and, where applicable, piles of structures and landscaping.	ICTAAL
3.2.7	Median separation	Yes	Yes	. Its width is the result of the width of its components: the two hard strips on the left and the median.	No	The median separation ensures the physical separation of the two traffic flows	ICTAAL

3	CROSS-SECTION	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned/described	Describe the nature of the motivation describing the relationship	Source
3.2.8	Turnouts,safety zones	Yes	No	Turnouts are provided every 2 km and, in the absence of a hard shoulder for emergency use, every kilometre. In addition, a turnout is being set up on either side of the tunnels and non-common structures.	No		ICTAAL
3.2.9	Surfacing	No	No		No		
3.2.10	Road markings	Yes	No		No		ICTAAL
3.3	Roadside						
3.3.1	Obstacle-free zones	Yes	No	L1=10 m; L2=8.5 m; In cutting, the safety zone does not extend beyond a height of 3 m.	No		ICTAAL
3.3.2	Type of Obstacle	Yes	No	Obstacle: tree, pole, masonry, directional sign support, rock wall, engineering structure support…	No		ICTAAL
3.3.3	Soft shoulders	Yes	No	see 3.3.1	No	Soft shoulder is part of the safety zone	ICTAAL
3.3.4	Slopes	Yes	No	see 3.3.1	No	Slopes are part of the safety zone	ICTAAL
3.3.5	Drainage channels	No	No		No		
3.4	Auxiliary lanes (e.g. bus lanes)	No	No		No		
3.5	Recommended cross-sections	Yes	No		No		ICTAAL
3.6	Access control	No	No		No		
3.7	Tunnels	Yes	No	Dossier pilote des tunnels – C.E.T.U. – 1990.	No		ICTAAL
3.8	Secondary lanes						
3.8.1	General	No	No		No		
3.8.2	Frontage roads	No	No		No		

3	CROSS-SECTION	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned/described	Describe the nature of the motivation describing the relationship	Source
3.8.3	Rest and service areas	Yes	No	A rest area must be provided at least every 30 km and a service area once every 60 km. However, on a motorway with moderate traffic or toll-free, integration, in the synoptic of the areas, services duly indicated, located at toll stations or off-road, can allow to increase the required spacing.	No	A distinction is made between rest areas, intended for vehicle parking, rest and the approval of users, the service areas also including a permanent distribution of fuel and parking areas associated with toll stations. These areas can offer additional services related to their functions.	ICTAAL

4	INTERCHANGE	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned/described	Describe the nature of the motivation describing the relationship	Source
4.1	**Interchange and Ramp Spacing**						
4.1.1	Minimum value for spacing distance?	Yes	No	> 1200 m (calculated between the earliest entry point of one and the earliest exit point of the next	No		ICTAAL
4.1.2	Minimum value for distance between successive entrances and exits?	Yes	No	see 4.1.1	No		
4.2	**Approach Alignment to Interchange**						
4.2.1	Maximum absolute value for the grade of the freeway through the interchange area	Yes	No	7%	No		ICTAAL
4.2.2	Minimum value for horizontal curvature throughout the interchange area	Yes	No	40 m (The minimum radius without superelevation (Rnd) is 300 m)	No		ICTAAL
4.2.3	Sight distance requirement in advance of each exit (desirably decision sight distance)	Yes	Yes	The conductor using an interchange must have: - along each ramp, the stopping distance on the rear of a vehicle stopped on its track; - on the approach of a turn, a distance of visibility on the markings limiting its track at the beginning of the circular arc, at least equal to the distance travelled at a constant speed V85 in 3 seconds, in order to enable it to perceive the curve and adapt its behaviour in time;	No		ICTAAL
4.3	**Interchange Configurations**						

4	INTERCHANGE	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned/described	Describe the nature of the motivation describing the relationship	Source
4.3.1	Differentiation between "service interchange" (between motorway and other road) and "system interchange" (between motorways)	Yes	Yes	A distinction is made between the nodes that provide links between motorways and the diffusers that connect the motorway to the ordinary roadway.	No		ICTAAL
4.3.1.1	An appropriate array of interchange configurations and variations must be evaluated in the design study phase	Yes	Yes	The type of interchange is chosen according to the exchanges to be ensured, the intensity of traffic, the operating mode and configuration of the site.	Qualitative		ICTAAL
4.3.2	Interchange configuration appropriate for the operational needs, fits the topography and potential site conditions and constraints,	Yes	Yes	A grade separated roundabout is not recommended. When it cannot be avoided, it is advisable to take important precautions, especially regarding the perception of the ring, mutual perception of users and aggressive devices.	Qualitative		ICTAAL
4.3.2.1	Requirements for consistency in exit pattern with other nearby interchanges	Yes	Yes	The junction with the ordinary roadway is treated in accordance with the recommendations for flat junctions.	No	Their layout (geometry, equipment...) must discourage counter-flow manoeuvres of the ramps. From this point of view, roundabouts are preferable to ordinary flat junctions.	ICTAAL

4	INTERCHANGE	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned/described	Describe the nature of the motivation describing the relationship	Source
4.3.3	Requirement for completeness of directional traffic movements provision	Yes	Yes	Divergence of two streams: The exit device depends on the amount of divergent traffic: below 1 800 pcph, it is treated without disappearance of a lane, beyond that, with disappearance of a lane. Convergence of two streams: The treatment of the junction depends on converging current traffic, the number of lanes in the merging leg and the targeted level of service. It is carried out by insertion or addition.	No	Divergence of two streams: The latter configuration is not recommended on ramps, due to conflicts caused by lane changes imposed on slow vehicles. Convergence of two streams: Any excess lanes shall be folded down downstream of the convergence musher	ICTAAL
4.3.4	Mandatory installation of all exits and entrances on the right side of the freeway mainline?	Yes	No		No		ICTAAL
4.3.5	Provisions for weaving section design?	Yes	Yes	The exchange movements are ensured by means of a weaving section, and for an interval of less than 500 m, by means of a collector. A weaving lane exceeding 750 m in length is not desirable, so an interval between 750 m and 1200 m is to be avoided.	No		ICTAAL
4.3.5.1	Distance between the physical merge and exit nose?	Yes	No	The distance between two access points (calculated between the earliest entry point of one and the earliest exit point of the next) must be more than 1200 m.	No		
4.3.6	Location of crossroad in the interchange	No	No		No		
4.3.6.1	Over the freeway	No	No		No		

4	INTERCHANGE	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned/described	Describe the nature of the motivation describing the relationship	Source
4.3.7	Route Continuity	No	No		No		
4.3.7.1	Priority route is the through facility	No	No		No		
4.4	**Ramp Design**						
4.4.1	Design speed of the ramp ≥50% of the mainline design speed	Yes	No	1 lane ramp : Rmin=100m 2 lane ramps: Vd=90 km/h -	No		
4.4.2	Length for acceleration at entrance ramps	Yes	No	An acceleration section whose length depends on the radius of the last curve of the ramp (must allow the conventional speed of 55 km/h to be reached at point "E = 1.00 m", with a level acceleration of 1 m/s2) +275 m	No		ICTAAL
4.4.3	Length for deceleration at exit ramps?	Yes	No	150 m + a deceleration section, the length of which allows to pass from the conventional speed (70 km/h, for a radius of the ramp less than 120 m) at the end of the manoeuvring section, to the speed associated with the radius of the first curve encountered with a step deceleration of 1.5 m/s2.	No		ICTAAL
4.4.4	Balanced number of exit and entrance?	Yes	No	Number of lanes depend on traffic volume	No		ICTAAL
4.5	**Crossroad Design**						
4.5.1	Sidewalks and bicyclist facilities provided along the interchange crossroad.	No	No		No		

4	INTERCHANGE	In guidelines?	Safety effect mentioned?, If so, how big	What is the assumed/adopted parameter value	Are the effects of deviating from the norm on safety mentioned/described	Describe the nature of the motivation describing the relationship	Source
4.5.1.1	Traffic control at the crossings at interchange ramps (Y or N)	Yes	Yes	The junction with the ordinary roadway is treated in accordance with the recommendations for flat junctions. Their arrangement must discourage counter-flow manoeuvres of the ramps. From this point of view, roundabouts are preferable to ordinary flat junctions.	No	Prevent counter-flow movements	ICTAAL
4.5.2	Length of access control along the crossroad beyond the interchange, to ensure its integrity	No	No		No		
4.5.3	Land development and access management measures are in place for the interchange area (Y or N)	No	No		No		
4.5.4	Design criteria for ramp/crossroad intersection	No	No		No		
4.5.4.1	Turning radii for design vehicle	No	No		No		
4.5.4.2	Capacity	No	No		No		
4.5.4.3	Traffic control	No	No		No		
4.5.4.4	Channelization	No	No		No		
4.5.4.5	Intersection sight distance	No	No		No		

7.2.5 Tableau 1: des routes interurbaines avec une seule voie. Items mentioned and rating for 'Classe II' and 'Classe III' category roads

1	CRITERES DE BASE	Mentionnée dans les directives du pays.	L'effet sur la sécurité est mentionné et dans quelle gradation ?	Quelles sont les valeurs de paramètre supposées / adoptées	Est-ce que les effets pour la sécurité en cas de déviation des normes mentionnés ?	Valeurs de références	Sources
1.1	*Approche générale*						
1.1.1	*La vitesse = point de départ*	*OUI*		*Classe II : 40 à 80 dépendant du relief classe III : 30 à 60*			*UA/VRU*
1.1.2	*La limitation de vitesse = point de départ*	*OUI*					*UA/VRU*
1.1.3	*La vitesse actuelle = point de départ*						
1.2	*Temps de réaction*						
1.3	*Position des yeux et des objets*						
1.3.1	*Niveau des yeux*						
1.3.2	*Position latérale des yeux*						
1.3.3	*hauteur des objets*						
1.3.4	*Position latérale des objets*						
1.4	*Coefficient de frottement*						
1.4.1	*Coefficient de frottement longitudinal*	*oui*					*UA/VRU*
1.4.2	*Coefficient de frottement transversal*	*oui*					*UA/VRU*
1.5	*Décélération et accélération du véhicule*						
1.5.1	*Décélération*	*Oui*					*UA*
1.5.2	*Accélération*	*Oui*					*UA/VRU*
1.6	*La distance minimale requise*						
1.6.1	*La distance d'arrêt*	*oui*					*UA/VRU*
1.6.2	*La distance pour dépasser*						
1.7	*Les distances de visibilité*						
1.7.1	*La distance de visibilité requise pour réagir et s'arrêter.*	*OUI*		*Dépendant de la vitesse de référence*			*UA/VRU*

1	CRITERES DE BASE	Mentionnée dans les directives du pays.	L'effet sur la sécurité est mentionné et dans quelle gradation ?	Quelles sont les valeurs de paramètre supposées / adoptées	Est-ce que les effets pour la sécurité en cas de déviation des normes mentionnés ?	Valeurs de références	Sources
1.7.2	La distance de visibilité requise pour réagir avant un virage	OUI					UA/VRU
1.7.3	La distance de visibilité requise pour dépasser un autre véhicule	OUI		Dépendant de la vitesse de référence			UAVRU
1.7.4	La distance de visibilité requise pour interrompre le dépassement.	Oui		Dépendant de la vitesse de référence			VRU
1.7.5	La distance de visibilité requise avant un carrefour	Oui					VRU
1.8	Conception sur base des caractéristiques des véhicules						
1.9	Espace de circulation						
1.9.1	Les dimensions	OUI					UA/VRU
1.9.2	Elargissement de chaussée/bande	OUI					UA/VRU
1.9.3	L'espace libre (au-dessus et à côté de la route)	OUI					UA/VRU
1.9.4	L'espace libre entre les objets	OUI					UA/VRU
Annex	L'éclairage public	Oui					VRU

2	ALIGNEMENT	Mentionnée dans les directives du pays.	L'effet sur la sécurité est mentionné et dans quelle gradation ?	Quelles sont les valeurs de paramètre supposées / adoptées	Est-ce que les effets pour la sécurité en cas de déviation des normes mentionnés ?	Valeurs de références	Sources
2.2	***L'alignement horizontal***						
2.2.1	*Les principes*	*OUI*	*OUI*	*1.6 KM*	*OUI*		*UA/VRU*
2.2.2	*Sections de routes droites et/ou des courbes avec un grand rayon*						
2.2.3	*Des virages*						
2.2.3.1	*Des rayons de courbure à éviter*	*OUI*					*UA/VRU*
2.2.3.2	*Dévers*	*OUI*		*Max 10*			*UA/VRU*
2.2.3.3	*Des rayons de courbure minimaux*	*OUI*		*Dépendant du relief : Classe II : 50 à 210m et Classe III : 30 à 115m*			*UA/VRU*
2.2.4	*Des règles pour connecter des sections droites avec des courbes*						
2.2.4.1	*Une courbe après une longue section droite*	*OUI*					*UA/VRU*
2.2.4.2	*La compatibilité de deux courbes consécutives*	*OUI*					*UA/VRU*
2.2.4.3	*Des courbes de transition*	*OUI*					*UA/VRU*
2.2.4.4	*Des manquements dans une courbe*						
2.2.4.5	*Consistance dans le design*						
2.2.5	*Un planning pour améliorer les voiries existantes.*	*oui*					*UEMOA*
2.3	***L'alignement vertical***						
2.3.1	*L'angle de pente.*	*OUI*		*4 catégories: <10% / < 25% / <60% / >60%*			*UA/VRU*
2.3.2	*La forme d'une courbe verticale*						
2.3.2.1	*Convexe*	*oui*					*VRU*
2.3.2.2	*Concave*	*Oui*					*VRU*
2.3.3	*Bande pour véhicules lents*						

2	ALIGNEMENT	Mentionnée dans les directives du pays.	L'effet sur la sécurité est mentionné et dans quelle gradation ?	Quelles sont les valeurs de paramètre supposées / adoptées	Est-ce que les effets pour la sécurité en cas de déviation des normes mentionnés ?	Valeurs de références	Sources
2.3.3.1	Bande pour dépasser	OUI					UA
2.3.3.2	Suppression de voie auxiliaire (voies véhicules lents ou bandes de dépassement): type et longueur de la pente	OUI					UA
2.3.4	Un planning pour améliorer les voiries existantes	oui					UEMOA
2.3.5	Voies de détresse						
2.3.5.1	Garanties et espacement						
2.3.5.2	Type et longueur	NON					
2.3.5.3	Zone d'arrêt pour le contrôle des freins						
2.4	La coordination des éléments verticaux et horizontaux						

3	PROFIL EN TRAVERS	Mentionnée dans les directives du pays.	L'effet sur la sécurité est mentionné et dans quelle gradation ?	Quelles sont les valeurs de paramètre supposées / adoptées	Est-ce que les effets pour la sécurité en cas de déviation des normes mentionnés ?	Valeurs de références	Sources
3.1.3	Conception intégrée des profils en travers et des autres éléments	OUI					UA
3.2	Chaussée principale						
3.2.1	Largeur de la route	OUI		Classe II & III: 40 m			UA
3.2.2	Les bandes						
3.2.2.1	Largeur des bandes en fonction de la vitesse	OUI		Classe II : 3.5m / classe III : 3.25m			UA
3.2.3	Une réduction de bande	Oui					VRU
3.2.4	Bande d'arrêt d'urgence						
3.2.4.1	Largeur de la bande adaptée	OUI					UA/VRU
3.2.5	Bande dérasée	Oui					VRU
3.2.6	Séparateur médian	OUI					UA/VRU
3.2.7	Refuges de sécurité	Oui					UA/VRU
3.2.8	Le revêtement	OUI					UA/VRU
3.2.9	Marquage routier	Oui					VRU
3.3	AU bord de la route						
3.3.1	Zone sans obstacles	oui					VRU
3.3.2	Le type d'obstacle	Oui					VRU
3.3.3	Zone non pavée						
3.3.4	Talus	Oui					VRU
3.3.5	Le drainage	OUI					UA/VRU
3.4	Des bandes secondaires / parallèles						

3	PROFIL EN TRAVERS	Mentionnée dans les directives du pays.	L'effet sur la sécurité est mentionné et dans quelle gradation ?	Quelles sont les valeurs de paramètre supposées / adoptées	Est-ce que les effets pour la sécurité en cas de déviation des normes mentionnés ?	Valeurs de références	Sources
3.4.1	Pistes cyclables	oui		Si le nombre de véhicules à deux roues est de l'ordre de 20 à 70 unités par heure			UA/VRU
3.4.2	Général	OUI					UA
3.4.3	Des trottoirs	oui					UA
3.4.4	Des arrêts de bus	oui					UA
3.5	Contrôle d'accès						
3.5.1	Voies (latérales) de desserte	oui					VRU
3.6	Tunnels	oui					UA

4	LES CARREFOURS	Mentionnée dans les directives du pays.	L'effet sur la sécurité est mentionné et dans quelle gradation ?	Quelles sont les valeurs de paramètre supposées / adoptées	Est-ce que les effets pour la sécurité en cas de déviation des normes mentionnés ?	Valeurs de références	Sources
4.1	Type de carrefour						
4.1.1	Nombre des branches	Oui					VRU
4.1.2	Type de régulation/régime de priorité	oui					VRU
4.1.3	Mesures pour éviter des conflits entre véhicules motorisés.	Oui					UA/VRU
4.1.4	Mesures pour éviter des conflits avec usagers vulnérables	Oui					VRU
4.2	Directives / modèles de conception	oui					UA/VRU
4.3	Les principes de conception	oui					VRU
4.4	Des données concernant les types d'accidents en fonction du type de carrefour	Oui					VRU
4.5	Carrefour entre une rue locale et une route principale (un grand axe).						
4.5.1	3 et 4 branches	Oui					VRU
4.5.2	Régulation de la priorité						
4.5.3	Canalisation du trafic sur les voies locales	Oui					VRU
4.5.4	Bandes de tourne-à-gauche sur la route principale						
4.5.5	Une bande de tourne-à-droite sur la route principale						
4.5.6	Aménagements pour cyclistes et piétons						
4.5.7	Des limitations de vitesses AU droit du carrefour						
4.5.8	Triangle de visibilité requis au droit du carrefour	Oui					VRU
4.6	Les carrefours entre deux routes principales. (grandes axes)						
4.6.1	Intersection X ou Y	Oui					VRU

4	LES CARREFOURS	Mentionnée dans les directives du pays.	L'effet sur la sécurité est mentionné et dans quelle gradation ?	Quelles sont les valeurs de paramètre supposées / adoptées	Est-ce que les effets pour la sécurité en cas de déviation des normes mentionnés ?	Valeurs de références	Sources
4.6.2	Giratoires	Oui					VRU
4.6.2.1	L'utilisation attendue						
4.6.2.2	Conception et forme						
4.6.2.3	L'angle d'observation	Oui					VRU
4.6.2.4	Aménagements pour les cyclistes						
4.6.3	Feux tricolores						
4.6.4	Croisement sur deux niveaux						

7.2.6 *Tableau 2: des routes interurbaines avec deux voies*. Items mentioned and rating for '*Classe Principale*' and '*Classe I*' category roads.

1	*CRITERES DE BASE*	*Mentionnée dans les directives du pays.*	*L'effet sur la sécurité est mentionné et dans quelle gradation ?*	*Quelles sont les valeurs de paramètre supposées / adoptées*	*Est-ce que les effets pour la sécurité en cas de déviation des normes mentionnés ?*	*Valeurs de références*	*Sources*
1.1	*Approche générale*						
1.1.1	*La vitesse = point de départ*	*Oui*					*UA / VRU*
1.1.2	*La limitation de vitesse = point de départ*	*Oui*		*Dépendant du relief : 'principal' : entre 60 et 120m / classe I : entre 50 et 100m*			*UA/VRU /IC*
1.1.3	*La vitesse actuelle = point de départ*						*IC*
1.2	*Temps de réaction*						
1.3	*Position des yeux et des objets*						
1.3.1	*Niveau des yeux*						*IC*
1.3.2	*Position latérale des yeux*						
1.3.3	*hauteur des objets*						
1.3.4	*Position latérale des objets*						
1.4	*Coefficient de frottement*						
1.4.1	*Coefficient de frottement longitudinal*	*Oui*					*UA / VRU*
1.4.2	*Coefficient de frottement transversal*	*Oui*					*UA / VRU*
1.5	*Décélération et accélération du véhicule*						
1.5.1	*Décélération*	*Oui*					*UA/IC*
1.5.2	*Accélération*	*Oui*					*UA / VRU / IC*
1.6	*La distance minimale requise*						

1	CRITERES DE BASE	Mentionnée dans les directives du pays.	L'effet sur la sécurité est mentionné et dans quelle gradation ?	Quelles sont les valeurs de paramètre supposées / adoptées	Est-ce que les effets pour la sécurité en cas de déviation des normes mentionnés ?	Valeurs de références	Sources
1.6.1	La distance d'arrêt	Oui					UA / VRU /IC
1.6.2	La distance pour dépasser						
1.7	Les distances de visibilité						
1.7.1	La distance de visibilité requise pour réagir et s'arrêter.	Oui		Dépendant de la vitesse de référence (entre 130 et 350m)			UA/VRU /IC
1.7.2	La distance de visibilité requise pour réagir avant un virage	Oui					UA/VRU /IC
1.7.3	La distance de visibilité requise pour dépasser une autre véhicule	Oui		Dépendant de la vitesse de référence (entre 226 et 471m)			UA/VRU
1.7.4	La distance de visibilité requise pour interrompre le dépassement.	Oui		Dépendant de la vitesse de référence (entre 226 et 471m)			VRU
1.7.5	La distance de visibilité requise avant un carrefour	Oui					VRU/IC
1.8	Conception sur base des caractéristiques des véhicules						
1.9	Espace de circulation						
1.9.1	Les dimensions	Oui					UA/IC
1.9.2	Elargissement de chaussée/bande	Oui					UA/IC
1.9.3	L'espace libre (Au-dessus et à côté de la route)	Oui					UA/IC
1.9.4	L'espace libre entre les objets	Oui					UA/IC
1.9.5	Zone latérale sans obstacles						IC
1.10	Perception de la route par l'usager	Oui					VRU/IC
1.11	Recommandations pour atténuer les impacts de l'effet barrière.						
Annex	L'éclairage public	Oui					VRU

2	ALIGNEMENT	Mentionnée dans les directives du pays.	L'effet sur la sécurité est mentionné et dans quelle gradation ?	Quelles sont les valeurs de paramètre supposées / adoptées	Est-ce que les effets pour la sécurité en cas de déviation des normes mentionnés ?	Valeurs de références	Sources
2.2	***L'alignement horizontal***						
2.2.1	*Les principes*	*Oui*					*UA/VRU*
2.2.2	*Sections de routes droites et/ou des courbes avec un grand rayon*						
2.2.3	*Des virages*						
2.2.3.1	*Des rayons de courbure à éviter*	*Oui*					*UA/VRU/IC*
2.2.3.2	*Dévers*	*Oui*		*Max 10%*			*UA/VRU/IC*
2.2.3.3	*Des rayons de courbure minimaux*	*oui*		*Dépendant du relief: 'principal'=115 à 520m ; Classe I= 80 à 350m*			*UA/VRU/IC*
2.2.4	*Des règles pour connecter des routes droites avec des courbes*						
2.2.4.1	*Une courbe après une longue ligne droite*	*Oui*					*UA/VRU*
2.2.4.2	*La compatibilité de deux courbes consécutives*	*Oui*					*UA/VRU*
2.2.4.3	*Des courbes de transition*	*oui*					*UA/VRU*
2.2.4.4	*Des manquements dans une courbe*						
2.2.4.5	*Consistance dans le design*	*Oui*					*VRU*
2.2.5	*Un planning pour améliorer les voiries existantes.*	*Oui*					*UEMOA*
2.3	***L'alignement vertical***						
2.3.1	*L'angle de pente.*	*Oui*					*VRU/IC*
2.3.2	*La forme d'une courbe verticale*						
2.3.2.1	*Convexe*	*Oui*					*VRU*
2.3.2.2	*Concave*	*Oui*					*VRU*
2.3.3	*Bande pour véhicules lents*						
2.3.3.1	*Bande pour dépasser*	*Oui*					*VRU/IC*

2	ALIGNEMENT	Mentionnée dans les directives du pays.	L'effet sur la sécurité est mentionné et dans quelle gradation ?	Quelles sont les valeurs de paramètre supposées / adoptées	Est-ce que les effets pour la sécurité en cas de déviation des normes mentionnés ?	Valeurs de références	Sources
2.3.3.2	*Suppression de voie auxiliaire (voies véhicules lents ou bandes de dépassement): type et longueur de la pente*	*Oui*					*VRU/IC*
2.3.4	*Un planning pour améliorer les voiries existantes*	*oui*					*UEMOA*
2.3.5	*Voies de détresse*						
2.3.5.1	*Garanties et espacement*						
2.3.5.2	*Type et longueur*						
2.3.5.3	*Zone d'arrêt pour le contrôle des freins*						
2.4	*Suppression de voie auxiliaire (voies véhicules lents ou bandes de dépassement): type et longueur de la pente*						

3	PROFIL EN TRAVERS	Mentionnée dans les directives du pays.	L'effet sur la sécurité est mentionné et dans quelle gradation ?	Quelles sont les valeurs de paramètre supposées / adoptées	Est-ce que les effets pour la sécurité en cas de déviation des normes mentionnés ?	Valeurs de références	Sources
3.1.1	Relation rayon de courbure/dévers/vitesse	Oui					UA/IC
3.1.2	Dévers (transition/longueur)	oui					UA/IC
3.1.3	Conception intégrée des profils en travers et des autres éléments	Oui					VRU/IC
3.2	Chaussée principale						
3.2.1	Largeur de la route	Oui		'principal'= 50m / classe I: 40m			UA/VRU
3.2.2	Les bandes						
3.2.2.1	Largeur des bandes en fonction de la vitesse	Oui		3.5m			UA/VRU/IC
3.2.3	Une réduction de bande	Oui					VRU/IC
3.2.4	Bande d'arrêt d'urgence						
3.2.4.1	Largeur de la bande adaptée	Oui					UA/VRU/IC
3.2.5	Bande dérasée	Oui					VRU/IC
3.2.6	Bande centrale neutralisée	Oui		Dépendant du relief: 'principal'=3 à 4m ; Classe I = 2.5 à 3.5m			UA/ VRU/IC
3.2.7	Séparateur médian	Oui					UA/VVRU/I C
3.2.8	Refuges de sécurité	Ouii					UA/VRU/IC
3.2.9	Le revêtement	Oui					UA/VRU/IC
3.2.10	Marquage routier	Oui					VRU/IC
3.3	Au bord de la route						
3.3.1	Zone sans obstacles	Oui					VRU
3.3.2	Le type d'obstacle	Oui					VRU
3.3.3	Zone non pavée						
3.3.4	Talus	Oui					VRU

3	PROFIL EN TRAVERS	Mentionnée dans les directives du pays.	L'effet sur la sécurité est mentionné et dans quelle gradation ?	Quelles sont les valeurs de paramètre supposées / adoptées	Est-ce que les effets pour la sécurité en cas de déviation des normes mentionnés ?	Valeurs de références	Sources
3.3.5	Le drainage	Oui					UA/VRU
3.4	Des bandes secondaires / parallèles (p.ex. des bandes de bus) pour les véhicules motorisés lents.	Oui					UA/VRU
3.5	Des profils en travers recommandés						
3.6	Contrôle d'accès	Oui					VRU/IC
3.7	Tunnels	oui					UA/VRU
3.8	Des bandes parallèles						
3.8.1	Général						
3.8.2	Voies (latérales) de desserte	Oui					VRU
3.8.3	Aires de repos et de service						

4	ECHANGEUR AUTOROUTIER	Mentionnée dans les directives du pays.	L'effet sur la sécurité est mentionné et dans quelle gradation ?	Quelles sont les valeurs de paramètre supposées / adoptées	Est-ce que les effets pour la sécurité en cas de déviation des normes mentionnés ?	Valeurs de références	Sources
4.1	Échangeur autoroutier et entrée et sortie						
4.1.1	Valeur minimale de la distance espacement	Oui					VRU/IC
4.1.2	Distance minimale entre des voies d'entrée et sortie successives.	Oui					VRU/IC
4.2	Profil en long à l'approche de l'échangeur						
4.2.1	Valeur maximale de la pente de l'autoroute	Oui					VRU/IC
4.2.2	Valeur minimale pour le rayon de courbure horizontal de l'autoroute	Oui					VRU/IC
4.2.3	Distance de visibilité requise avant chaque sortie (distance de visibilité préférable)	Oui					VRU/IC
4.3	Configuration de l'échangeur						
4.3.1	Différenciation entre les échangeurs entre une autoroute et d'autres routes (nommés diffuseurs) et les échangeurs entre autoroutes	Oui					UA/VRU/IC
4.3.1.1	Différentes configurations appropriées d'échangeurs et leurs variantes, doivent être évaluées lors de la phase d'étude de conception.	Oui					UA/VRU/IC
4.3.2	Configuration d'échange adaptée aux besoins opérationnels, adaptée à la topographie et aux conditions et contraintes potentielles du site,	Oui					VRU/IC
4.3.2.1	Exigences relatives à la cohérence du modèle de sortie avec les autres échangeurs à proximité						
4.3.3	L'aménagement répond aux besoins des différents mouvements de circulation souhaités Les différents mouvements directionnels et leurs besoins respectifs sont couverts par l'aménagement..	Oui					VRU/IC
4.3.4	L'obligation d'aménager toutes les entrées et sorties par la droite						
4.3.5	Des dispositions pour les sections d'entrecroisement						

4	*ECHANGEUR AUTOROUTIER*	**Mentionnée dans les directives du pays.**	**L'effet sur la sécurité est mentionné et dans quelle gradation ?**	**Quelles sont les valeurs de paramètre supposées / adoptées**	**Est-ce que les effets pour la sécurité en cas de déviation des normes mentionnés ?**	**Valeurs de références**	**Sources**
4.3.5.1	*La distance entre de début de la bande de décélération et la balise de musoir.*	*Oui*					*VRU*
4.3.6	*Emplacement de croisement dans l'échangeur.*						
4.3.6.1	*Sur l'autoroute*	*Oui*					*UA/VRU*
4.3.7	*Continuité de l'itinéraire*						
4.3.7.1	*La priorité est pour la voie de transit*	*Oui*					*VRU*
4.4	*Configuration des bretelles*						
4.4.1	*Vitesse de conception de la bretelle ≥50% celle de la voie principal*	*Oui*					*UA/VRU/IC*
4.4.2	*La longueur de la bande d'accélération (entrée)*	*Oui*					*VRU/IC*
4.4.3	*La longueur de la bande de décélération (sortie)*	*Oui*					*VRU/IC*
4.4.4	*Nombre équilibré de sorties et d'entrées?*	*Oui*					*VRU/IC*
4.5	*La configuration des routes transversales*						
4.5.1	*Trottoirs et pistes cyclables prévues sur la route transversale.* *(Les piétons et les cyclistes sont vulnérables en particulier aux accès et sorties de la bretelle).*	*Oui*					*VRU/IC*
4.5.1.1	*Feux de circulation aux carrefours à la sortie des échangeurs (OUI ou NON)*						
4.5.2	*Longueur de la bande d'insertion depuis la bretelle vers la route transversale (un minimum de 30 m dans les zones urbaines et 100 m dans les zones rurales).*	*Oui*					*VRU/IC*
4.5.3	*Planification et gestion des accès carrossables le long de la route transversale (OUI ou NON)*	*Oui*					*VRU/IC*
4.5.4	*Critères de configuration pour les bretelles/ les intersections routières*						
4.5.4.1	*Prendre en compte les rayons de giration des véhicules*	*Oui*					*VRU/IC*

4	***ECHANGEUR AUTOROUTIER***	***Mentionnée dans les directives du pays.***	***L'effet sur la sécurité est mentionné et dans quelle gradation ?***	***Quelles sont les valeurs de paramètre supposées / adoptées***	***Est-ce que les effets pour la sécurité en cas de déviation des normes mentionnés ?***	***Valeurs de références***	***Sources***
4.5.4.2	*La capacité routière*	*Oui*					*UA/VRU/IC*
4.5.4.3	*La régulation du trafic*	*Oui*					*VRU/IC*
4.5.4.4	*Présélection des bandes/voies.*	*Oui*					*VRU/IC*
4.5.4.5	*Triangle de visibilité au droit de l'intersection*	*Oui*					*VRU/IC*

7.3 SaferAfrica prioritizing design features in guidelines used in Burkina Faso

7.3.1 Prioritizing ratings for interurban single carriageway roads – African Union Directive

Rating team: João Cardoso; Carlos Roque. Country: Burkina Faso Guidelines assessed: *Avant-projet Accord intergouvernemental pour l'harmonisation des normes et standards sur le réseau autoroutier transafricain. Union Africaine.*

ARP	BASIC ASSUMPTIONS	D Final score Priority D=AxBxC Very low to very high D=AxBxC (Max=27)	e AU In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	h Total h=exfxg Score (Max=12)	Total score D+h (Max=39)	%	Weighted	Single Carriageway Priority ranking based on score BASIC ASSUMPTIONS AU
1.1	**General approach**									
1.1.1	Design speed approach	18	1	2	3	6	24	61.54	58.33	MEDIUM
1.1.2	Speed limit approach	18	2	2	3	12	30	76.92	83.33	HIGH
1.1.3	Actual speed approach	18	2	2	3	12	30	76.92	83.33	HIGH
1.2	**Reaction time**	18	2	2	3	12	30	76.92	83.33	HIGH
1.3	**Eye position and object position**									
1.3.1	Eye height	12	2	2	3	12	24	61.54	72.22	HIGH
1.3.2	Lateral eye position	12	2	2	3	12	24	61.54	72.22	HIGH
1.3.3	Object height	12	2	2	3	12	24	61.54	72.22	HIGH
1.3.4	Lateral object position	12	2	2	3	12	24	61.54	72.22	HIGH
1.4	**Friction coefficient**									
1.4.1	Longitudinal friction coefficient	18	2	2	3	12	30	76.92	83.33	HIGH
1.4.2	Side friction coefficient	18	2	2	3	12	30	76.92	83.33	HIGH

ARP	BASIC ASSUMPTIONS	D Final score Priority D=AxBxC Very low to very high D=AxBxC (Max=27)	e AU In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	h Total h=exfxg Score (Max=12)	Total score D+h (Max=39)	%	Weighted	Single Carriageway Priority ranking based on score BASIC ASSUMPTIONS AU
1.5	**Vehicle deceleration and acceleration**									
1.5.1	Deceleration	18	2	2	3	12	30	76.92	83.33	HIGH
1.5.2	Acceleration	8	2	2	3	12	20	51.28	64.81	MEDIUM
1.6	**Action distances**									
1.6.1	Stopping distance	18	1	2	3	6	24	61.54	58.33	MEDIUM
1.6.2	Overtaking distance	18	1	2	3	6	24	61.54	58.33	MEDIUM
1.7	**Sight distance**									
1.7.1	Stopping sight distance	27	1	2	3	6	33	84.62	75.00	HIGH
1.7.2	Meeting sight distance	27	1	2	3	6	33	84.62	75.00	HIGH
1.7.3	Overtaking sight distance	27	1	2	3	6	33	84.62	75.00	HIGH
1.7.4	Abort overtaking sight distance	6	1	2	3	6	12	30.77	36.11	LOW
1.7.5	Crossing sight distance	8	2	2	3	12	20	51.28	64.81	MEDIUM
1.8	**Design vehicle characteristics**	27	1	2	3	6	33	84.62	75.00	HIGH
1.9	**Clearances**									
1.9.1	Dimensions	18	2	2	3	12	30	76.92	83.33	HIGH
1.9.2	Swept path	18	2	2	3	12	30	76.92	83.33	HIGH
1.9.3	Overhead and lateral clearances	18	1	2	3	6	24	61.54	58.33	MEDIUM
1.9.4	Safety distances	18	2	2	3	12	30	76.92	83.33	HIGH
Annex	**Road lighting**	6	1	2	3	6	12	30.77	36.11	LOW

ARP	ALIGNMENT	D Final score Priority D=AxBxC Very low to very high	e AU In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	Total exfxg Score (Max=12)	Total score (Max=39)	%	Weighted	Single Carriageway Priority ranking based on score ALIGNMENT AU
2.2	**Horizontal alignment**									
2.2.1	Principles	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.2.2	Straight sections and large radius curves	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.2.3	Curves									
2.2.3.1	Radii not recommended	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.2.3.2	Super elevation	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.2.3.3	Minimum radius	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.2.4	Rules for linking alignment elements		1	2	3	6				
2.2.4.1	Curve following a straight section	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.2.4.2	Compatibility of two successive curves	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.2.4.3	Transition curves	27	1	2	3	6	33	84.62	75.00	HIGH
2.2.4.4	Internal defects of a bend	8	2	2	3	12	20	51.28	64.81	MEDIUM
2.2.4.5	Design consistency	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.2.5	Project planning to improve existing roads	6	1	2	3	6	12	30.77	36.11	LOW
2.3	**Vertical alignment**									
2.3.1	Gradient	27	1	2	3	6	33	84.62	75.00	HIGH
2.3.2	Vertical connecting curves									
2.3.2.1	Convex curves	27	1	2	3	6	33	84.62	75.00	HIGH
2.3.2.2	Concave curves	18	1	2	3	6	24	61.54	58.33	MEDIUM

ARP	ALIGNMENT	D Final score Priority D=AxBxC Very low to very high	e AU In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	Total exfxg Score (Max=12)	Total score (Max=39)	%	Weighted	Single Carriageway Priority ranking based on score ALIGNMENT AU
2.3.3	Climbing lanes									
2.3.3.1	Passing/Climbing lanes (old 3.2.4)	27	1	2	3	6	33	84.62	75.00	HIGH
2.3.3.2	Auxiliary (climbing or passing) lane suppression: type and length of drop	27	2	2	3	12	39	100.0	100.00	TOP
2.3.4	Improvement of existing roads	6	1	2	3	6	12	30.77	36.11	LOW
2.3.5	Emergency escape ramps									
2.3.5.1	Warrants and spacing	18	2	2	3	12	30	76.92	83.33	HIGH
2.3.5.2	Type and length	27	2	2	3	12	39	100.0	100.00	TOP
2.3.5.3	Stop areas for brake checking	2	2	2	3	12	14	35.90	53.70	MEDIUM
2.4	**Coordination of horizontal and vertical alignments**	6	1	2	3	6	12	30.77	36.11	LOW

ARP	CROSS-SECTION	D Final score Priority D=AxBxC Very low to very high	e AU In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	Total exfxg Score (Max=12)	Total score (Max=39)	%	Weighted	Single Carriageway Priority ranking based on score CROSS-SECTION AU
3.1.3	Integrated design	6	1	2	3	6	12	30.77	36.11	LOW
3.2	**Main carriageway**									
3.2.1	Road Width	18	1	2	3	6	24	61.54	58.33	MEDIUM
3.2.2	Running lanes		1	2	3	6	6	15.38	25.00	LOW
3.2.2.1	Lane width vs design speed	18	2	2	3	12	30	76.92	83.33	HIGH
3.2.3	Crossfall	6	1	2	3	6	12	30.77	36.11	LOW
3.2.4	Hard shoulders	12	1	2	3	6	18	46.15	47.22	MEDIUM
3.2.4.1	Shoulder width suitable for emergency lane	12	2	2	3	12	24	61.54	72.22	HIGH
3.2.5	Inner shoulder									
3.2.6	Median separation									
3.2.7	Turnouts, safety zones	6	1	2	3	6	12	30.77	36.11	LOW
3.2.8	Surfacing	12	1	2	3	6	18	46.15	47.22	MEDIUM
3.2.9	Road markings	12	1	2	3	6	18	46.15	47.22	MEDIUM
3.3	**Roadside**									
3.3.1	Obstacle-free zones	18	1	2	3	6	24	61.54	58.33	MEDIUM
3.3.2	Type of Obstacle	12	1	2	3	6	18	46.15	47.22	MEDIUM
3.3.3	Soft shoulders	12	2	2	3	12	24	61.54	72.22	HIGH
3.3.4	Slopes	12	1	2	3	6	18	46.15	47.22	MEDIUM
3.3.5	Drainage channels	12	1	2	3	6	18	46.15	47.22	MEDIUM
3.4	**Secondary lanes**									
3.4.1	Cycle lane	27	1	2	3	6	33	84.62	75.00	HIGH

ARP	CROSS-SECTION	D Final score Priority D=AxBxC Very low to very high	e AU In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	Total exfxg Score (Max=12)	Total score (Max=39)	%	Weighted	Single Carriageway Priority ranking based on score CROSS-SECTION AU
3.4.2	General	18	1	2	3	6	24	61.54	58.33	MEDIUM
3.4.3	Pedestrian sidewalk	27	1	2	3	6	33	84.62	75.00	HIGH
3.4.4	Bus stops bays	12	1	2	3	6	18	46.15	47.22	MEDIUM
3.5	**Access control**	27				0	27	69.23	50.00	MEDIUM
3.5.1	Frontage roads	18	1	2	3	6	24	61.54	58.33	MEDIUM
3.6	**Tunnels**	9	2	2	3	12	21	53.85	66.67	MEDIUM

ARP	INTERSECTIONS	D Final score Priority D=AxBxC Very low to very high	e AU In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	Total exfxg Score (Max=12)	Total score (Max=39)	%	Weighted	Single Carriageway Priority ranking based on score INTERSECTIONS AU
4.1	**Intersection types**									
4.1.1	Number of arms	18	1	2	3	6	24	61.54	58.33	MEDIUM
4.1.2	Traffic control mode	27	1	2	3	6	33	84.62	75.00	HIGH
4.1.3	Traffic conflict countermeasures for motor vehicles	18	1	2	3	6	24	61.54	58.33	MEDIUM
4.1.4	Traffic conflict countermeasures for vulnerable road users	27	1	2	3	6	33	84.62	75.00	HIGH
4.2	**Use of design templates**	18	2	2	3	12	30	76.92	83.33	HIGH
4.3	**Design principles**	18	2	2	3	12	30	76.92	83.33	HIGH
4.4	**Traffic safety records for intersection types**	12	2	2	3	12	24	61.54	72.22	HIGH
4.5	**Intersection between a distributor (high level) and a local road**									
4.5.1	3- and 4-way	12	2	2	3	12	24	61.54	72.22	HIGH
4.5.2	Priority control mode	27	1	2	3	6	33	84.62	75.00	HIGH
4.5.3	Minor road channelization	18	1	2	3	6	24	61.54	58.33	MEDIUM
4.5.4	Major road left turn lanes	27	1	2	3	6	33	84.62	75.00	HIGH
4.5.5	Right turn lanes	18	1	2	3	6	24	61.54	58.33	MEDIUM
4.5.6	Bicycle and pedestrian facilities	27	1	2	3	6	33	84.62	75.00	HIGH
4.5.7	Local speed limits	27	2	2	3	12	39	100.0	100.00	TOP
4.5.8	Crossing sight distance requirements	18	1	2	3	6	24	61.54	58.33	MEDIUM
4.6	**Intersection between two distributor (high level) roads**	0								

ARP	INTERSECTIONS	D Final score Priority D=AxBxC Very low to very high	e AU In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	Total exfxg Score (Max=12)	Total score (Max=39)	%	Weighted	Single Carriageway Priority ranking based on score INTERSECTIONS AU
4.6.1	X or Y intersection	18	1	2	3	6	24	61.54	58.33	MEDIUM
4.6.2	Roundabout		1	2	3	6				
4.6.2.1	Expected Use	27	2	2	3	12	39	100.0	100.00	TOP
4.6.2.2	Shape and layout (refers to whather it is a traditional t or X or some deviation)	6	2	2	3	12	18	46.15	61.11	MEDIUM
4.6.2.3	Crossing sight distance requirements	18	1	2	3	6	24	61.54	58.33	MEDIUM
4.6.2.4	Bicycle facilities	18	1	2	3	6	24	61.54	58.33	MEDIUM
4.6.3	Traffic signals	12	2	2	3	12	24	61.54	72.22	HIGH
4.6.4	Grade separation	18	1	2	3	6	24	61.54	58.33	MEDIUM

7.3.2 Prioritizing ratings for interurban single carriageway roads – UEMOA regulation

Rating team: João Cardoso; Carlos Roque. Country: Burkina Faso Guidelines assessed: Règlement N°08/2009/CM/, on the adoption of the status of the UEMOA community road network, and corresponding management procedures.

ARP	BASIC ASSUMPTIONS	D Final score Priority D=AxBxC Very low to very high D=AxBxC (Max=27)	e UEMOA In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	h Total h=exfxg Score (Max=12)	Total score D+h (Max=39)	%	Weighted	Single Carriageway Priority ranking based on score BASIC ASSUMPTIONS UEMOA
1.1	**General approach**									
1.1.1	Design speed approach	18	1	2	3	6	24	61.54	58.33	MEDIUM
1.1.2	Speed limit approach	18	2	2	3	12	30	76.92	83.33	HIGH
1.1.3	Actual speed approach	18	2	2	3	12	30	76.92	83.33	HIGH
1.2	**Reaction time**	18	2	2	3	12	30	76.92	83.33	HIGH
1.3	**Eye position and object position**									
1.3.1	Eye height	12	2	2	3	12	24	61.54	72.22	HIGH
1.3.2	Lateral eye position	12	2	2	3	12	24	61.54	72.22	HIGH
1.3.3	Object height	12	2	2	3	12	24	61.54	72.22	HIGH
1.3.4	Lateral object position	12	2	2	3	12	24	61.54	72.22	HIGH
1.4	**Friction coefficient**									
1.4.1	Longitudinal friction coefficient	18	2	2	3	12	30	76.92	83.33	HIGH
1.4.2	Side friction coefficient	18	2	2	3	12	30	76.92	83.33	HIGH
1.5	**Vehicle deceleration and acceleration**									
1.5.1	Deceleration	18	2	2	3	12	30	76.92	83.33	HIGH
1.5.2	Acceleration	8	2	2	3	12	20	51.28	64.81	MEDIUM
1.6	**Action distances**									
1.6.1	Stopping distance	18	2	2	3	12	30	76.92	83.33	HIGH
1.6.2	Overtaking distance	18	2	2	3	12	30	76.92	83.33	HIGH
1.7	**Sight distance**									
1.7.1	Stopping sight distance	27	2	2	3	12	39	100.0	100.00	TOP
1.7.2	Meeting sight distance	27	2	2	3	12	39	100.0	100.00	TOP
1.7.3	Overtaking sight distance	27	1	2	3	6	33	84.62	75.00	HIGH
1.7.4	Abort overtaking sight distance	6	1	2	3	6	12	30.77	36.11	LOW
1.7.5	Crossing sight distance	8	2	2	3	12	20	51.28	64.81	MEDIUM

ARP	BASIC ASSUMPTIONS	D Final score Priority D=AxBxC Very low to very high D=AxBxC (Max=27)	e UEMOA In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	h Total h=exfxg Score (Max=12)	Total score D+h (Max=39)	%	Weighted	Single Carriageway Priority ranking based on score BASIC ASSUMPTIONS UEMOA
1.8	**Design vehicle characteristics**	27	2	2	3	12	39	100.0	100.00	TOP
1.9	**Clearances**									
1.9.1	Dimensions	18	2	2	3	12	30	76.92	83.33	HIGH
1.9.2	Swept path	18	2	2	3	12	30	76.92	83.33	HIGH
1.9.3	Overhead and lateral clearances	18	1	2	3	6	24	61.54	58.33	MEDIUM
1.9.4	Safety distances	18	2	2	3	12	30	76.92	83.33	HIGH
Annex	**Road lighting**	6	2	2	3	12	18	46.15	61.11	MEDIUM

ARP	ALIGNMENT	D Final score Priority D=AxBxC Very low to very high	e UEMOA In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	Total exfxg Score (Max=12)	Total score (Max=39)	%	Weighted	Single Carriageway Priority ranking based on score ALIGNMENT UEMOA
2.2	**Horizontal alignment**									
2.2.1	Principles	18	2	2	3	12	30	76.92	83.33	HIGH
2.2.2	Straight sections and large radius curves	18	2	2	3	12	30	76.92	83.33	HIGH
2.2.3	Curves									
2.2.3.1	Radii not recommended	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.2.3.2	Super elevation	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.2.3.3	Minimum radius	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.2.4	Rules for linking alignment elements									
2.2.4.1	Curve following a straight section	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.2.4.2	Compatibility of two successive curves	18	1	2	2	4	22	56.41	50.00	MEDIUM
2.2.4.3	Transition curves	27	1	2	3	6	33	84.62	75.00	HIGH
2.2.4.4	Internal defects of a bend	8	2	2	3	12	20	51.28	64.81	MEDIUM
2.2.4.5	Design consistency	18	2	2	3	12	30	76.92	83.33	HIGH
2.2.5	Project planning to improve existing roads	6	2	2	3	12	18	46.15	61.11	MEDIUM
2.3	**Vertical alignment**									
2.3.1	Gradient	27	1	2	3	6	33	84.62	75.00	HIGH
2.3.2	Vertical connecting curves									
2.3.2.1	Convex curves	27	1	2	3	6	33	84.62	75.00	HIGH
2.3.2.2	Concave curves	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.3.3	Climbing lanes									
2.3.3.1	Passing/Climbing lanes (old 3.2.4)	27	1	2	3	6	33	84.62	75.00	HIGH
2.3.3.2	Auxiliary (climbing or passing) lane suppression: type and length of drop	27	2	2	3	12	39	100.0	100.00	TOP
2.3.4	Improvement of existing roads	6	2	2	3	12	18	46.15	61.11	MEDIUM
2.3.5	Emergency escape ramps									
2.3.5.1	Warrants and spacing	18	2	2	3	12	30	76.92	83.33	HIGH
2.3.5.2	Type and length	27	2	2	3	12	39	100.0	100.00	TOP

ARP	ALIGNMENT	D Final score Priority D=AxBxC Very low to very high	e UEMOA In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	Total exfxg Score (Max=12)	Total score (Max=39)	%	Weighted	Single Carriageway Priority ranking based on score ALIGNMENT UEMOA
2.3.5.3	Stop areas for brake checking	2	2	2	3	12	14	35.90	53.70	MEDIUM
2.4	**Coordination of horizontal and vertical alignments**	6	2	2	3	12	18	46.15	61.11	MEDIUM

ARP	CROSS-SECTION	D Final score Priority D=AxBxC Very low to very high	e UEMOA In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	Total exfxg Score (Max=12)	Total score (Max=39)	%	Weighted	Single Carriageway Priority ranking based on score CROSS-SECTION UEMOA
3.1.3	Integrated design	6	1	2	3	6	12	30.77	36.11	LOW
3.2	**Main carriageway**									
3.2.1	Road Width	18	1	2	3	6	24	61.54	58.33	MEDIUM
3.2.2	Running lanes		1	2	3	6	6	15.38	25.00	LOW
3.2.2.1	Lane width vs design speed	18	2	2	3	12	30	76.92	83.33	HIGH
3.2.3	Crossfall	6	2	2	3	12	18	46.15	61.11	MEDIUM
3.2.4	Hard shoulders	12	1	1	2	2	14	35.90	30.56	LOW
3.2.4.1	Shoulder width suitable for emergency lane	12	2	2	3	12	24	61.54	72.22	HIGH
3.2.5	Inner shoulder									
3.2.6	Median separation									
3.2.7	Turnouts, safety zones	6	1	1	2	2	8	20.51	19.44	LOW
3.2.8	Surfacing	12	1	1	2	2	14	35.90	30.56	LOW
3.2.9	Road markings	12	1	2	3	6	18	46.15	47.22	MEDIUM
3.3	**Roadside**									
3.3.1	Obstacle-free zones	18	2	2	3	12	30	76.92	83.33	HIGH
3.3.2	Type of Obstacle	12	2	2	3	12	24	61.54	72.22	HIGH
3.3.3	Soft shoulders	12	2	2	3	12	24	61.54	72.22	HIGH
3.3.4	Slopes	12	1	2	3	6	18	46.15	47.22	MEDIUM
3.3.5	Drainage channels	12	2	2	3	12	24	61.54	72.22	HIGH
3.4	**Secondary lanes**									
3.4.1	Cycle lane	27	1	2	3	6	33	84.62	75.00	HIGH
3.4.2	General	18	1	2	3	6	24	61.54	58.33	MEDIUM
3.4.3	Pedestrian sidewalk	27	1	2	3	6	33	84.62	75.00	HIGH
3.4.4	Bus stops bays	12	2	2	3	12	24	61.54	72.22	HIGH
3.5	**Access control**	27	2	2	3	12	39	100.0	100.00	TOP
3.5.1	Frontage roads	18	2	2	3	12	30	76.92	83.33	HIGH
3.6	**Tunnels**	9	2	2	3	12	21	53.85	66.67	MEDIUM

ARP	INTERSECTIONS	D Final score Priority D=AxBxC Very low to very high	e UEMOA In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	Total exfxg Score (Max=12)	Total score (Max=39)	%	Weighted	Single Carriageway Priority ranking based on score INTERSECTIONS UEMOA
4.1	**Intersection types**									
4.1.1	Number of arms	18	1	2	3	6	24	61.54	58.33	MEDIUM
4.1.2	Traffic control mode	27	2	2	3	12	39	100.0	100.00	TOP
4.1.3	Traffic conflict countermeasures for motor vehicles	18	1	1	2	2	20	51.28	41.67	MEDIUM
4.1.4	Traffic conflict countermeasures for vulnerable road users	27	2	2	3	12	39	100.0	100.00	TOP
4.2	**Use of design templates**	18	2	2	3	12	30	76.92	83.33	HIGH
4.3	**Design principles**	18	2	2	3	12	30	76.92	83.33	HIGH
4.4	**Traffic safety records for intersection types**	12	2	2	3	12	24	61.54	72.22	HIGH
4.5	**Intersection between a distributor high level) and a local road**		1							
4.5.1	3- and 4-way	12	1	2	3	6	18	46.15	47.22	MEDIUM
4.5.2	Priority control mode	27	1	2	3	6	33	84.62	75.00	HIGH
4.5.3	Minor road channelization	18	1	2	3	6	24	61.54	58.33	MEDIUM
4.5.4	Major road left turn lanes	27	1	2	3	6	33	84.62	75.00	HIGH
4.5.5	Right turn lanes	18	2	2	3	12	30	76.92	83.33	HIGH
4.5.6	Bicycle and pedestrian facilities	27	2	2	3	12	39	100.0	100.00	TOP
4.5.7	Local speed limits	27	2	2	3	12	39	100.0	100.00	TOP
4.5.8	Crossing sight distance requirements	18	1	1	2	2	20	51.28	41.67	MEDIUM
4.6	**Intersection between two distributor (high level) roads**	0								
4.6.1	X or Y intersection	18	2	2	3	12	30	76.92	83.33	HIGH
4.6.2	Roundabout		1	2	3	6				
4.6.2.1	Expected Use	27	1	2	3	6	33	84.62	75.00	HIGH
4.6.2.2	Shape and layout (refers to whether it is a traditional t or X or some deviation)	6	1	2	3	6	12	30.77	36.11	LOW
4.6.2.3	Crossing sight distance requirements	18	1	1	2	2	20	51.28	41.67	MEDIUM

ARP	INTERSECTIONS	D Final score Priority D=AxBxC Very low to very high	e UEMOA In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	Total exfxg Score (Max=12)	Total score (Max=39)	%	Weighted	Single Carriageway Priority ranking based on score INTERSECTIONS UEMOA
4.6.2.4	Bicycle facilities	18	2	2	3	12	30	76.92	83.33	HIGH
4.6.3	Traffic signals	12	2	2	3	12	24	61.54	72.22	HIGH
4.6.4	Grade separation	18	2	2	3	12	30	76.92	83.33	HIGH

7.3.3 Prioritizing ratings for interurban single carriageway roads – French ARP

Rating team: João Cardoso; Carlos Roque. Country: Burkina Faso Guidelines assessed: *Recommandations techniques pour la conception générale et la géométrie de la route. Aménagement des routes principales; SETRA, France.*

ARP	BASIC ASSUMPTIONS	D Final score Priority D=AxBxC Very low to very high D=AxBxC (Max=27)	e ARP In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	h Total h=exfxg Score (Max=12)	Total score D+h (Max=39)	%	Weighted	Single Carriageway Priority ranking based on score BASIC ASSUMPTIONS ARP
1.1	**General approach**									
1.1.1	Design speed approach	18	1	2	3	6	24	61.54	58.33	MEDIUM
1.1.2	Speed limit approach	18	2	2	3	12	30	76.92	83.33	HIGH
1.1.3	Actual speed approach	18	1	2	3	6	24	61.54	58.33	MEDIUM
1.2	**Reaction time**	18	1	2	3	6	24	61.54	58.33	MEDIUM
1.3	**Eye position and object position**									
1.3.1	Eye height	12	1	2	3	6	18	46.15	47.22	MEDIUM
1.3.2	Lateral eye position	12	1	2	3	6	18	46.15	47.22	MEDIUM
1.3.3	Object height	12	1	2	3	6	18	46.15	47.22	MEDIUM
1.3.4	Lateral object position	12	1	2	3	6	18	46.15	47.22	MEDIUM
1.4	**Friction coefficient**									
1.4.1	Longitudinal friction coefficient	18	2	2	3	12	30	76.92	83.33	HIGH
1.4.2	Side friction coefficient	18	2	2	3	12	30	76.92	83.33	HIGH
1.5	**Vehicle deceleration and acceleration**									
1.5.1	Deceleration	18	2	2	3	12	30	76.92	83.33	HIGH
1.5.2	Acceleration	8	2	2	3	12	20	51.28	64.81	MEDIUM

ARP	BASIC ASSUMPTIONS	D Final score Priority D=AxBxC Very low to very high D=AxBxC (Max=27)	e ARP In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	h Total h=exfxg Score (Max=12)	Total score D+h (Max=39)	%	Weighted	Single Carriageway Priority ranking based on score BASIC ASSUMPTIONS ARP
1.6	**Action distances**									
1.6.1	Stopping distance	18	1	2	3	6	24	61.54	58.33	MEDIUM
1.6.2	Overtaking distance	18	1	2	3	6	24	61.54	58.33	MEDIUM
1.7	**Sight distance**									
1.7.1	Stopping sight distance	27	1	2	3	6	33	84.62	75.00	HIGH
1.7.2	Meeting sight distance	27	1	2	3	6	33	84.62	75.00	HIGH
1.7.3	Overtaking sight distance	27	1	2	3	6	33	84.62	75.00	HIGH
1.7.4	Abort overtaking sight distance	6	2	2	3	12	18	46.15	61.11	MEDIUM
1.7.5	Crossing sight distance	8	2	2	3	12	20	51.28	64.81	MEDIUM
1.8	**Design vehicle characteristics**	27	2	2	3	12	39	100.0	100.00	TOP
1.9	**Clearances**									
1.9.1	Dimensions	18	2	2	3	12	30	76.92	83.33	HIGH
1.9.2	Swept path	18	2	2	3	12	30	76.92	83.33	HIGH
1.9.3	Overhead and lateral clearances	18	1	2	3	6	24	61.54	58.33	MEDIUM
1.9.4	Safety distances	18	1	2	3	6	24	61.54	58.33	MEDIUM
Annex	**Road lighting**	6	1	2	3	6	12	30.77	36.11	LOW

ARP	ALIGNMENT	D Final score Priority D=AxBxC Very low to very high	e ARP In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	Total exfxg Score (Max=12)	Total score (Max=39)	%	Weighted	Single Carriageway Priority ranking based on score ALIGNMENT ARP
2.2	**Horizontal alignment**									
2.2.1	Principles	18	1	1	3	3	21	53.85	45.83	MEDIUM
2.2.2	Straight sections and large radius curves	18	1	1	3	3	21	53.85	45.83	MEDIUM
2.2.3	Curves									
2.2.3.1	Radii not recommended	18	1	1	2	2	20	51.28	41.67	MEDIUM
2.2.3.2	Super elevation	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.2.3.3	Minimum radius	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.2.4	Rules for linking alignment elements		1	2	3	6				
2.2.4.1	Curve following a straight section	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.2.4.2	Compatibility of two successive curves	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.2.4.3	Transition curves	27	1	2	3	6	33	84.62	75.00	HIGH
2.2.4.4	Internal defects of a bend	8	1	1	2	2	10	25.64	23.15	LOW
2.2.4.5	Design consistency	18	2	2	3	12	30	76.92	83.33	HIGH
2.2.5	Project planning to improve existing roads	6	1	1	2	2	8	20.51	19.44	LOW
2.3	**Vertical alignment**									
2.3.1	Gradient	27	1	1	3	3	30	76.92	62.50	MEDIUM
2.3.2	Vertical connecting curves									
2.3.2.1	Convex curves	27	1	1	3	3	30	76.92	62.50	MEDIUM
2.3.2.2	Concave curves	18	1	1	3	3	21	53.85	45.83	MEDIUM

ARP	ALIGNMENT	D Final score Priority D=AxBxC Very low to very high	e ARP In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	Total exfxg Score (Max=12)	Total score (Max=39)	%	Weighted	Single Carriageway Priority ranking based on score ALIGNMENT ARP
2.3.3	Climbing lanes									
2.3.3.1	Passing/Climbing lanes (old 3.2.4)	27	1	1	2	2	29	74.36	58.33	MEDIUM
2.3.3.2	Auxiliary (climbing or passing) lane suppression: type and length of drop	27	1	2	3	6	33	84.62	75.00	HIGH
2.3.4	Improvement of existing roads	6	1	1	2	3	9	23.08	23.61	LOW
2.3.5	Emergency escape ramps									
2.3.5.1	Warrants and spacing	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.3.5.2	Type and length	27	1	2	3	6	33	84.62	75.00	HIGH
2.3.5.3	Stop areas for brake checking	2	2	2	3	12	14	35.90	53.70	MEDIUM
2.4	**Coordination of horizontal and vertical alignments**	6	1	2	3	6	12	30.77	36.11	LOW

ARP	CROSS-SECTION	D Final score Priority D=AxBxC Very low to very high	e ARP In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	Total exfxg Score (Max=12)	Total score (Max=39)	%	Weighted	Single Carriageway Priority ranking based on score CROSS-SECTION ARP
3.1.3	Integrated design	6	1	1	2	2	8	20.51	19.44	LOW
3.2	**Main carriageway**									
3.2.1	Road Width	18	1	2	3	6	24	61.54	58.33	MEDIUM
3.2.2	Running lanes		1	2	2	4	4	10.26	16.67	LOW
3.2.2.1	Lane width vs design speed	18	2	2	3	12	30	76.92	83.33	HIGH
3.2.3	Crossfall	6	1	2	3	6	12	30.77	36.11	LOW
3.2.4	Hard shoulders	12	1	1	3	3	15	38.46	34.72	LOW
3.2.4.1	Shoulder width suitable for emergency lane	12	2	2	3	12	24	61.54	72.22	HIGH
3.2.5	Inner shoulder									
3.2.6	Median separation									
3.2.7	Turnouts, safety zones	6	2	2	3	12	18	46.15	61.11	MEDIUM
3.2.8	Surfacing	12	1	2	3	6	18	46.15	47.22	MEDIUM
3.2.9	Road markings	12	1	2	3	6	18	46.15	47.22	MEDIUM
3.3	**Roadside**									
3.3.1	Obstacle-free zones	18	1	2	3	6	24	61.54	58.33	MEDIUM
3.3.2	Type of Obstacle	12	2	2	3	12	24	61.54	72.22	HIGH
3.3.3	Soft shoulders	12	1	2	3	6	18	46.15	47.22	MEDIUM
3.3.4	Slopes	12	2	2	3	12	24	61.54	72.22	HIGH
3.3.5	Drainage channels	12	1	1	3	3	15	38.46	34.72	LOW
3.4	**Secondary lanes**									
3.4.1	Cycle lane	27	1	1	3	3	30	76.92	62.50	MEDIUM

ARP	CROSS-SECTION	D Final score Priority D=AxBxC Very low to very high	e ARP In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	Total exfxg Score (Max=12)	Total score (Max=39)	%	Weighted	Single Carriageway Priority ranking based on score CROSS-SECTION ARP
3.4.2	General	18	1	1	3	3	21	53.85	45.83	MEDIUM
3.4.3	Pedestrian sidewalk	27	1	1	3	3	30	76.92	62.50	MEDIUM
3.4.4	Bus stops bays	12	1	1	3	3	15	38.46	34.72	LOW
3.5	**Access control**	27				0	27	69.23	50.00	MEDIUM
3.5.1	Frontage roads	18	1	1	3	3	21	53.85	45.83	MEDIUM
3.6	**Tunnels**	9	2	2	3	12	21	53.85	66.67	MEDIUM

ARP	INTERSECTIONS	D Final score Priority D=AxBxC Very low to very high	e ARP In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	Total exfxg Score (Max=12)	Total score (Max=39)	%	Weighted	Single Carriageway Priority ranking based on score INTERSECTIONS ARP
4.1	**Intersection types**									
4.1.1	Number of arms	18	1	2	3	6	24	61.54	58.33	MEDIUM
4.1.2	Traffic control mode	27	1	2	1	2	29	74.36	58.33	MEDIUM
4.1.3	Traffic conflict countermeasures for motor vehicles	18	1	1	2	2	20	51.28	41.67	MEDIUM
4.1.4	Traffic conflict countermeasures for vulnerable road users	27	2	2	2	8	35	89.74	83.33	HIGH
4.2	**Use of design templates**	18	1	1	3	3	21	53.85	45.83	MEDIUM
4.3	**Design principles**	18	1	1	3	3	21	53.85	45.83	MEDIUM
4.4	**Traffic safety records for intersection types**	12	1	1	3	3	15	38.46	34.72	LOW
4.5	**Intersection between a distributor (high level) and a local road**									
4.5.1	3- and 4-way	12	1	2	3	6	18	46.15	47.22	MEDIUM
4.5.2	Priority control mode	27	2	1	3	6	33	84.62	75.00	HIGH
4.5.3	Minor road channelization	18	1	2	3	6	24	61.54	58.33	MEDIUM
4.5.4	Major road left turn lanes	27	1	1	3	3	30	76.92	62.50	MEDIUM
4.5.5	Right turn lanes	18	1	1	3	3	21	53.85	45.83	MEDIUM
4.5.6	Bicycle and pedestrian facilities	27	2	2	3	12	39	100.0	100.00	TOP
4.5.7	Local speed limits	27	2	2	3	12	39	100.0	100.00	TOP
4.5.8	Crossing sight distance requirements	18	1	2	3	6	24	61.54	58.33	MEDIUM
4.6	**Intersection between two distributor (high level) roads**	0								

ARP	INTERSECTIONS	D Final score Priority D=AxBxC Very low to very high	e ARP In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	Total exfxg Score (Max=12)	Total score (Max=39)	%	Weighted	Single Carriageway Priority ranking based on score INTERSECTIONS ARP
4.6.1	X or Y intersection	18	1	2		0	18	46.15	33.33	LOW
4.6.2	Roundabout		1	1	2	2				
4.6.2.1	Expected Use	27	2	2	2	8	35	89.74	83.33	HIGH
4.6.2.2	Shape and layout (refers to whether it is a traditional t or X or some deviation)	6	1	1	3	3	9	23.08	23.61	LOW
4.6.2.3	Crossing sight distance requirements	18	2	2	3	12	30	76.92	83.33	HIGH
4.6.2.4	Bicycle facilities	18	1	1	3	3	21	53.85	45.83	MEDIUM
4.6.3	Traffic signals	12	2	2	3	12	24	61.54	72.22	HIGH
4.6.4	Grade separation	18	2	2	3	12	30	76.92	83.33	HIGH

7.3.4 Prioritizing ratings for interurban dual carriageway roads – African Union Directive

Rating team: João Cardoso; Carlos Roque. Country: Burkina Faso Guidelines assessed: *Avant-projet Accord intergouvernemental pour l'harmonisation des normes et standards sur le réseau autoroutier transafricain. Union Africaine.*

	BASIC ASSUMPTIONS	D Final score Priority D=AxBxC Very low to very high D=AxBxC (Max=27)	e AU In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	h Total h=exfxg Score (Max=12)	Total score D+h (Max=39)	%	Weighted	Dual Carriageways Priority ranking based on score BASIC ASSUMPTIONS AU
1.1	**General approach**									
1.1.1	Design speed approach	27	1	2	3	6	33	84.62	75.00	HIGH
1.1.2	Speed limit approach	18	2	2	3	12	30	76.92	83.33	HIGH
1.1.3	Actual speed approach	18	2	2	3	12	30	76.92	83.33	HIGH
1.2	**Reaction time**	18	2	2	3	12	30	76.92	83.33	HIGH
1.3	**Eye position and object position**									
1.3.1	Eye height	12	2	2	3	12	24	61.54	72.22	HIGH
1.3.2	Lateral eye position	6	2	2	3	12	18	46.15	61.11	MEDIUM
1.3.3	Object height	6	2	2	3	12	18	46.15	61.11	MEDIUM
1.3.4	Lateral object position	6	2	2	3	12	18	46.15	61.11	MEDIUM
1.4	**Friction coefficient**									
1.4.1	Longitudinal friction coefficient	18	2	2	3	12	30	76.92	83.33	HIGH
1.4.2	Side friction coefficient	18	2	2	3	12	30	76.92	83.33	HIGH
1.5	**Vehicle deceleration and acceleration**									
1.5.1	Deceleration	18	2	2	3	12	30	76.92	83.33	HIGH
1.5.2	Acceleration	8	2	2	3	12	20	51.28	64.81	MEDIUM
1.6	**Action distances**									
1.6.1	Stopping distance	18	2	2	3	12	30	76.92	83.33	HIGH
1.6.2	Overtaking distance									
1.7	**Sight distance**									
1.7.1	Stopping sight distance	27	2	2	3	12	39	100.0	100.00	TOP
1.7.2	Meeting sight distance									
1.7.3	Overtaking sight distance									
1.7.4	Abort overtaking sight distance									
1.7.5	Crossing sight distance	8	2	2	3	12	20	51.28	64.81	MEDIUM
1.8	**Design vehicle characteristics**	27	2	2	3	12	39	100.0	100.00	TOP

	BASIC ASSUMPTIONS	D Final score Priority D=AxBxC Very low to very high D=AxBxC (Max=27)	e AU In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	h Total h=exfxg Score (Max=12)	Total score D+h (Max=39)	%	Weighted	Dual Carriageways Priority ranking based on score BASIC ASSUMPTIONS AU
1.9	**Clearances**									
1.9.1	Dimensions	18	2	2	3	12	30	76.92	83.33	HIGH
1.9.2	Swept path	18	2	2	3	12	30	76.92	83.33	HIGH
1.9.3	Overhead and lateral clearances	18	2	2	3	12	30	76.92	83.33	HIGH
1.9.4	Safety distances	18	2	2	3	12	30	76.92	83.33	HIGH
1.9.5	Dynamic lateral clearance	18	2	2	3	12	30	76.92	83.33	HIGH
1.10	**Road image (Rhol=2to7*RBol)**	4	2	2	3	12	16	41.03	57.41	MEDIUM
1.11	**Recommendations for mitigating barrier effect impacts.**	18	2	2	3	12	30	76.92	83.33	HIGH
Annex	**Road lighting**	6	2	2	3	12	18	46.15	61.11	MEDIUM

	ALIGNMENT	D Final score Priority D=AxBxC Very low to very high	e AU In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	Total exfxg Score (Max=12)	Total score (Max=39)	%	Weighted	Dual Carriageways Priority ranking based on score ALIGNMENT AU
2.2	**Horizontal alignment**									
2.2.1	Principles	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.2.2	Straight sections and large radius curves	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.2.3	Curves									
2.2.3.1	Radii not recommended	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.2.3.2	Super elevation	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.2.3.3	Minimum radius	27	1	2	3	6	33	84.62	75.00	HIGH
2.2.4	Rules for linking alignment elements									
2.2.4.1	Curve following a straight section	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.2.4.2	Compatibility of two successive curves	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.2.4.3	Transition curves	27	1	2	3	6	33	84.62	75.00	HIGH
2.2.4.4	Internal defects of a bend	18				0	18	46.15	33.33	LOW
2.2.4.5	Design consistency	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.2.5	Project planning to improve existing roads	6	1	2	3	6	12	30.77	36.11	LOW
2.3	**Vertical alignment**									
2.3.1	Gradient	27	1	2	3	6	33	84.62	75.00	HIGH
2.3.2	Vertical connecting curves									
2.3.2.1	Convex curves	27	1	2	3	6	33	84.62	75.00	HIGH
2.3.2.2	Concave curves	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.3.3	Climbing lanes									
2.3.3.1	Passing/Climbing lanes (old 3.2.4)	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.3.3.2	Auxiliary (climbing or passing) lane suppression: type and length of drop	18	2	2	3	12	30	76.92	83.33	HIGH
2.3.4	Improvement of existing roads	6	1	2	3	6	12	30.77	36.11	LOW
2.3.5	Emergency escape ramps									
2.3.5.1	Warrants and spacing	18	2	2	3	12	30	76.92	83.33	HIGH
2.3.5.2	Type and length	27	2	2	3	12	39	100.0	100.00	TOP

	ALIGNMENT	D Final score Priority D=AxBxC Very low to very high	e AU In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	Total exfxg Score (Max=12)	Total score (Max=39)	%	Weighted	Dual Carriageways Priority ranking based on score ALIGNMENT AU
2.3.5.3	Stop areas for brake checking	2	2	2	3	12	14	35.90	53.70	MEDIUM
2.4	**Coordination of horizontal and vertical alignments**	6	1	2	3	6	12	30.77	36.11	LOW

	CROSS-SECTION	D Final score Priority D=AxBxC Very low to very high	e AU In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	Total exfxg Score (Max=12)	Total score (Max=39)	%	Weighted	Dual Carriageways Priority ranking based on score CROSS-SECTION AU
3.1.1	Relationship curve radius / superlevation / speed	9	1	2	3	6	15	38.46	41.67	MEDIUM
3.1.2	Superelevation (transition type / length)	4	1	2	3	6	10	25.64	32.41	LOW
3.1.3	Integrated design	6	1	2	3	6	12	30.77	36.11	LOW
3.2	**Main carriageway**									
3.2.1	Road Width	18	1	2	3	6	24	61.54	58.33	MEDIUM
3.2.2	Running lanes									
3.2.2.1	Lane width vs. design speed	18	1	2	3	6	24	61.54	58.33	MEDIUM
3.2.3	Crossfall	6	1	2	3	6	12	30.77	36.11	LOW
3.2.4	Hard shoulders	12	1	2	3	6	18	46.15	47.22	MEDIUM
3.2.4.1	Outside shoulder width suitable for emergency lane	27	2	2	3	12	39	100.0	100.00	TOP
3.2.5	Inner shoulder	12	2	2	3	12	24	61.54	72.22	HIGH
3.2.6	Central reservation	6	1	2	3	6	12	30.77	36.11	LOW
3.2.7	Median separation	18	1	2	3	6	24	61.54	58.33	MEDIUM
3.2.8	Turnouts, safety zones	6	1	2	3	6	12	30.77	36.11	LOW
3.2.9	Surfacing	18	1	2	3	6	24	61.54	58.33	MEDIUM
3.2.10	Road markings	12	1	2	3	6	18	46.15	47.22	MEDIUM
3.3	**Roadside**									
3.3.1	Obstacle-free zones	18	1	2	3	6	24	61.54	58.33	MEDIUM
3.3.2	Type of Obstacle	12	1	2	3	6	18	46.15	47.22	MEDIUM
3.3.3	Soft shoulders	12	2	2	2	8	20	51.28	55.56	MEDIUM
3.3.4	Slopes	12	1	2	3	6	18	46.15	47.22	MEDIUM
3.3.5	Drainage channels	18	1	2	3	6	24	61.54	58.33	MEDIUM
3.4	**Auxiliary lanes (e.g. bus lanes)**	18	1	2	3	6	24	61.54	58.33	MEDIUM
3.5	**Recommended cross-sections**	18	1	2	3	6	24	61.54	58.33	MEDIUM
3.6	**Access control**	27	1	2	3	6	33	84.62	75.00	HIGH
3.7	**Tunnels**	9	2	2	3	12	21	53.85	66.67	MEDIUM
3.8	**Secondary lanes**									
3.8.1	General	18	2	2	3	12	30	76.92	83.33	HIGH
3.8.2	Frontage roads	18	1	2	3	6	24	61.54	58.33	MEDIUM
3.8.3	Rest and service areas	4	2	2	3	12	16	41.03	57.41	MEDIUM

	INTERCHANGE	D Final score Priority D=AxBxC Very low to very high	e AU In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	Total exfxg Score (Max=12)	Total score (Max=39)	%	Weighted	Dual Carriageways Priority ranking based on score INTERCHANGE AU
4.1	**Interchange and Ramp Spacing**									
4.1.1	Minimum value for spacing distance?	8	2	2	3	12	20	51.28	64.81	MEDIUM
4.1.2	Minimum value for distance between successive entrances and exits?	8	2	2	3	12	20	51.28	64.81	MEDIUM
4.2	**Approach Alignment to Interchange**									
4.2.1	Maximum absolute value for the grade of the freeway through the interchange area	8	2	2	3	12	20	51.28	64.81	MEDIUM
4.2.2	Minimum value for horizontal curvature throughout the interchange area	18	2	2	3	12	30	76.92	83.33	HIGH
4.2.3	Sight distance requirement in advance of each exit (desirably decision sight distance)	18	2	2	3	12	30	76.92	83.33	HIGH
4.3	**Interchange Configurations**									
4.3.1	Differentiation between “service interchange” (between motorway and other road) and “system interchange” (between motorways)	12	1	2	3	6	18	46.15	47.22	MEDIUM
4.3.1.1	An appropriate array of interchange configurations and variations must be evaluated in the design study phase	12	1	2	3	6	18	46.15	47.22	MEDIUM
4.3.2	Interchange configuration appropriate for the operational needs, fits the topography and potential site conditions and constraints,	8	1	2	3	6	14	35.90	39.81	LOW
4.3.2.1	Requirements for consistency in exit pattern with other nearby interchanges	12	2	2	3	12	24	61.54	72.22	HIGH
4.3.3	Requirement for completeness of directional traffic movements provision	8	2	2	3	12	20	51.28	64.81	MEDIUM

	INTERCHANGE	D Final score Priority D=AxBxC Very low to very high	e AU In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	Total exfxg Score (Max=12)	Total score (Max=39)	%	Weighted	Dual Carriageways Priority ranking based on score INTERCHANGE AU
4.3.4	Mandatory installation of all exits and entrances on the right side of the freeway mainline?	12	2	2	3	12	24	61.54	72.22	HIGH
4.3.5	Provisions for weaving section design?	12	2	2	3	12	24	61.54	72.22	HIGH
4.3.5.1	Distance between the physical merge and exit nose?	4	2	2	3	12	16	41.03	57.41	MEDIUM
4.3.6	Location of crossroad in the interchange	4	2	2	3	12	16	41.03	57.41	MEDIUM
4.3.6.1	Over the freeway	4	1	2	3	6	10	25.64	32.41	LOW
4.3.7	Route Continuity									
4.3.7.1	Priority route is the through facility	12	2	2	3	12	24	61.54	72.22	HIGH
4.4	**Ramp Design**									
4.4.1	Design speed of the ramp ≥50% of the mainline design speed	4	2	2	3	12	16	41.03	57.41	MEDIUM
4.4.2	Length for acceleration at entrance ramps	18	1	2	3	6	24	61.54	58.33	MEDIUM
4.4.3	Length for deceleration at exit ramps?	18	1	2	3	6	24	61.54	58.33	MEDIUM
4.4.4	Balanced number of exit and entrance?	8	2	2	3	12	20	51.28	64.81	MEDIUM
4.5	**Crossroad Design**									
4.5.1	Sidewalks and bicyclist facilities provided along the interchange crossroad.	12	2	2	3	12	24	61.54	72.22	HIGH
4.5.1.1	Traffic control at the crossings at interchange ramps (Y or N)	12	2	2	3	12	24	61.54	72.22	HIGH
4.5.2	Length of access control along the crossroad beyond the interchange, to ensure its integrity	12	2	2	3	12	24	61.54	72.22	HIGH
4.5.3	Land development and access management measures are in place for the interchange area (Y or N)	12	2	2	3	12	24	61.54	72.22	HIGH
4.5.4	Design criteria for ramp/crossroad intersection					0				

	INTERCHANGE	D Final score Priority D=AxBxC Very low to very high	e AU In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	Total exfxg Score (Max=12)	Total score (Max=39)	%	Weighted	Dual Carriageways Priority ranking based on score INTERCHANGE AU
4.5.4.1	Turning radii for design vehicle	9	2	2	3	12	21	53.85	66.67	MEDIUM
4.5.4.2	Capacity	12	2	2	3	12	24	61.54	72.22	HIGH
4.5.4.3	Traffic control	12	2	2	3	12	24	61.54	72.22	HIGH
4.5.4.4	Channelization	12	2	2	3	12	24	61.54	72.22	HIGH
4.5.4.5	Intersection sight distance	27	2	2	3	12	39	100.0	100.00	TOP

7.3.5 Prioritizing ratings for interurban dual carriageway roads – UEMOA regulation

Rating team: João Cardoso; Carlos Roque. Country: Burkina Faso Guidelines assessed: *Règlement N°08/2009/CM/, on the adoption of the status of the UEMOA community road network, and corresponding management procedures*.

	BASIC ASSUMPTIONS	D Final score Priority D=AxBxC Very low to very high D=AxBxC (Max=27)	e UEMOA In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	h Total h=exfxg Score (Max=12)	Total score D+h (Max=39)	%	Weighted	Dual Carriageways Priority ranking based on score BASIC ASSUMPTIONS UEMOA
1.1	**General approach**									
1.1.1	Design speed approach	27	1	2	3	6	33	84.62	75.00	HIGH
1.1.2	Speed limit approach	18	2	2	3	6	24	61.54	58.33	MEDIUM
1.1.3	Actual speed approach	18	2	2	3	12	30	76.92	83.33	HIGH
1.2	**Reaction time**	18	2	2	3	12	30	76.92	83.33	HIGH
1.3	**Eye position and object position**									
1.3.1	Eye height	12	2	2	3	12	24	61.54	72.22	HIGH
1.3.2	Lateral eye position	6	2	2	3	12	18	46.15	61.11	MEDIUM
1.3.3	Object height	6	2	2	3	12	18	46.15	61.11	MEDIUM
1.3.4	Lateral object position	6	2	2	3	12	18	46.15	61.11	MEDIUM
1.4	**Friction coefficient**									
1.4.1	Longitudinal friction coefficient	18	2	2	3	12	30	76.92	83.33	HIGH
1.4.2	Side friction coefficient	18	2	2	3	12	30	76.92	83.33	HIGH
1.5	**Vehicle deceleration and acceleration**									
1.5.1	Deceleration	18	2	2	3	12	30	76.92	83.33	HIGH
1.5.2	Acceleration	8	2	2	3	12	20	51.28	64.81	MEDIUM
1.6	**Action distances**									
1.6.1	Stopping distance	18	2	2	3	12	30	76.92	83.33	HIGH
1.6.2	Overtaking distance									
1.7	**Sight distance**									
1.7.1	Stopping sight distance	27	2	2	3	12	39	100.0	100.00	TOP
1.7.2	Meeting sight distance									
1.7.3	Overtaking sight distance									
1.7.4	Abort overtaking sight distance									
1.7.5	Crossing sight distance	8	1	2	3	6	14	35.90	39.81	LOW
1.8	**Design vehicle characteristics**	27	2	2	3	12	39	100.0	100.00	TOP

	BASIC ASSUMPTIONS	D Final score Priority D=AxBxC Very low to very high D=AxBxC (Max=27)	e UEMOA In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	h Total h=exfxg Score (Max=12)	Total score D+h (Max=39)	%	Weighted	Dual Carriageways Priority ranking based on score BASIC ASSUMPTIONS UEMOA
1.9	**Clearances**									
1.9.1	Dimensions	18	2	2	3	12	30	76.92	83.33	HIGH
1.9.2	Swept path	18	2	2	3	12	30	76.92	83.33	HIGH
1.9.3	Overhead and lateral clearances	18	2	2	3	12	30	76.92	83.33	HIGH
1.9.4	Safety distances	18	1	2	3	6	24	61.54	58.33	MEDIUM
1.9.5	Dynamic lateral clearance	18	2	2	3	12	30	76.92	83.33	HIGH
1.10	**Road image (Rhol=2to7*RBol)**	4	2	2	3	12	16	41.03	57.41	MEDIUM
1.11	**Recommendations for mitigating barrier effect impacts.**	18	2	2	3	12	30	76.92	83.33	HIGH
Annex	**Road lighting**	6	1	2	3	6	12	30.77	36.11	LOW

	ALIGNMENT	D Final score Priority D=AxBxC Very low to very high	e UEMOA In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	Total exfxg Score (Max=12)	Total score (Max=39)	%	Weighted	Dual Carriageways Priority ranking based on score ALIGNMENT UEMOA
2.2	**Horizontal alignment**									
2.2.1	Principles	18	2	2	3	12	30	76.92	83.33	HIGH
2.2.2	Straight sections and large radius curves	18	2	2	3	12	30	76.92	83.33	HIGH
2.2.3	Curves									
2.2.3.1	Radii not recommended	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.2.3.2	Super elevation	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.2.3.3	Minimum radius	27	1	2	3	6	33	84.62	75.00	HIGH
2.2.4	Rules for linking alignment elements									
2.2.4.1	Curve following a straight section	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.2.4.2	Compatibility of two successive curves	18	1	2	2	4	22	56.41	50.00	MEDIUM
2.2.4.3	Transition curves	27	1	2	3	6	33	84.62	75.00	HIGH
2.2.4.4	Internal defects of a bend	18	2	2	3	12	30	76.92	83.33	HIGH
2.2.4.5	Design consistency	18	2	2	3	12	30	76.92	83.33	HIGH
2.2.5	Project planning to improve existing roads	6	2	2	3	12	18	46.15	61.11	MEDIUM
2.3	**Vertical alignment**									
2.3.1	Gradient	27	1	2	3	6	33	84.62	75.00	HIGH
2.3.2	Vertical connecting curves									
2.3.2.1	Convex curves	27	1	2	3	6	33	84.62	75.00	HIGH
2.3.2.2	Concave curves	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.3.3	Climbing lanes		2	2	3	12	12	30.77	50.00	MEDIUM
2.3.3.1	Passing/Climbing lanes (old 3.2.4)	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.3.3.2	Auxiliary (climbing or passing) lane suppression: type and length of drop	18	2	2	3	12	30	76.92	83.33	HIGH
2.3.4	Improvement of existing roads	6	2	2	3	12	18	46.15	61.11	MEDIUM
2.3.5	Emergency escape ramps									
2.3.5.1	Warrants and spacing	18	2	2	3	12	30	76.92	83.33	HIGH
2.3.5.2	Type and length	27	2	2	3	12	39	100.0	100.00	TOP

	ALIGNMENT	D Final score Priority D=AxBxC Very low to very high	e UEMOA In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	Total exfxg Score (Max=12)	Total score (Max=39)	%	Weighted	Dual Carriageways Priority ranking based on score ALIGNMENT UEMOA
2.3.5.3	Stop areas for brake checking	2	2	2	3	12	14	35.90	53.70	MEDIUM
2.4	**Coordination of horizontal and vertical alignments**	6	1	2	3	6	12	30.77	36.11	LOW

	CROSS-SECTION	D Final score Priority D=AxBxC Very low to very high	e UEMOA In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	Total exfxg Score (Max=12)	Total score (Max=39)	%	Weighted	Dual Carriageways Priority ranking based on score CROSS-SECTION UEMOA
3.1.1	Relationship curve radius / superlevation / speed	9	2	2	3	12	21	53.85	66.67	MEDIUM
3.1.2	Superelevation (transition type / length)	4	1	2	3	6	10	25.64	32.41	LOW
3.1.3	Integrated design	6	1	2	3	6	12	30.77	36.11	LOW
3.2	**Main carriageway**									
3.2.1	Road Width	18	1	2	3	6	24	61.54	58.33	MEDIUM
3.2.2	Running lanes				3					
3.2.2.1	Lane width vs. design speed	18	2	2	3	12	30	76.92	83.33	HIGH
3.2.3	Crossfall	6	2	2	3	12	18	46.15	61.11	MEDIUM
3.2.4	Hard shoulders	12	1	1	2	2	14	35.90	30.56	LOW
3.2.4.1	Outside shoulder width suitable for emergency lane	27	2	2	3	12	39	100.0	100.00	TOP
3.2.5	Inner shoulder	12	2	2	3	12	24	61.54	72.22	HIGH
3.2.6	Central reservation	6	2	2	3	12	18	46.15	61.11	MEDIUM
3.2.7	Median separation	18	1	1	2	2	20	51.28	41.67	MEDIUM
3.2.8	Turnouts, safety zones	6	1	1	2	2	8	20.51	19.44	LOW
3.2.9	Surfacing	18	1	2	3	6	24	61.54	58.33	MEDIUM
3.2.10	Road markings	12	1	2	3	6	18	46.15	47.22	MEDIUM
3.3	**Roadside**									
3.3.1	Obstacle-free zones	18	2	2	3	12	30	76.92	83.33	HIGH
3.3.2	Type of Obstacle	12	2	2	3	12	24	61.54	72.22	HIGH
3.3.3	Soft shoulders	12	2	2	3	12	24	61.54	72.22	HIGH
3.3.4	Slopes	12	1	2	3	6	18	46.15	47.22	MEDIUM
3.3.5	Drainage channels	18	2	2	3	12	30	76.92	83.33	HIGH
3.4	**Auxiliary lanes (e.g. bus lanes)**	18	2	2	3	12	30	76.92	83.33	HIGH
3.5	**Recommended cross-sections**	18	2	2	3	12	30	76.92	83.33	HIGH
3.6	**Access control**	27	2	2	3	12	39	100.0	100.00	TOP
3.7	**Tunnels**	9	2	2	3	12	21	53.85	66.67	MEDIUM
3.8	**Secondary lanes**									
3.8.1	General	18	1	2	3	6	24	61.54	58.33	MEDIUM
3.8.2	Frontage roads	18	1	2	3	6	24	61.54	58.33	MEDIUM
3.8.3	Rest and service areas	4	1	2	3	6	10	25.64	32.41	LOW

	INTERCHANGE	D Final score Priority D=AxBxC Very low to very high	e UEMOA In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	Total exfxg Score (Max=12)	Total score (Max=39)	%	Weighted	Dual Carriageways Priority ranking based on score INTERCHANGE UEMOA
4.1	**Interchange and Ramp Spacing**									
4.1.1	Minimum value for spacing distance?	8	2	2	3	12	20	51.28	64.81	MEDIUM
4.1.2	Minimum value for distance between successive entrances and exits?	8	2	2	3	12	20	51.28	64.81	MEDIUM
4.2	**Approach Alignment to Interchange**									
4.2.1	Maximum absolute value for the grade of the freeway through the interchange area	8	2	2	3	12	20	51.28	64.81	MEDIUM
4.2.2	Minimum value for horizontal curvature throughout the interchange area	18	2	2	3	12	30	76.92	83.33	HIGH
4.2.3	Sight distance requirement in advance of each exit (desirably decision sight distance)	18	1	2	3	6	24	61.54	58.33	MEDIUM
4.3	**Interchange Configurations**									
4.3.1	Differentiation between "service interchange" (between motorway and other road) and "system interchange" (between motorways)	12	1	2	3	6	18	46.15	47.22	MEDIUM
4.3.1.1	An appropriate array of interchange configurations and variations must be evaluated in the design study phase	12	2	2	3	12	24	61.54	72.22	HIGH
4.3.2	Interchange configuration appropriate for the operational needs, fits the topography and potential site conditions and constraints,	8	2	2	3	12	20	51.28	64.81	MEDIUM
4.3.2.1	Requirements for consistency in exit pattern with other nearby interchanges	12	2	2	3	12	24	61.54	72.22	HIGH
4.3.3	Requirement for completeness of directional traffic movements provision	8	2	2	3	12	20	51.28	64.81	MEDIUM

	INTERCHANGE	D Final score Priority D=AxBxC Very low to very high	e UEMOA In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	Total exfxg Score (Max=12)	Total score (Max=39)	%	Weighted	Dual Carriageways Priority ranking based on score INTERCHANGE UEMOA
4.3.4	Mandatory installation of all exits and entrances on the right side of the freeway mainline?	12	2	2	3	12	24	61.54	72.22	HIGH
4.3.5	Provisions for weaving section design?	12	2	2	3	12	24	61.54	72.22	HIGH
4.3.5.1	Distance between the physical merge and exit nose?	4	2			0	4	10.26	7.41	LOW
4.3.6	Location of crossroad in the interchange	4	2	2	3	12	16	41.03	57.41	MEDIUM
4.3.6.1	Over the freeway	4	2	2	3	12	16	41.03	57.41	MEDIUM
4.3.7	Route Continuity									
4.3.7.1	Priority route is the through facility	12	2	2	3	12	24	61.54	72.22	HIGH
4.4	**Ramp Design**									
4.4.1	Design speed of the ramp ≥50% of the mainline design speed	4	2	2	3	12	16	41.03	57.41	MEDIUM
4.4.2	Length for acceleration at entrance ramps	18	1	2	3	6	24	61.54	58.33	MEDIUM
4.4.3	Length for deceleration at exit ramps?	18	1	2	3	6	24	61.54	58.33	MEDIUM
4.4.4	Balanced number of exit and entrance?	8	2	2	3	12	20	51.28	64.81	MEDIUM
4.5	**Crossroad Design**		2	2	3	12	12	30.77	50.00	MEDIUM
4.5.1	Sidewalks and bicyclist facilities provided along the interchange crossroad.	12	1	2	3	6	18	46.15	47.22	MEDIUM
4.5.1.1	Traffic control at the crossings at interchange ramps (Y or N)	12	2	2	3	12	24	61.54	72.22	HIGH
4.5.2	Length of access control along the crossroad beyond the interchange, to ensure its integrity	12	2	2	3	12	24	61.54	72.22	HIGH
4.5.3	Land development and access management measures are in place for the interchange area (Y or N)	12	2	2	3	12	24	61.54	72.22	HIGH
4.5.4	Design criteria for ramp/crossroad intersection									

	INTERCHANGE	D Final score Priority D=AxBxC Very low to very high	e UEMOA In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	Total exfxg Score (Max=12)	Total score (Max=39)	%	Weighted	Dual Carriageways Priority ranking based on score INTERCHANGE UEMOA
4.5.4.1	Turning radii for design vehicle	9	2	2	3	12	21	53.85	66.67	MEDIUM
4.5.4.2	Capacity	12	2	2	3	12	24	61.54	72.22	HIGH
4.5.4.3	Traffic control	12	2	2	3	12	24	61.54	72.22	HIGH
4.5.4.4	Channelization	12	2	2	3	12	24	61.54	72.22	HIGH
4.5.4.5	Intersection sight distance	27	2	2	3	12	39	100.0	100.00	TOP

7.3.6 Prioritizing ratings for interurban dual carriageway roads – French ICTAAL

Rating team: João Cardoso; Carlos Roque. Country: Burkina Faso Guidelines assessed: *ICTAAL - Instruction sur les conditions techniques d'aménagement des autoroutes de liaison; SETRA, France.*

	BASIC ASSUMPTIONS	D Final score Priority D=AxBxC Very low to very high D=AxBxC (Max=27)	e ICTAAL In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	h Total h=exfxg Score (Max=12)	Total score D+h (Max=39)	%	Weighted	Dual Carriageways Priority ranking based on score BASIC ASSUMPTIONS ICTAAL
1.1	**General approach**									
1.1.1	Design speed approach	27	1	2	3	6	33	84.62	75.00	HIGH
1.1.2	Speed limit approach	18	1	2	3	6	24	61.54	58.33	MEDIUM
1.1.3	Actual speed approach	18	1	2	3	12	30	76.92	83.33	HIGH
1.2	**Reaction time**	18	1	2	3	12	30	76.92	83.33	HIGH
1.3	**Eye position and object position**									
1.3.1	Eye height	12	1	2	3	12	24	61.54	72.22	HIGH
1.3.2	Lateral eye position	6	1	2	3	12	18	46.15	61.11	MEDIUM
1.3.3	Object height	6	1	2	3	12	18	46.15	61.11	MEDIUM
1.3.4	Lateral object position	6	1	2	3	12	18	46.15	61.11	MEDIUM
1.4	**Friction coefficient**									
1.4.1	Longitudinal friction coefficient	18	2	2	3	12	30	76.92	83.33	HIGH
1.4.2	Side friction coefficient	18	2	2	3	12	30	76.92	83.33	HIGH
1.5	**Vehicle deceleration and acceleration**									
1.5.1	Deceleration	18	1	2	3	12	30	76.92	83.33	HIGH
1.5.2	Acceleration	8	1	2	3	12	20	51.28	64.81	MEDIUM
1.6	**Action distances**									
1.6.1	Stopping distance	18	1	2	3	12	30	76.92	83.33	HIGH
1.6.2	Overtaking distance									
1.7	**Sight distance**									
1.7.1	Stopping sight distance	27	1	2	3	12	39	100.0	100.00	TOP
1.7.2	Meeting sight distance									
1.7.3	Overtaking sight distance									
1.7.4	Abort overtaking sight distance									
1.7.5	Crossing sight distance	8	2	2	3	6	14	35.90	39.81	LOW
1.8	**Design vehicle characteristics**	27	2	2	3	12	39	100.0	100.00	TOP

	BASIC ASSUMPTIONS	D Final score Priority D=AxBxC Very low to very high D=AxBxC (Max=27)	e ICTAAL In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	h Total h=exfxg Score (Max=12)	Total score D+h (Max=39)	%	Weighted	Dual Carriageways Priority ranking based on score BASIC ASSUMPTIONS ICTAAL
1.9	**Clearances**									
1.9.1	Dimensions	18	2	2	3	12	30	76.92	83.33	HIGH
1.9.2	Swept path	18	2	2	3	12	30	76.92	83.33	HIGH
1.9.3	Overhead and lateral clearances	18	2	2	3	12	30	76.92	83.33	HIGH
1.9.4	Safety distances	18	2	2	3	6	24	61.54	58.33	MEDIUM
1.9.5	Dynamic lateral clearance	18	2	2	3	12	30	76.92	83.33	HIGH
1.10	**Road image (Rhol=2to7*RBol)**	4	2	2	3	12	16	41.03	57.41	MEDIUM
1.11	**Recommendations for mitigating barrier effect impacts.**	18	1	2	3	6	24	61.54	58.33	MEDIUM
Annex	**Road lighting**	6	1	2	3	6	12	30.77	36.11	LOW

	ALIGNMENT	D Final score Priority D=AxBxC Very low to very high	e ICTAAL In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	Total exfxg Score (Max=12)	Total score (Max=39)	%	Weighted	Dual Carriageways Priority ranking based on score ALIGNMENT ICTAAL
2.2	**Horizontal alignment**									
2.2.1	Principles	18	1	1	3	3	21	53.85	45.83	MEDIUM
2.2.2	Straight sections and large radius curves	18	1	1	3	3	21	53.85	45.83	MEDIUM
2.2.3	Curves									
2.2.3.1	Radii not recommended	18	1	1	2	2	20	51.28	41.67	MEDIUM
2.2.3.2	Super elevation	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.2.3.3	Minimum radius	27	1	1	3	3	30	76.92	62.50	MEDIUM
2.2.4	Rules for linking alignment elements					0				
2.2.4.1	Curve following a straight section	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.2.4.2	Compatibility of two successive curves	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.2.4.3	Transition curves	27	1	2	3	6	33	84.62	75.00	HIGH
2.2.4.4	Internal defects of a bend	18	1	1	3	3	21	53.85	45.83	MEDIUM
2.2.4.5	Design consistency	18	2	2	3	12	30	76.92	83.33	HIGH
2.2.5	Project planning to improve existing roads	6	1	1	3	3	9	23.08	23.61	LOW
2.3	**Vertical alignment**									
2.3.1	Gradient	27	1	2	3	6	33	84.62	75.00	HIGH
2.3.2	Vertical connecting curves									
2.3.2.1	Convex curves	27	1	2	3	6	33	84.62	75.00	HIGH
2.3.2.2	Concave curves	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.3.3	Climbing lanes					0	0	0.00	0.00	
2.3.3.1	Passing/Climbing lanes (old 3.2.4)	18	1	2	3	6	24	61.54	58.33	MEDIUM

	ALIGNMENT	D Final score Priority D=AxBxC Very low to very high	e ICTAAL In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	Total exfxg Score (Max=12)	Total score (Max=39)	%	Weighted	Dual Carriageways Priority ranking based on score ALIGNMENT ICTAAL
2.3.3.2	Auxiliary (climbing or passing) lane suppression: type and length of drop	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.3.4	Improvement of existing roads	6	1	2	3	6	12	30.77	36.11	LOW
2.3.5	Emergency escape ramps					0				
2.3.5.1	Warrants and spacing	18	1	2	3	6	24	61.54	58.33	MEDIUM
2.3.5.2	Type and length	27	1	2	3	6	33	84.62	75.00	HIGH
2.3.5.3	Stop areas for brake checking	2	2	2	3	12	14	35.90	53.70	MEDIUM
2.4	**Coordination of horizontal and vertical alignments**	6	1	2	3	6	12	30.77	36.11	LOW

	CROSS-SECTION	D Final score Priority D=AxBxC Very low to very high	e ICTAAL In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	Total exfxg Score (Max=12)	Total score (Max=39)	%	Weighted	Dual Carriageways Priority ranking based on score CROSS-SECTION ICTAAL
3.1.1	Relationship curve radius / superlevation / speed	9	1	2	3	6	15	38.46	41.67	MEDIUM
3.1.2	Superelevation (transition type / length)	4	1	2	3	6	10	25.64	32.41	LOW
3.1.3	Integrated design	6	1	1	3	3	9	23.08	23.61	LOW
3.2	**Main carriageway**									
3.2.1	Road Width	18	1	2	3	6	24	61.54	58.33	MEDIUM
3.2.2	Running lanes									
3.2.2.1	Lane width vs. design speed	18	2	2	3	12	30	76.92	83.33	HIGH
3.2.3	Crossfall	6	1	2	3	6	12	30.77	36.11	LOW
3.2.4	Hard shoulders	12	1	1	2	2	14	35.90	30.56	LOW
3.2.4.1	Outside shoulder width suitable for emergency lane	27	1	2	2	4	31	79.49	66.67	MEDIUM
3.2.5	Inner shoulder	12	1	2	2	4	16	41.03	38.89	LOW
3.2.6	Central reservation	6	1	2	2	4	10	25.64	27.78	LOW
3.2.7	Median separation	18	1	1	3	3	21	53.85	45.83	MEDIUM
3.2.8	Turnouts, safety zones	6	1	2	3	6	12	30.77	36.11	LOW
3.2.9	Surfacing	18	2	2	3	12	30	76.92	83.33	HIGH
3.2.10	Road markings	12	1	2	3	6	18	46.15	47.22	MEDIUM
3.3	**Roadside**									
3.3.1	Obstacle-free zones	18	1	2	3	6	24	61.54	58.33	MEDIUM
3.3.2	Type of Obstacle	12	1	2	3	6	18	46.15	47.22	MEDIUM
3.3.3	Soft shoulders	12	1	2	3	6	18	46.15	47.22	MEDIUM
3.3.4	Slopes	12	1	2	3	6	18	46.15	47.22	MEDIUM
3.3.5	Drainage channels	18	2	2	3	12	30	76.92	83.33	HIGH
3.4	**Auxiliary lanes (e.g. bus lanes)**	18	2	2	3	12	30	76.92	83.33	HIGH
3.5	**Recommended cross-sections**	18	1	2	3	6	24	61.54	58.33	MEDIUM
3.6	**Access control**	27	2	2	3	12	39	100.0	100.00	TOP
3.7	**Tunnels**	9	1	2	3	6	15	38.46	41.67	MEDIUM
3.8	**Secondary lanes**									
3.8.1	General	18	2	2	3	12	30	76.92	83.33	HIGH
3.8.2	Frontage roads	18	2	2	3	12	30	76.92	83.33	HIGH
3.8.3	Rest and service areas	4	1	2	3	6	10	25.64	32.41	LOW

	INTERCHANGE	D Final score Priority D=AxBxC Very low to very high	e ICTAAL In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	Total exfxg Score (Max=12)	Total score (Max=39)	%	Weighted	Dual Carriageways Priority ranking based on score INTERCHANGE ICTAAL
4.1	**Interchange and Ramp Spacing**									
4.1.1	Minimum value for spacing distance?	8	1	2	3	6	14	35.90	39.81	LOW
4.1.2	Minimum value for distance between successive entrances and exits?	8	1	2	3	6	14	35.90	39.81	LOW
4.2	**Approach Alignment to Interchange**									
4.2.1	Maximum absolute value for the grade of the freeway through the interchange area	8	1	2	3	6	14	35.90	39.81	LOW
4.2.2	Minimum value for horizontal curvature throughout the interchange area	18	1	2	3	6	24	61.54	58.33	MEDIUM
4.2.3	Sight distance requirement in advance of each exit (desirably decision sight distance)	18	1	1	3	3	21	53.85	45.83	MEDIUM
4.3	**Interchange Configurations**									
4.3.1	Differentiation between "service interchange" (between motorway and other road) and "system interchange" (between motorways)	12	1	1	3	3	15	38.46	34.72	LOW
4.3.1.1	An appropriate array of interchange configurations and variations must be evaluated in the design study phase	12	1	1	2	2	14	35.90	30.56	LOW
4.3.2	Interchange configuration appropriate for the operational needs, fits the topography and potential site conditions and constraints,	8	1	1	2	2	10	25.64	23.15	LOW
4.3.2.1	Requirements for consistency in exit pattern with other nearby interchanges	12	1	1	3	3	15	38.46	34.72	LOW
4.3.3	Requirement for completeness of directional traffic movements provision	8	1	1	3	3	11	28.21	27.31	LOW

	INTERCHANGE	D Final score Priority D=AxBxC Very low to very high	e ICTAAL In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	Total exfxg Score (Max=12)	Total score (Max=39)	%	Weighted	Dual Carriageways Priority ranking based on score INTERCHANGE ICTAAL
4.3.4	Mandatory installation of all exits and entrances on the right side of the freeway mainline?	12	1	2	3	6	18	46.15	47.22	MEDIUM
4.3.5	Provisions for weaving section design?	12	1	1	3	3	15	38.46	34.72	LOW
4.3.5.1	Distance between the physical merge and exit nose?	4	1	2	3	6	10	25.64	32.41	LOW
4.3.6	Location of crossroad in the interchange	4	2	2	3	12	16	41.03	57.41	MEDIUM
4.3.6.1	Over the freeway	4	2	2	3	12	16	41.03	57.41	MEDIUM
4.3.7	Route Continuity									
4.3.7.1	Priority route is the through facility	12	1	2	3	6				
4.4	**Ramp Design**									
4.4.1	Design speed of the ramp ≥50% of the mainline design speed	4	1	2	3	6	10	25.64	32.41	LOW
4.4.2	Length for acceleration at entrance ramps	18	1	2	3	6	24	61.54	58.33	MEDIUM
4.4.3	Length for deceleration at exit ramps?	18	1	2	3	6	24	61.54	58.33	MEDIUM
4.4.4	Balanced number of exit and entrance?	8	1	2	3	6	14	35.90	39.81	LOW
4.5	**Crossroad Design**									
4.5.1	Sidewalks and bicyclist facilities provided along the interchange crossroad.	12	2	2	3	12	24	61.54	72.22	HIGH
4.5.1.1	Traffic control at the crossings at interchange ramps (Y or N)	12	2	1	2	4	16	41.03	38.89	LOW
4.5.2	Length of access control along the crossroad beyond the interchange, to ensure its integrity	12	2	2	3	12	24	61.54	72.22	HIGH
4.5.3	Land development and access management measures are in place for the interchange area (Y or N)	12	2	2	3	12	24	61.54	72.22	HIGH
4.5.4	Design criteria for ramp/crossroad intersection		2	2	3					

	INTERCHANGE	D Final score Priority D=AxBxC Very low to very high	e ICTAAL In guidelines? Yes=1, No=2	f Safety effect mentioned?, If so, how big Yes=1; No=2	g Are the effects of deviating from the norm on safety mentioned/described No=3; Yes, qualitative=2; Yes, quantitative=1	Total exfxg Score (Max=12)	Total score (Max=39)	%	Weighted	Dual Carriageways Priority ranking based on score INTERCHANGE ICTAAL
4.5.4.1	Turning radii for design vehicle	9	2	2	3	12	21	53.85	66.67	MEDIUM
4.5.4.2	Capacity	12	2	2	3	12	24	61.54	72.22	HIGH
4.5.4.3	Traffic control	12	2	2	3	12	24	61.54	72.22	HIGH
4.5.4.4	Channelization	12	2	2	3	12	24	61.54	72.22	HIGH
4.5.4.5	Intersection sight distance	27	2	2	3	12	39	100.0	100.00	TOP

7.4 Road characteristics by category in Burkina Faso

Routes bitumées :

- *Ouvrage d'art de franchissement calculé pour la crue cinquantenaire et d'assainissement pour la crue décennale avec pour caractéristiques :*
    - *Largeur d'emprise 60 m*
    - *Largeur de plate-forme 10.00 m en raz campagne et 12.00 m en traversée d'agglomération*
    - *Largeur du revêtement 7.00 m en raz campagne et 8.00 m en traversée d'agglomération*
    - *Vitesse de référence 100 km/h*
    - *Rayon minimal 600 m*
    - *Rayon minimal absolu 425 m*
    - *Ce standard peur être réduit à 9.00 m de plate-forme, par des accotements de 1.00 m chacun, dans le cas de réfection de route existante.*

Routes en terre moderne :

- *Ouvrage d'art de franchissement calculé pour la crue cinquantenaire et d'assainissement pour la crue décennale avec pour caractéristiques :*
    - *Largeur d'emprise 60 m*
    - *Largeur de plate-forme 10.60 m en raz campagne et 12.60 m en traversée d'agglomération*
    - *Vitesse de référence 100 km/h*
    - *Rayon minimal 600 m*
    - *Rayon minimal absolu 425 m*
    - *Couche de roulement continue en graveleux latéritiques*
    - *Ce standard permet le bitumage par la réalisation de la couche de base et du revêtement bitumineux sans reprise des terrassements ni des ouvrages.*

Routes en terre ordinaire :

- *Ouvrage d'art et d'assainissement construit avec pour caractéristiques :*
    - *Largeur d'emprise 30 m*
    - *Largeur de chaussée 7,00 m*
    - *Vitesse de référence 80 km/h*
    - *Rayon minimal 300 m*
    - *Couche de roulement continue en graveleux latéritiques*

Pistes améliorées de type A :

- *Ouvrage d'art et d'assainissement principaux avec pour caractéristiques :*
    - *Largeur d'emprise 20 m*
    - *Largeur de chaussée 6,00 m*
    - *Vitesse de référence 80 km/h*

    - *Rayon minimal 300 m*
    - *Couche de roulement en graveleux latéritiques sur plus de 80% de la longueur*
    - *Coupures momentanées*

Pistes améliorées de type B :

- *Ouvrage d'art et d'assainissement principaux construit avec pour caractéristiques :*
    - *Largeur d'emprise 20 m*
    - *Largeur de chaussée 5,00 m*
    - *Vitesse de référence 60 km/h*
    - *Rayon minimal 300 m*
    - *Couche de roulement en graveleux latéritiques limitée aux zones difficiles*
    - *Coupures fréquentes pendant les pluies*

Pistes ordinaires :

- *Piste saisonnière avec pour caractéristiques :*
    - *Largeur d'emprise 15 m*
    - *Largeur de chaussée 5,00 m*
    - *Vitesse de référence 50 Km/h*
    - *Rayon minimal 120 m*
    - *Pas de couche de roulement et pas d'assainissement*