



European Bank
for Reconstruction and Development



**Kazakhstan: Beineu-Bozoy-Saksaulsk Roads:
PROJECT FEASIBILITY ASSESSMENT
PR 017140
Road Safety Audit Report**

October 2026

REPORT ISSUE RECORD

PROJECT NAME	KAZAKHSTAN: BEINEU-BOZOY-SAKSAULSK ROADS – PROJECT FEASIBILITY ASSESSMENT
PROJECT REF	PR 017140
CLIENT	JSC KZAVTOZHOL (KAZ) NC
COUNTRY	KAZAKHSTAN
IFI	EBRD
OFFICER RESPONSIBLE	Harry Karandinos
CONSULTANT	SYSTEMA CONSULTING S.A.
PROJECT MANAGER	Natalia Tselenti
REPORT TITLE	Road Safety Audit Report

Table of Contents

1	Introduction	1
1.1	Project Brief and RSA Objectives.....	1
1.2	Technical Specifications & Scope	2
1.3	Data Collection	14
1.4	Site Visit.....	14
1.5	Items Raised prior to the RSA	15
2	Key Issues Raised in this Road Safety Audit	16
2.1	General Issues	16
2.2	Operating Strategy	19
2.3	Climate and Weather Implications.....	21
2.4	Geometric Design Elements	22
2.5	Gradients	23
2.6	Cross-Sections	23
2.7	Interchanges and Intersections.....	25
2.8	Traffic and Information Signs	29
2.9	Highway Lighting	29
2.10	Roadside Safety Provisions	30
2.11	Provisions for Special Road Users	32
2.12	Provisions for Wildlife Movements.....	32
3	Summary of Problems Identified and Corresponding Recommendations	34
	APPENDIX A – Design Reports and Drawings Provided for Road Safety Audit.....	37

List of Figures

Figure 1 - Examined new road and surrounding area	5
Figure 2- Alignment Plan of the Beineu–Saksausk Road	6
Figure 3 - Examined Road – Sections 1 & 2 in Mangystau region (Beineu District, ~ km 0-125)	7
Figure 4 - Examined Road – Sections 3 - 9 in Aktobe region (Bayganin & Shalkar districts, km ~125 - 370)	8
Figure 5 - Examined Road – Sections 9 – 14 in <i>Kyzylorda region (Aral district, km ~370 -559)</i>	9
Figure 6 - Typical Embankment Configurations (Types 1, 1a, 2, 2a and 3)	10
Figure 7 - Typical road pavement structure	11
Figure 8 - Typical cross-section for technical category IV road (intersected roads)	12
Figure 9 - Typical cross-section for technical category V road (intersected roads)	12
Figure 10 – Typical cattle crossing by overpass	13
Figure 11 – Typical cross-sections of a railway overpass (left) and a bridge (right)	13
Figure 12 - Example of radar speed signs	20
Figure 13 – Example of extended straight alignment	23
Figure 14 - Typical cross-section without emergency lanes provision	24
Figure 15 – Typical overpass cross-section without emergency lanes provision	24
Figure 16: Elevated embankment in a sand area without roadside protection	25
Figure 17 - Grade-separated intersection at the start of the project road	26
Figure 18 – T-junction that leads to a Road Maintenance Unit without channelization for left-turn from the main road	27
Figure 19 – T-junction without channelization for left-turn from the main road (km ~78+600)	27
Figure 20 – Four-leg intersection without channelization (km ~105+400)	27
Figure 21 - Four-leg intersection without channelization (km ~109+850)	28
Figure 22 – Last intersection within the examined section of the project (km 325+500)	28
Figure 23 – Typical overpass requiring verification of roadside safety measures (km 221+100)	31
Figure 24 – Railway overpass requiring verification of barrier transitions and parapets (km 108+550)	31
Figure 25: Wildlife crossing warning signage and 80 km/h speed limit	33

List of Tables

Table 1 - Stage I of construction - Construction of the main road	2
Table 2 - Stage II of construction - Construction of access roads, road maintenance and ITS	3
Table 3 - Design parameters of the new highway	4
Table 4 - Identified utility crossings along the project corridor	17
Table 5 - Problems identified and recommendations	34
Table 6 - Prioritisation of High-Risk Findings	36

Abbreviations and Definitions

AADT	Average Annual Daily Traffic
ADB	Asian Development Bank
BBS	Beineu-Bozoy-Saksaulsk
DBK	Development Bank of Kazakhstan
EBRD	European Bank for Reconstruction and Development
ESIA	Environmental and Social Impact Assessment
ESP	Environmental and Social Policy (EBRD, 2024)
ESR	Environmental and Social Requirement (EBRD, 2024)
HGV	Heavy Goods Vehicle(s)
IBRD	International Bank for Reconstruction and Development
IDF	Intensity–Duration–Frequency
ITS	Intelligent Transportation System(s)
I/C	Interchange
PCU	Passenger Car Unit
RMF	Road Maintenance Facility
RSA	Road Safety Audit
SSD	Stopping Sight Distance
ToR	Terms of Reference
VRS	Vehicle Restraint System(s)

1 Introduction

The **European Bank for Reconstruction and Development** (EBRD) intends to provide financing to **JSC KazAvtoZhol** for the construction of a new high-speed interurban corridor of approximately 560 km between the towns of Beineu, Bozoy and Saksaulsk (BBS) along M-32 highway across three regions, Mangistau Region, Aktobe Region, and Kyzylorda Region. The road will be part of the BBS highway a major infrastructure project with a total length of approximately 736 kilometres, part of the international Europe-Caucasus-Asia (TRACECA) transport corridor, facilitating overland trade between China and Western Europe via Kazakhstan. The new road will have a single carriageway cross-section and a design speed of up to 120 km/h, supplemented by a network of access roads connecting remote settlements and infrastructure facilities.

This report is part of the **Workstream 2: Environmental and Social Impact Assessment** activities, and more specifically, comprises the Road Safety Audit Report for the preparation of the road project's Environmental and Social Impact Assessment (ESIA).

1.1 Project Brief and RSA Objectives

This Report includes an overview of the design and other influencing factors associated with the new road infrastructure relating to road safety. The Road Safety Audit (RSA) team carried out the tasks according to the Terms of Reference (ToR).

The Road Safety Audit has been undertaken with reference to the EBRD Environmental and Social Policy (ESP) 2024, Environmental and Social Requirement 4 (ESR4) – Health, Safety and Security, and the associated ESR4 Guidance Note (November 2025), together with the applicable national design standards and relevant international road safety good practice. In accordance with the ESR4 Guidance Note, particular consideration has been given to road safety risks affecting road users and project-affected communities, including vulnerable road users, intersection safety, speed management, emergency response, driver fatigue, wildlife movements and natural and climate-related hazards.

The audit comprised an examination of the drawings and other information relating to the scheme supplied by JSC KazAvtoZhol. Appendix A describes the drawings and other information examined within this road safety audit. The audit team did not liaise with police, maintenance personnel or other stakeholders (except for JSC KazAvtoZhol) at this stage of the road safety audit given the preliminary design stage and the predominantly greenfield nature of the Project, with no existing road infrastructure along most of the proposed alignment. Initial feedback from the relevant regional Police and Maintenance Departments was nevertheless available through the local Feasibility Study (ТЭО) whereby Public Consultations were also undertaken.

All of the problems described in this report are considered to require action in order to improve the safety of the scheme and minimize accident occurrence and severity. Each problem within the report is given a **severity** rating. The severity rating is applied based on the auditor's assessment of the collision type and expected operating speed should a collision occur. There are 3 severity ratings used within the report. These are high, medium and low:

- **High** – Risk of fatal or serious injury
- **Medium** – Risk of moderate injury and significant collision damage
- **Low** – Low collision damage and negligible injury.

1.2 Technical Specifications & Scope

The project comprises a total planned road network of 799.67 km, implemented across two major construction stages. The works include the development of a new interregional highway, associated access roads, and supporting operational infrastructure. The following subsections summarise the technical characteristics relevant to the Road Safety Audit.

Stage I: Main Road Construction (559 km)

Stage I covers the construction of the main highway corridor, classified as a Technical Category II Road. The total length of this section is 559.166 km, divided into 14 construction lots distributed across three regions:

- **Lots 1–3 (km 0 to km 125)**
125 km within the Beineu district, Mangystau region
Type of works: New construction
- **Lots 4–6 (km 125 to km 246)**
121 km within the Baiganinsky district, Aktobe region
Type of works: New construction
- **Lots 7–9 (km 246 to km 370)**
124 km within the Shalkar district, Aktobe region
Type of works: New construction
- **Lots 10–14 (km 370 to km 559+166)**
189.166 km within the Aral district, Kyzylorda region
Type of works: New construction

Table 1 - Stage I of construction - Construction of the main road

Lot number	Start, km+	End, km +	Length, km	Type of work	Location/ area	IFI/ Scope
1	0+000	40+000	40.00	new construction	Mangystau region, Beineu district 125 km (km 0-125)	EBRD [160.00 km]
2	40+000	80+000	40.00	new construction		
3	80+000	125+000	45.00	new construction		
4	125+000	160+000	35.00	new construction	Aktobe region, Baiganinsky district, 121 km (km 125-246)	IBRD [126.00 km]
5	160+000	200+000	40.00	new construction		
6	200+000	246+000	46.00	new construction	Aktobe region, Shalkar district 124 km (km 246-370)	ADB [124.00 km]
7	246+000	286+000	40.00	new construction		
8	286+000	326+000	40.00	new construction		
9	326+000	370+000	44.00	new construction	Kyzylorda region, Aral district 189 km (km 370-559)	DBK [149.17 km]
10	370+000	410+000	40.00	new construction		
11	410+000	450+000	40.00	new construction		
12	450+000	490+000	40.00	new construction		
13	490+000	530+000	40.00	new construction		
14	530+000	559+166	29.166	new construction		
Total			559.166			

It is noted that only **Lots 1–7 (km 0–286)**, falling under EBRD and IBRD financing, are within the scope of this Road Safety Audit Report.

Stage II: Access Roads & Other Infrastructure

Stage II includes secondary infrastructure and 240.5 km of access roads connecting local municipalities to the main corridor. This stage is divided into three lots:

- Lot 1 – Intelligent Transportation System (ITS): Installation of 6 intermediate control toll gates (APK) distributed along the route (km 1+720, km 125, km 229, km 333, km 439, km 558).
- Lot 2 – Road Maintenance Facilities (RMF): Construction of 3 new maintenance facilities (in Turysh, Bozoy, and Akespe villages) and major repairs on 1 existing facility in Shalkar city.
- Lot 3 – Access Roads:
 - Shalkar access road (Bozoy-Shalkar): 206 km of new building/major renovation under Technical Category IV.
 - Saksaulsk village access road: 33 km of repairs under Technical Category IV.
 - Turysh village access road: 1.5 km of new construction under Technical Category V.

Three toll gates, one RMF, and 1.5 km of access roads serving Turysh village will be financed by EBRD and IBRD, and these elements are included within the scope of this RSA.

Table 2 - Stage II of construction - Construction of access roads, road maintenance and ITS

Lot number	Start, km +	End, km +	Length, km	Type of work	Location/ area	IFI/ Scope
Lot 1 - Construction - ITS arches of intermediate control (toll gates)						
1	km 1+720		-	new construction	Mangystau region, Beineu district	EBRD
1	km 125+000		-	new construction		
1	km 229+000		-	new construction	Aktobe region, Baiganinsky district	IBRD
1	km 333+000		-	new construction	Aktobe region, Shalkar district	ADB
1	km 439+920		-	new construction	Kyzylorda region, Aral district	DBK
1	km 558+000		-	new construction		
Lot 2 - Construction/major repairs of Road Maintenance Facilities (RMF)						
2	-	village of Turysh	-	new construction	Mangystau region, Beineu district	EBRD
2	-	village of Bozoy	-	new construction	Aktobe region, Shalkar district	ADB
2	-	Shalkar city	-	Major repairs		
2	-	village of Akespe	-	new construction	Kyzylorda region, Aral district	DBK
Lot 3 - Access roads to populated areas						
Access road to the town of Shalkar, Bozoy-Shalkar, technical category IV						ADB
3	0+000	206+000	206	new construction/ major renovation	Aktobe region, Shalkar district	
Access road to the village of Saksaulsk, technical category IV						DBK
3	0+000	33+000	33	repair	Kyzylorda region, Aral district	
Access road to the village of Turysh, technical category V						EBRD
3	0+000	1+500	1.5	new construction	Mangystau region, Beineu district	
Total			240.5			

Main construction and design characteristics

The new road will have one lane per direction and according to the existing design documentation, the following key features are foreseen:

1. 11 bridges
2. 1 overpass at interchanges
3. 1 interchange (type "Trumpet")
4. 3 railway overpasses

5. 6 agricultural machinery overpasses
6. 18 cattle crossings (underpasses, bridge-type)
7. 92 culverts

The table below presents the design parameters adopted for the Beineu–Saksayulsk main road. All values reflect the standards applicable to a Category II highway and the parameters incorporated into the approved Feasibility Study (ТЭО).

Table 3 - Design parameters of the new highway

Parameter	Values adopted in the Feasibility Study (Beineu–Saksayulsk Road)
Road category	Category II
Total road length, km	559.166
Forecast traffic volume for year 2046 (vehicles/day)	5,842
Forecast traffic volume for year 2046 (PCU/day)	13,626
Heavy Goods Vehicles (%)	40-45
Design speed, km/h	120
Number of traffic lanes	2
Lane width, m	3.75
Shoulder width, m	3.75
Carriageway width, m	$3.75 \times 2 = 7.50$
Pavement structure width, m	9.0
Formation width (earthwork), m	15.0
Carriageway crossfall, ‰	15
Maximum longitudinal gradient, ‰	40
Minimum sight distance, m — stopping	250
Minimum sight distance, m — opposing vehicle	450
Minimum horizontal curve radius, m	800
Minimum crest vertical curve radius, m	15,000
Minimum sag vertical curve radius, m	5,000
Embankment height for snowfall protection, m	2.1
Side slope gradient for embankments up to 3 m	1:4
Side slope gradient for embankments above 3 m	1:1.5
Surface	Non-rigid type, polymer-modified

In the following figures, the road site location and typical cross sections are shown.

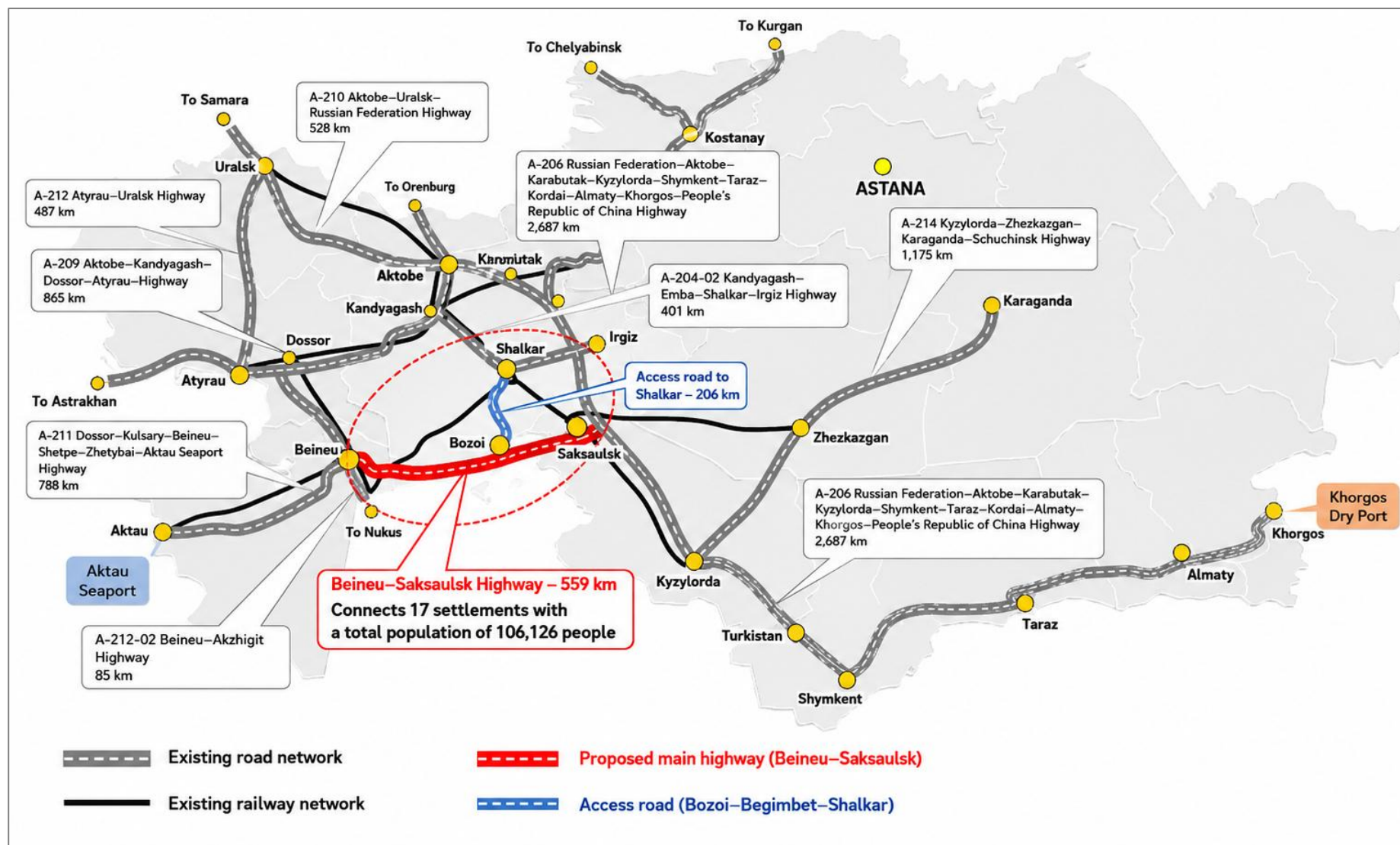


Figure 1 - Examined new road and surrounding area

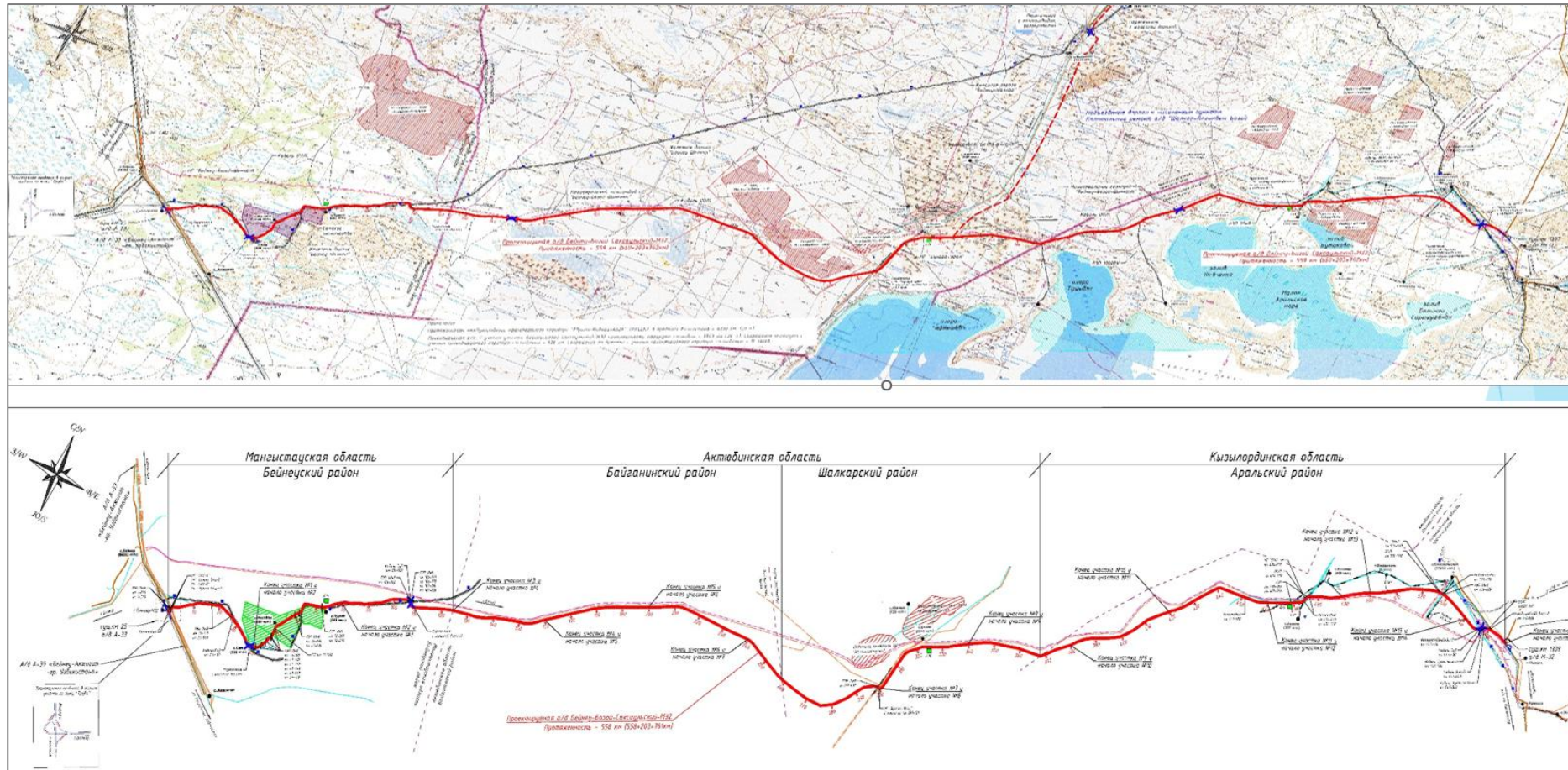


Figure 2- Alignment Plan of the Beineu-Saksaulsk Road

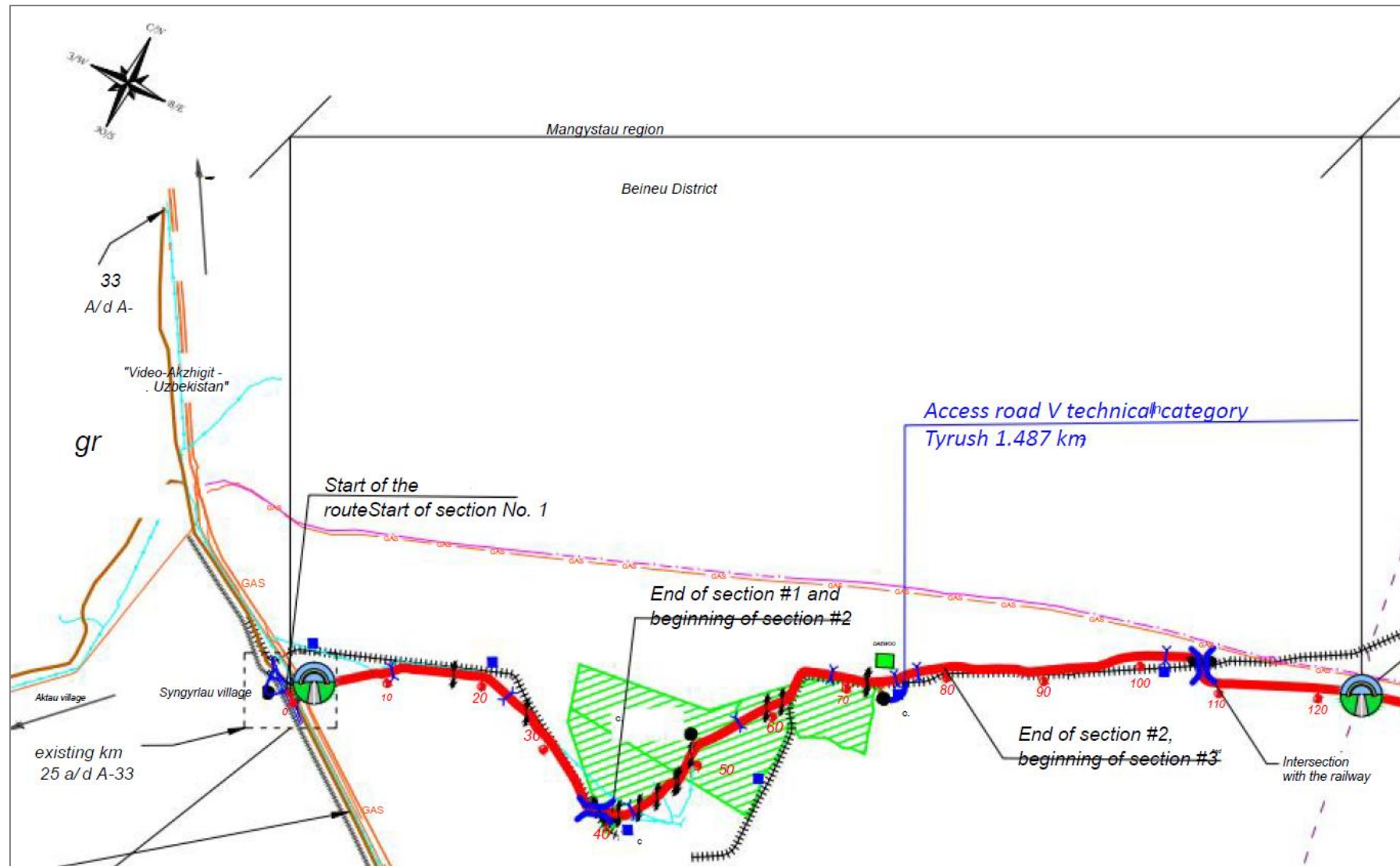


Figure 3 - Examined Road – Sections 1 & 2 in Mangystau region (Beineu District, ~ km 0-125)

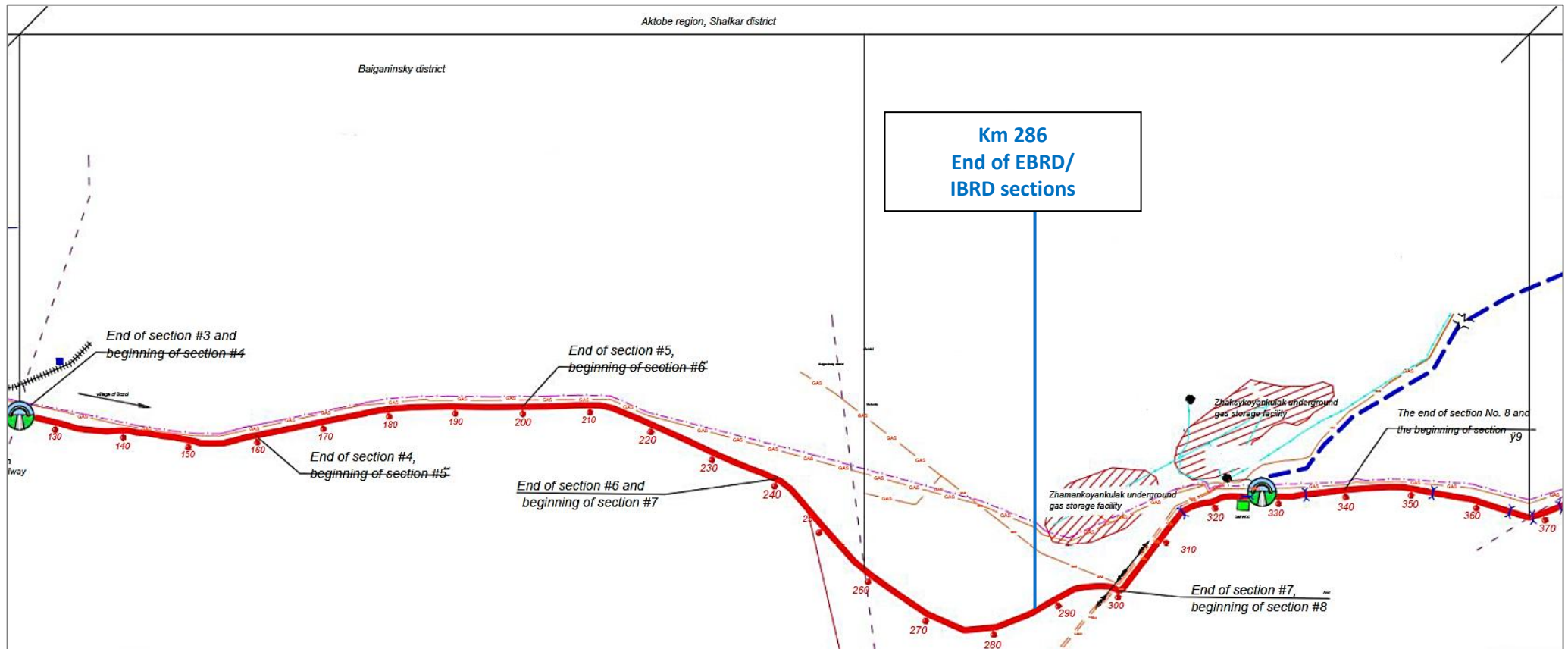


Figure 4 - Examined Road – Sections 3 - 9 in Aktope region (Bayganin & Shalkar districts, km ~125 - 370)

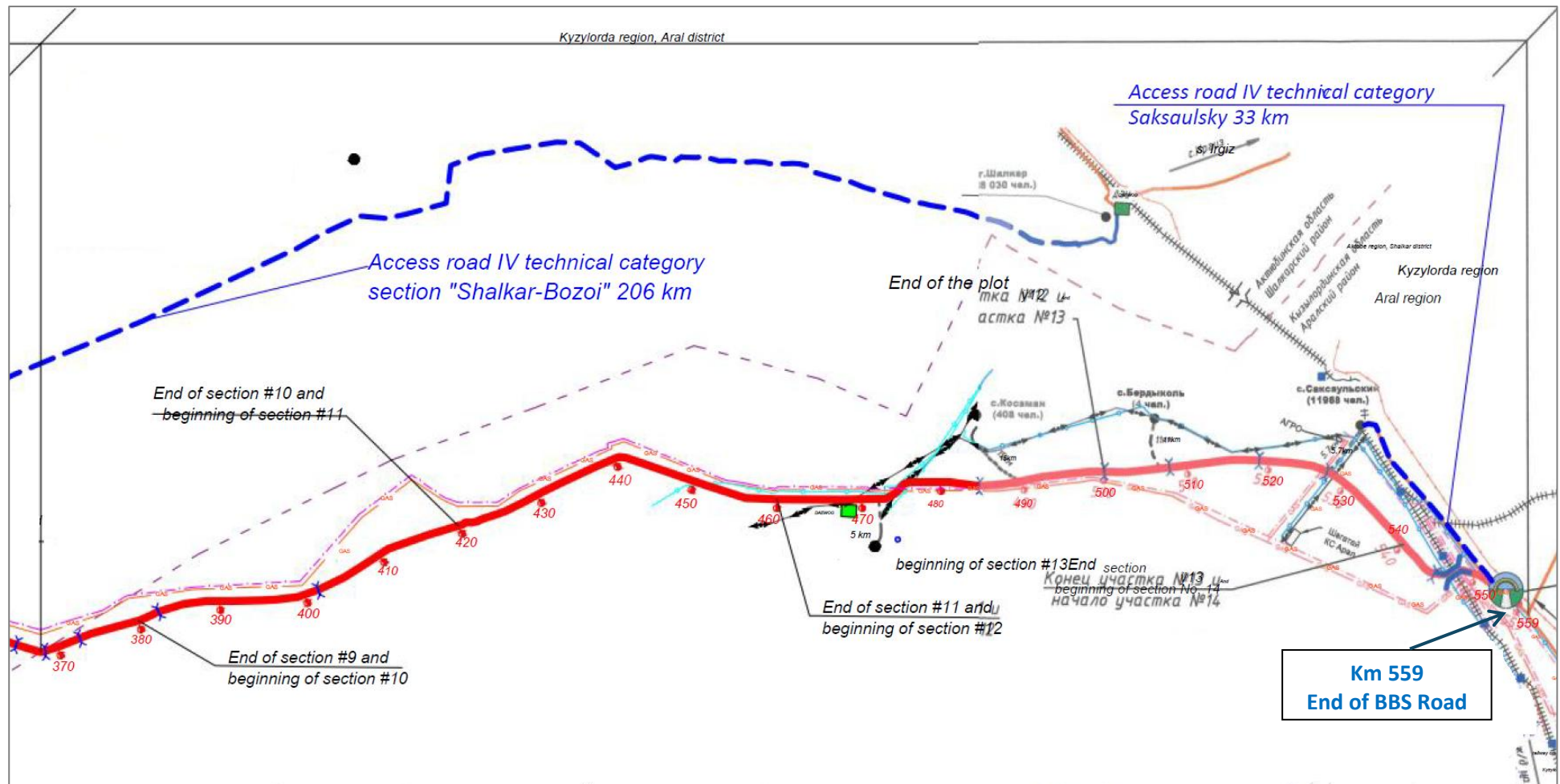
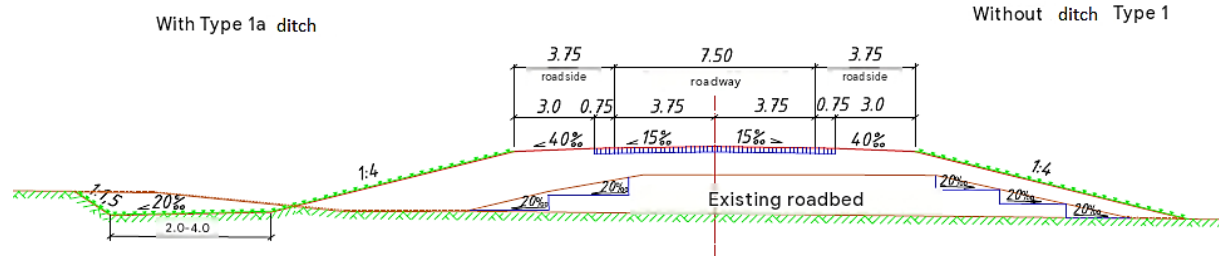
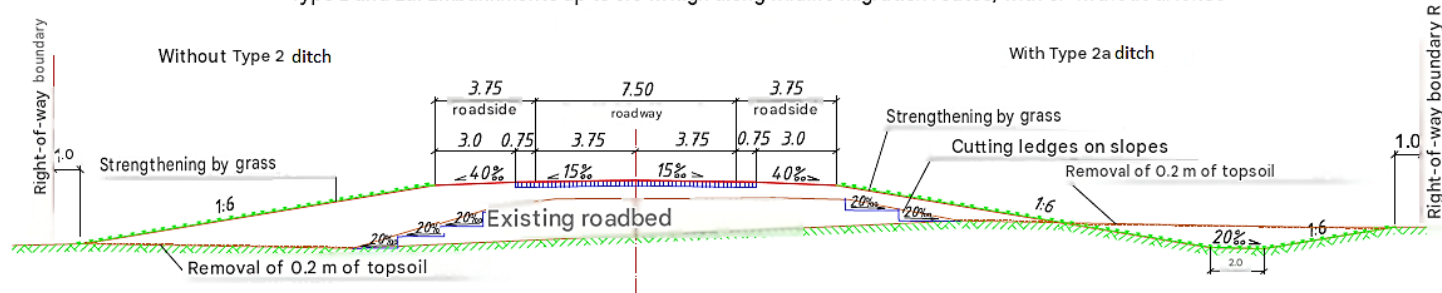


Figure 5 - Examined Road – Sections 9 – 14 in Kyzylorda region (Aral district, km ~370 -559)

Type 1 and 1a. Embankment up to 3.0 m high when widening an existing road with or without ditches



Type 2 and 2a. Embankments up to 3.0 m high along wildlife migration routes, with or without ditches



Type 3. Embankment height from 3.0 m to 6.0 m

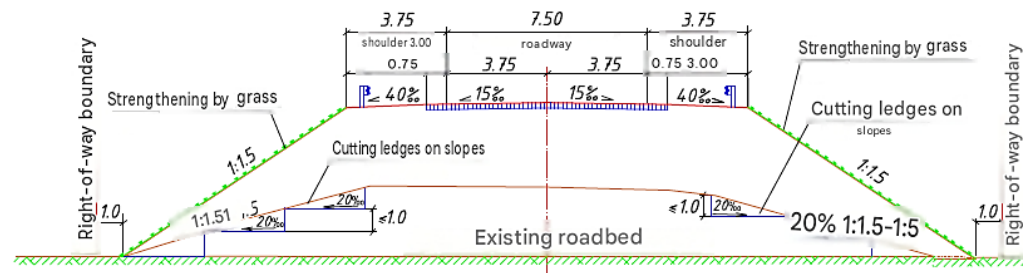


Figure 6 - Typical Embankment Configurations (Types 1, 1a, 2, 2a and 3)

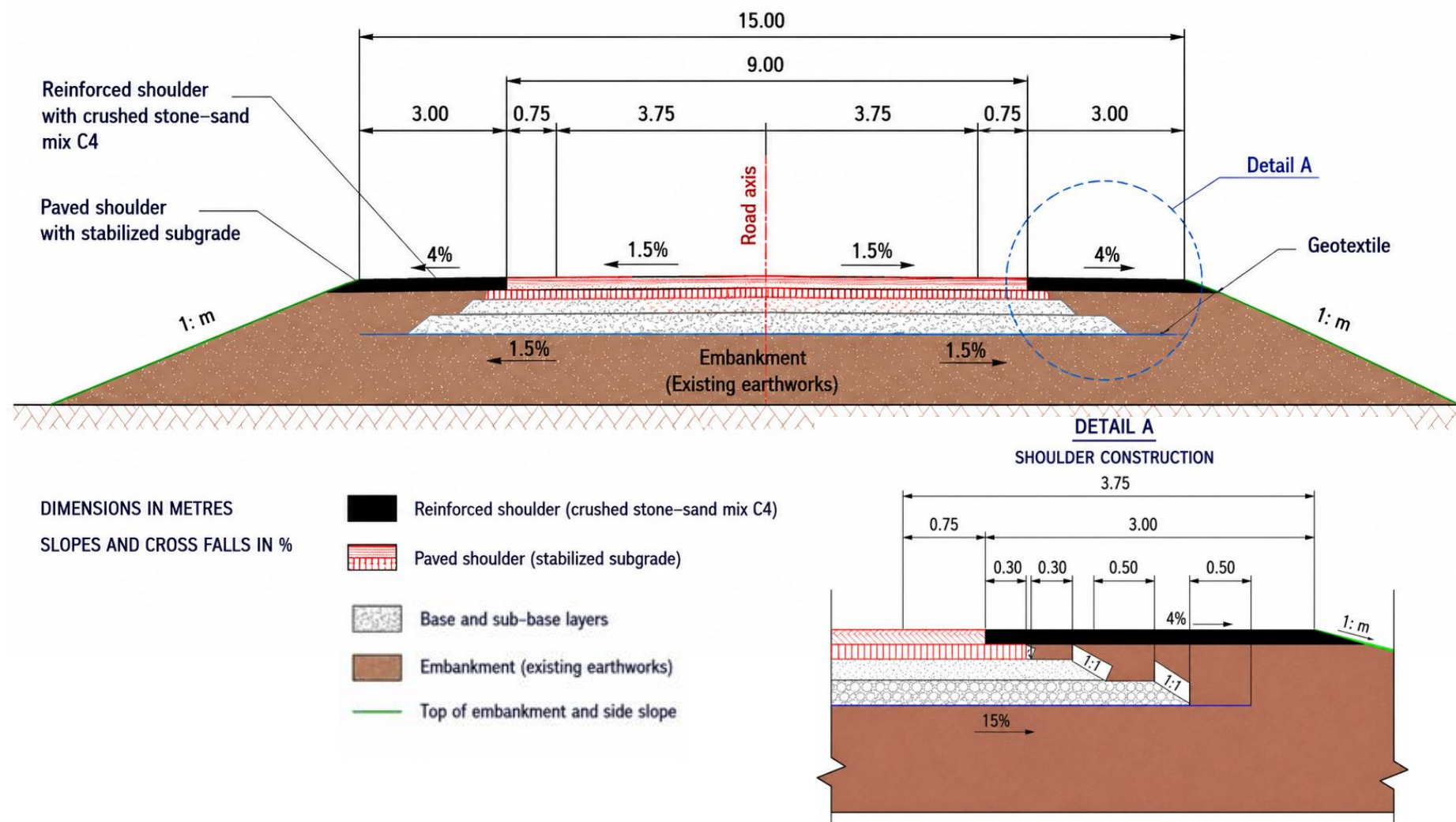


Figure 7 - Typical road pavement structure

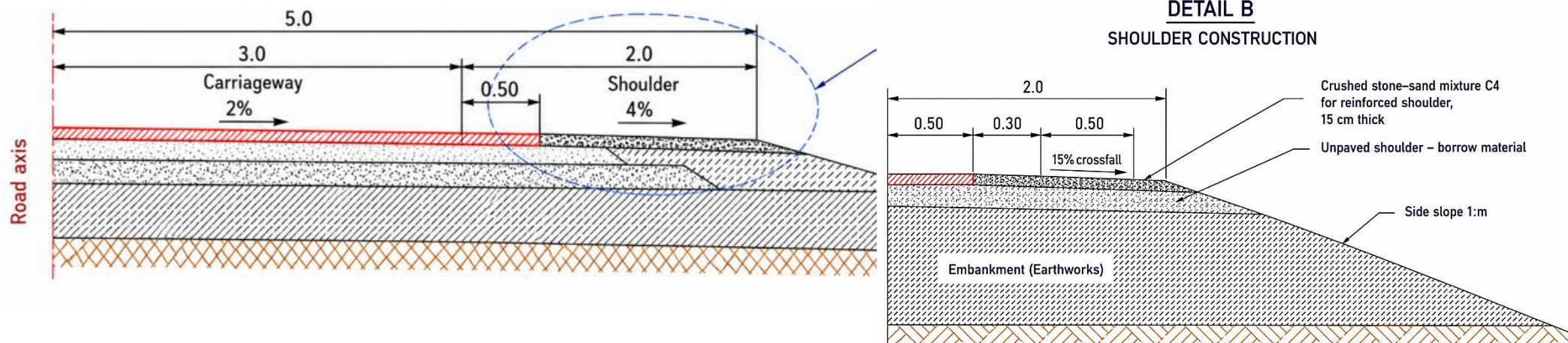


Figure 8 - Typical cross-section for technical category IV road (intersected roads)

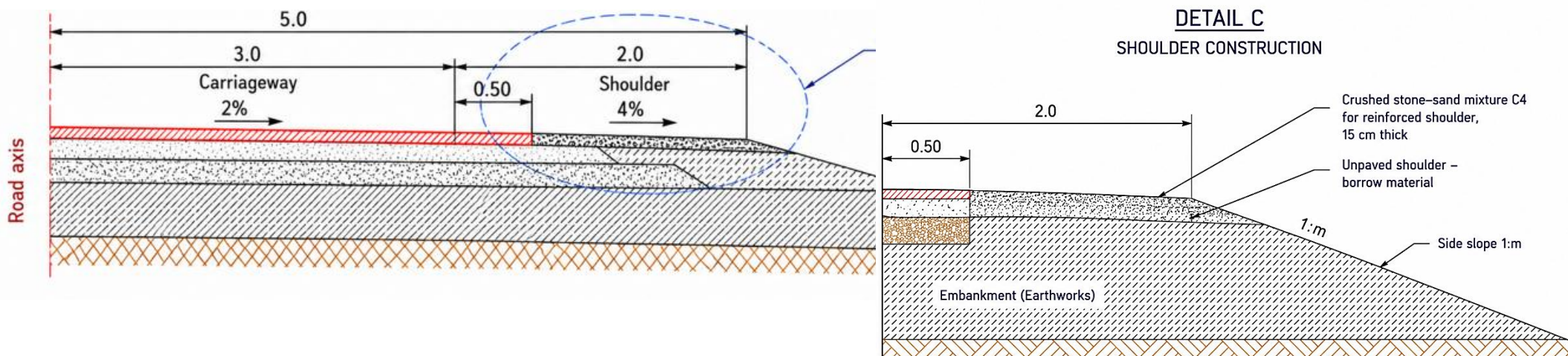


Figure 9 - Typical cross-section for technical category V road (intersected roads)

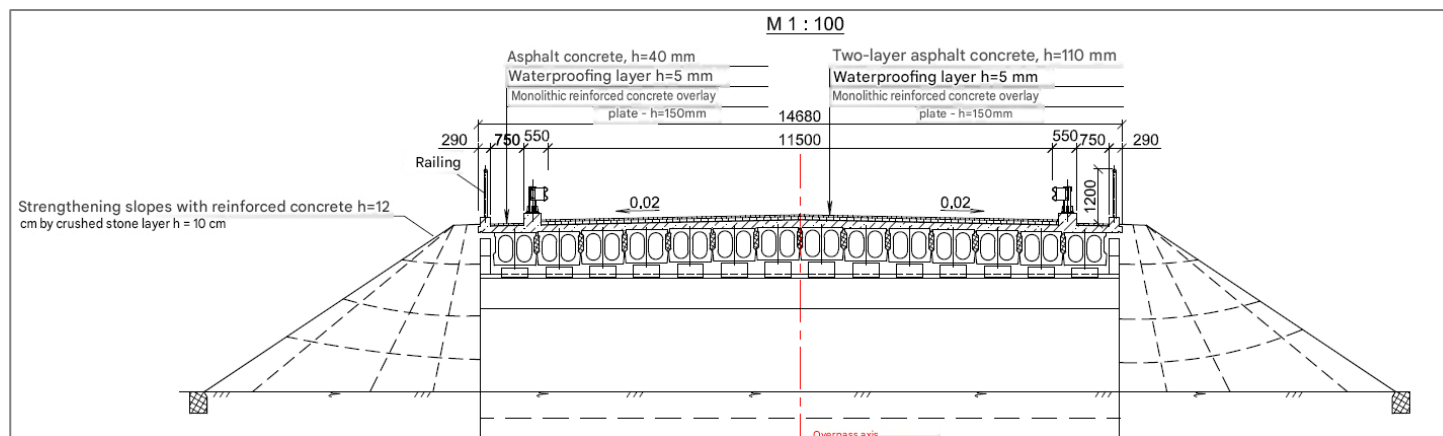


Figure 10 – Typical cattle crossing by overpass

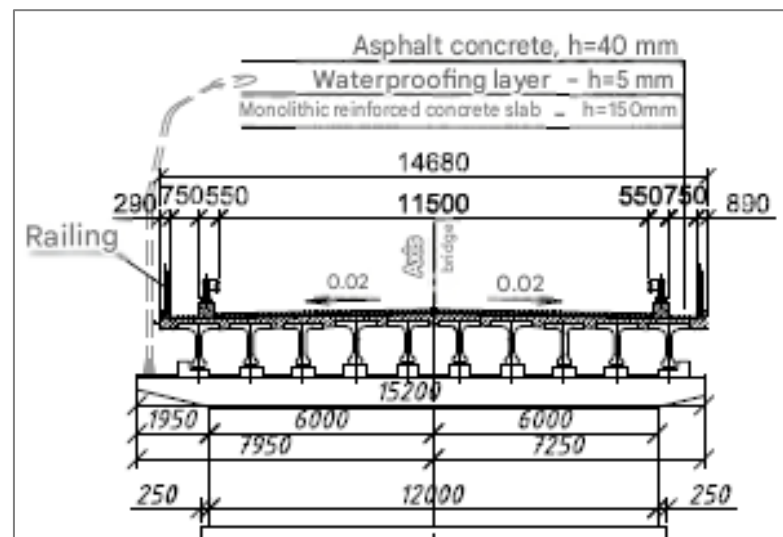
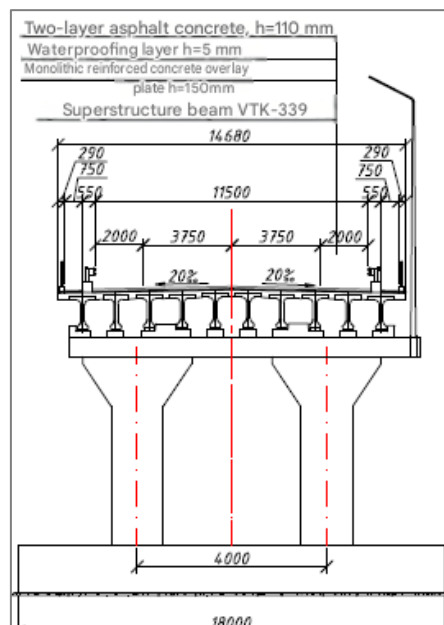


Figure 11 – Typical cross-sections of a railway overpass (left) and a bridge (right)

1.3 Data Collection

The following data are typical of the items which are required and examined as part of a “Stage 1” Preliminary Road Safety Audit:

- Audit report and decisions on earlier stage audits
- Project area plan showing road network and general topographic details in the region of the project
- Statement of the design criteria
- Relevant traffic demand information
- Horizontal and vertical alignment plans
- Cross-sections
- Grading and drainage plans showing the location and general details of drainage structures
- Bridge layout plans including cross-sections and details of barrier systems
- Interchange and/or intersection layouts
- Traffic signal layouts and design information
- Traffic signing and road marking plans
- Street lighting layouts and design information
- Landscaping and beautification plans and tree planting details
- Plans showing relevant overhead services/utilities
- Minutes of public hearings.

The Road Safety Audit team reviewed all available documentation relevant to the preliminary design of the Beineu–Bozoy–Saksaulsk (BBS) Highway Project. The purpose of this review was to understand the design intent, identify potential safety issues at an early stage, and ensure that the Project aligns with international best practice and the requirements of the European Bank for Reconstruction and Development (EBRD).

Consideration was also given to the potential road-safety and mobility needs of communities located near the proposed alignment, including pedestrian access and movements near settlements and other activity areas (minutes of public hearings).

The files (reports and drawings) provided to the RSA Team by the Beneficiary originate from the project’s Feasibility Study and are listed in **Appendix A**. It is noted that no prior Road Safety Audits were provided.

Furthermore, the RSA was conducted with reference to the following standards and guidelines:

- **EU Directive 2008/96/EC** on Road Infrastructure Safety Management.
- **GG119 (2019)** – Road Safety Audit Guidelines.
- **EBRD Environmental and Social Policy 2024: Health, Safety and Security**, including the associated **ESR4 Guidance Note** (November 2025).
- **Kazakh national road design standards** for Category II, III, and IV roads.
- **EBRD Terms of Reference** for the BBS Highway Project (2025).

These documents formed the basis for evaluating the adequacy of the preliminary design from a safety perspective.

1.4 Site Visit

Given that the Project comprises predominantly the construction of a new highway along a largely undeveloped corridor, there is no existing road infrastructure along most of the examined alignment to be inspected. In addition, given the remote location of the corridor and the early stage of the Project,

no physical on-site inspection was conducted by the RSA Team at this stage. Instead, a desktop-based assessment was undertaken using satellite imagery, topographic information, hydrological datasets, and available environmental studies. This approach is consistent with international RSA practice for preliminary design audits in areas where physical access is limited or where the design has not yet progressed to a stage requiring field verification.

In addition, local collaborators provided contextual information on existing conditions that may influence the future road's safety performance, including terrain constraints, visibility limitations, drainage patterns, wildlife movement, and other potential hazards that may not be fully captured in the preliminary design documentation.

The main issues regarding the site of the project, as noted by the RSA team, are the following:

- Flat to gently undulating topography, with occasional dune formations.
- Sparse vegetation, dominated by low shrubs and desert grasses.
- Long distances without settlements, services, or emergency support facilities, contributing to operational and emergency-response challenges.
- Extreme climatic conditions, including high summer temperatures, winter freezing, and frequent strong winds.
- Historic migration routes of the Ustyurt Saiga antelope crossing the proposed corridor.
- Barriers created by the Shalkar–Beineu railway, which have already disrupted animal movement.
- Open desert terrain, offering no natural guidance for wildlife movement and increasing the likelihood of animal–vehicle conflicts.

These observations provide essential context for understanding the environmental and operational constraints of the corridor and support the identification of safety issues presented in the following chapter (2. Key Issues Raised in this Road Safety Audit).

1.5 Items Raised prior to the RSA

No information was provided to the RSA Team regarding any road safety assessments that may have been undertaken during earlier design stages.

In accordance with the EBRD ESR4 Guidance Note, the present Road Safety Audit represents the preliminary design-stage assessment. Further road safety reviews should be undertaken during the detailed design, pre-opening and early operational stages to verify that the recommendations identified at this stage have been appropriately addressed and to identify any additional safety risks arising from subsequent design development and actual road operation.

Construction-phase traffic management measures are outside the scope of this Road Safety Audit and should be addressed through the project Traffic Management Plan during subsequent construction planning and implementation stages.

2 Key Issues Raised in this Road Safety Audit

This chapter presents the road safety issues identified during the Stage 1 Road Safety Audit of the Beineu–Bozoy–Saksaulsk (BBS) Highway. The issues have been grouped into thematic categories consistent with international RSA practice. Each issue describes the potential hazard, the likely safety impact, and the road users affected. The issues identified at this stage are based on the preliminary design documentation delivered to RSA team, satellite-based corridor assessment, environmental datasets, and the contextual information provided in the Terms of Reference.

It should be noted that the present Road Safety Audit has been undertaken at the Feasibility Study stage of a “Design & Build” project. As such, detailed designs for elements such as traffic signs, road markings, lighting, road restraint systems, and other roadside infrastructure are not yet available for review. Consequently, a number of the recommendations contained in this report are intended to highlight safety-related aspects that should be addressed and verified during the subsequent stages of design development. These recommendations should be understood as road safety warnings and prompts for further consideration, with the objective of ensuring that the final design incorporates the appropriate measures and complies with the applicable standards, regulations, and road safety principles.

The key issues raised during the Road Safety Audit of the available technical design have been discussed and reviewed by JSC KazAvtoZhol, while specific matters (such as the speed limit strategy, speed management and signing) will be further examined and addressed during the Detailed Design, where the optimal solutions will be provided.

2.1 General Issues

2.1.1 Problem: Lack of speed limit strategy

Location: Entire length of the road
Ranking: Medium
Summary: Risk of vehicles travelling at high speeds.

The preliminary design does not include a defined speed management strategy or any posted speed limits, despite the presence of long, straight sections that naturally encourage drivers to reach high speeds. Without clear regulatory guidance, the risk of excessive speed increases significantly, particularly in areas approaching curves, junctions, or access points, leading to a higher likelihood of severe collisions.

Recommendation

A comprehensive speed management approach should be incorporated into the detailed design, including the placement of speed limit signs at appropriate intervals along both directions of travel and specifically before and after intersections, curves, and other critical locations to ensure consistent driver compliance and reduce speed-related crash risk.

2.1.2 Problem: High proportion of heavy goods vehicles

Location: Entire length of the road
Ranking: High
Summary: Risk of speed differentials, rear-end collisions and overtaking conflicts.

The projected traffic volume for the design year (2046) is approximately 13,600 PCU/day, with heavy goods vehicles (HGVs) comprising approximately 40–45% of the traffic stream. This high proportion of

HGVs is expected to influence traffic operations throughout the corridor by increasing speed differentials, reducing overtaking opportunities and contributing to vehicle platooning.

Recommendation

During the detailed design, verify that the highway layout and operational strategy adequately accommodate the forecast heavy vehicle composition. Particular attention should be given to overtaking opportunities, the potential need for auxiliary lanes, intersection layouts, rest areas, emergency stopping facilities, and other measures intended to reduce speed differentials and minimise conflicts between heavy and light vehicles. Sight-distance requirements should also be verified, particularly at intersections and other critical locations, taking into account the high proportion of heavy vehicles and the braking performance of HGVs under the relevant road and operating conditions. Additionally, consider the implementation of a speed management strategy for heavy goods vehicles, including differential speed limits where appropriate, to reduce speed differentials between light and heavy vehicles, improve traffic flow stability, and minimise the risk of overtaking and rear-end collisions.

2.1.3 Problem: Numerous utility crossings

Location: Various locations

Ranking: Low

Summary: Risk of secondary collisions and roadside hazards following utility failures or maintenance activities.

The preliminary design indicates numerous crossings of the proposed highway by overhead electricity transmission lines, telecommunication lines and underground gas pipelines. Although utility crossings are common, their design and protection should ensure that they do not create roadside hazards or compromise the safe operation of the highway during normal operation, maintenance activities or following accidental damage or infrastructure failure. Particular attention should be given to the location of utility supports, crossing arrangements and access requirements to minimise risks to road users.

Recommendation

During the detailed design stage, verify that all utility crossings comply with the applicable national standards and utility authority requirements. Overhead utility crossings should provide adequate vertical and lateral clearances, while underground services should be designed and protected to avoid conflicts with the highway infrastructure. Utility support structures should, wherever practicable, be located outside the clear zone or protected by appropriate roadside safety measures where required.

Table 4 - Identified utility crossings along the project corridor

Approx. Chainage	Utility Type
~0+250 - 1+300	Overhead powerlines, water pipelines and telecommunication lines
~2+500 - 2+600	Gas pipelines
~2+920 - +3+160	Gas pipelines, overhead powerlines and telecommunication line
~18+130	Overhead powerline
~28+340	Overhead powerline
~39+650 - 39+700	Gas pipelines, overhead powerlines and telecommunication line
~42+700	Overhead powerline
~45+210	Overhead powerline
~47+180	Overhead powerline
~48+820	Overhead powerline
~49+420	Overhead powerline

Approx. Chainage	Utility Type
~52+640	Overhead powerline
~52+880	Water pipelines
~53+840	Gas pipeline
~60+200	Gas pipeline
~61+380	Overhead powerline
~64+190	Gas pipeline
~64+300	Overhead powerline
~73+730	Overhead powerline
~74+750	Overhead powerline
~108+470 - 108+600	Overhead powerlines and telecommunication line
~300+600 – 300+750	Gas pipelines and overhead powerline

2.1.4 Problem: Protection of communities adjacent to the highway

Location: Various locations

Ranking: Medium

Summary: Risk of conflicts between highway traffic and local community movements.

The proposed highway passes in close proximity to three villages. Although direct access may be controlled, nearby settlements can generate pedestrian movements, agricultural traffic, local vehicles and occasional animal crossings. Without appropriate access management, roadside protection and measures to discourage unauthorised access, there is an increased risk of conflicts between high-speed through traffic and local road users.

Recommendation

During the detailed design, review all sections adjacent to settlements to ensure that appropriate measures are provided to protect nearby communities. Particular attention should be given to access management, roadside fencing where appropriate, pedestrian and livestock crossing facilities (where required), local road connections, and clear signing and delineation to minimise interactions between local and through traffic.

2.1.5 Problem: No provision for overtaking opportunities

Location: Entire length of the road

Ranking: High

Summary: Risk of head-on collisions while overtaking.

The proposed highway is a single-carriageway road with one lane in each direction, a design speed of 120 km/h and a forecast heavy vehicle composition. In the absence of physical separation between opposing traffic streams, limited overtaking opportunities may result in extended following of slower-moving heavy vehicles and increased driver pressure to overtake, potentially increasing the risk of unsafe overtaking manoeuvres and head-on collisions.

Recommendation

During the detailed design, undertake an assessment to determine the need for additional overtaking opportunities, including overtaking/passing lanes or 2+1 sections, at appropriate locations and intervals, and if necessary to justify the assessment. The assessment should take into account forecast traffic volumes and directional distribution, heavy vehicle composition, available terrain and gradients, available sight distance, expected vehicle speeds and platooning, and the applicable national design

requirements. Where warranted, appropriate overtaking facilities should be incorporated to provide safe opportunities for passing slower-moving vehicles and reduce the potential for unsafe overtaking manoeuvres and head-on collisions.

2.2 Operating Strategy

2.2.1 Problem: Long distances to emergency services

Location: Entire length of the road

Ranking: High

Summary: Increased fatality risk due to delayed response times.

The proposed corridor passes through remote desert terrain with no nearby settlements, medical services, or emergency response facilities, meaning that collisions, breakdowns, or medical incidents may go unreported for extended periods. Limited mobile network coverage further increases the likelihood of delayed detection, significantly raising the risk of severe or fatal outcomes, especially in run-off-road crashes or wildlife collisions.

Recommendation

Install a continuous system of SOS emergency communication points or satellite-based beacons at regular intervals (e.g. a dedicated emergency telephone number), supported by clear signage and safe stopping areas, to ensure rapid incident reporting and reduce emergency response times along the corridor.

2.2.2 Problem: No provision for lay-bys

Location: Entire length of the road

Ranking: High

Summary: Risk of side-swipe and rear-end collisions due to long distances between laybys, rest and service areas.

The preliminary design does not indicate provision for dedicated lay-bys along the corridor. Without designated stopping places, drivers experiencing fatigue, mechanical issues, or emergencies may be forced to stop on the shoulder, increasing the risk of side-swipe and rear-end collisions, particularly on high-speed sections with limited visibility.

Recommendation

The detailed design should incorporate lay-bys in both directions at regular intervals (approximately one every 5 km), supported by appropriate warning and informational signage and adequate lighting.

2.2.3 Problem: Access arrangements to rest and service areas

Location: Various locations

Ranking: High

Summary: Risk of collisions due to inadequate or insufficiently developed access arrangements to rest and service areas.

The Project will include a number of rest areas along the corridor; however, the available preliminary design information does not indicate the detailed access arrangements or how these facilities will be safely integrated with the mainline. Given the high design speed of 120 km/h and the long,

uninterrupted sections of the route, inappropriate access locations or insufficient deceleration/acceleration provisions could result in sudden braking, turning or merging manoeuvres and increase the risk of rear-end and side-swipe collisions. Particular attention should also be given to the safe access and egress of heavy vehicles.

Recommendation

During the detailed design, the access arrangements for all proposed rest and service areas should be developed and assessed in accordance with the applicable standards and forecast traffic demand. Particular attention should be given to the location and visibility of accesses, adequate deceleration and acceleration provisions, turning arrangements, access spacing, advance signing, pavement markings, lighting where warranted, and the safe accommodation of heavy vehicles. The design should also ensure that vehicles entering or leaving these facilities do not adversely affect the safe operation of the mainline.

2.2.4 Problem: Absence of speed enforcement

Location: Various locations

Ranking: High

Summary: Risk of rear-end and side-swipe collisions and secondary loss-of-control collisions due to excessive speeds.

The new single-carriageway road, designed for 120km/h and characterised by long straight sections and open desert terrain, is likely to result in operating speeds significantly above the posted limits. Excessive speeds increase the risk of rear-end and side-swipe collisions, as well as secondary loss-of-control events during sudden braking or evasive manoeuvres, making the absence of a speed enforcement strategy a critical safety concern.

Recommendation

A speed enforcement strategy should be incorporated into the detailed design, including the installation of radar speed display signs at crucial locations to inform drivers of their actual speed and reinforce compliance with the posted limits, thereby reducing the likelihood of speed-related collisions. In addition, speed-limit signs should be provided at appropriate intervals, particularly on approaches to curves, junctions and other high-risk sections, to ensure that drivers are adequately informed of the applicable speed limit and any changes in speed restrictions.



Figure 12 - Example of radar speed signs

2.2.5 Problem: Safe access to maintenance facilities requires verification

Location: Maintenance facility near Turysh village (km 75+200)

Ranking: Medium

Summary: Risk of delayed maintenance response and unsafe vehicle movements.

The preliminary design includes a maintenance facility near Turysh village within the examined section of the project. However, the available information does not demonstrate the detailed access arrangements to these facilities. Maintenance depots must remain safely accessible throughout the year to enable timely inspection, maintenance and emergency response activities. Particular attention should be given to ensuring reliable all-weather access, including during snow, sandstorms and flooding, and to providing safe ingress and egress for heavy maintenance vehicles.

Recommendation

During the detailed design, verify that the maintenance facility is provided with safe, reliable and all-weather access suitable for the expected maintenance fleet. The access arrangements should remain operational during adverse weather conditions, including snow, sandstorms and flooding, and should provide appropriate geometry, pavement strength and visibility for heavy vehicles.

2.3 Climate and Weather Implications

2.3.1 Problem: Extreme weather and temperature conditions

Location: Along the entire length of the road

Ranking: High

Summary: Risk of all types of collisions.

The project area is subject to extreme temperatures, strong winds, dust storms, snowfalls, and low-sun glare, all of which can severely affect driver visibility, vehicle stability, pavement performance, and overall roadside safety. These conditions increase the likelihood of loss-of-control events, reduced reaction times, and collisions, particularly in exposed sections of the corridor.

Recommendation

The detailed design should include a robust maintenance plan outlining frequent inspection and upkeep of pavement, signage, and safety devices in weather-sensitive areas, along with provisions for timely replacement of damaged signs and lighting in locations most affected by extreme conditions to minimise driver confusion and maintain safe operating conditions.

2.3.2 Problem: Flood prone areas and potential roadway overtopping

Location: Various locations

Ranking: High

Summary: Risk of loss of vehicle control and pavement damage.

Satellite imagery and the geodetic layout indicate the presence of erosion channels, shallow basins, and depressions that are highly susceptible to flash-flooding during intense rainfall events typical of the region. Inadequate drainage capacity or insufficient embankment height in these areas increases the risk of roadway overtopping, loss of vehicle control, pavement damage, and temporary loss of connectivity.

Recommendation

A detailed hydrological assessment using updated rainfall intensity–duration–frequency (IDF) curves should be undertaken to confirm all flood-prone segments and validate the preliminary drainage assumptions. Where necessary, culvert sizing, spacing, and numbers should be increased, and

embankments raised at basin crossings or erosion channels to prevent overtopping and ensure safe passage during extreme storm events.

2.3.3 Problem: Wind-blown sand encroachment onto the carriageway

Location: Various locations

Ranking: Medium

Summary: Risk of loss of vehicle control, skidding and multi vehicle collisions.

The project area is exposed to frequent strong winds, which can transport loose desert sand onto the pavement surface. When this occurs, visibility may be suddenly reduced and the available friction on the road surface decreases, creating hazardous driving conditions. Sand deposits may also obscure pavement markings, narrow the effective carriageway width, and contribute to unexpected driver manoeuvres, especially at high speeds.

Recommendation

The detailed design should identify the sections most exposed to sand movement and incorporate sand-control measures such as fencing, windbreaks, and vegetation barriers (where feasible) and other suitable engineering solutions. In addition, a regular maintenance and cleaning programme must be established to ensure timely removal of sand from the pavement and shoulders, particularly after significant wind events.

2.4 Geometric Design Elements

2.4.1 Problem: Potential visibility impairment due to low sun glare

Location: Various locations

Ranking: Medium

Summary: Risk of rear-end collisions and loss-of-control events.

Several sections of the proposed alignment are oriented such that drivers may travel directly towards the rising or setting sun during certain periods of the year. Drivers travelling towards the rising or setting sun may experience temporary loss of visibility, reducing their ability to detect hazards, changes in alignment, slow-moving vehicles or crossing movements in sufficient time.

Recommendation

Review the alignment orientation relative to seasonal sun positions and consider appropriate mitigation measures, including enhanced delineation, high-performance road markings and warning signs where required.

2.4.2 Problem: Long monotonous sections may contribute to driver fatigue and reduced driver alertness

Location: Various locations

Ranking: High

Summary: Risk of run off road crashes due to fatigue or reduced alertness.

The proposed highway traverses extensive sections of relatively uniform terrain with long uninterrupted alignments. Such conditions may lead to reduced driver vigilance, fatigue and delayed hazard

perception, increasing the risk of run-off-road, rear-end and other fatigue-related crashes, particularly among heavy vehicle operators and long-distance travellers.

Recommendation

Review opportunities for fatigue mitigation measures, including strategically located rest facilities, enhanced delineation, and traffic-management features that assist in maintaining driver awareness.

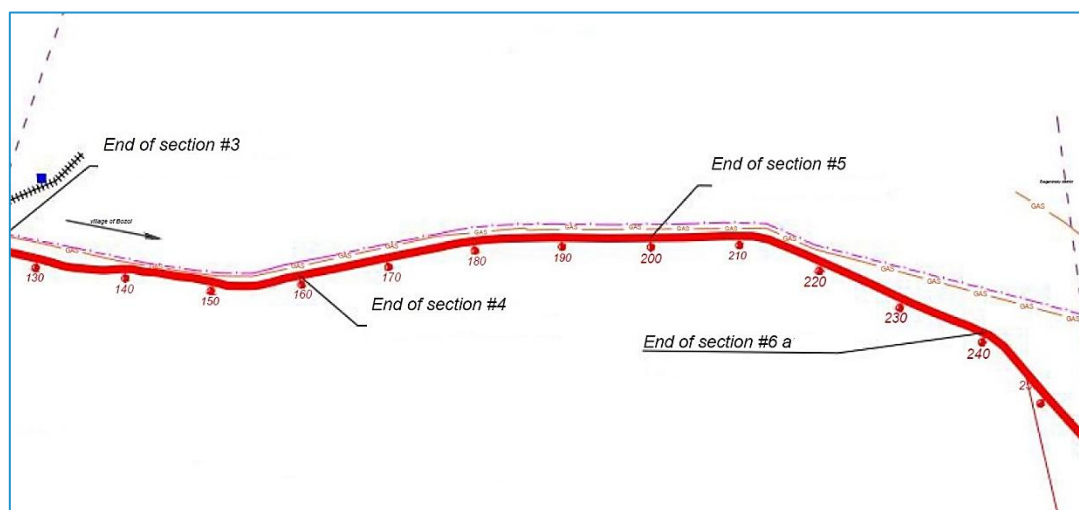


Figure 13 – Example of extended straight alignment

2.5 Gradients

2.5.1 Problem: Minimum longitudinal gradient criteria have not been specified

Location: Various locations

Ranking: Medium

Summary: Risk of roadway departures due to slippery conditions.

In the absence of defined minimum gradient requirements, isolated sections of the roadway may experience inadequate drainage and water accumulation, potentially affecting vehicle stability and pavement performance. For drainage purposes the minimum longitudinal gradient should be at least 0.5%-0.7%.

Recommendation

Define and apply minimum longitudinal gradient criteria consistent with the applicable design standards and drainage requirements.

2.6 Cross-Sections

2.6.1 Problem: Lack of emergency access/stopping areas

Location: Along the entire length of the road

Ranking: High

Summary: Risk of rear-end and side-swipe collisions.

Emergency stopping areas such as lanes, lay-bys or suitably designed paved shoulders are commonly provided on high-standard highways to accommodate emergency vehicles and to allow broken-down vehicles to move clear of the traffic stream. In the event of an emergency or breakdown, a motorist can pull into the shoulder/emergency lane in order to get out of the flow of the traffic and obtain a greater degree of safety. Therefore, the shoulder/emergency lanes are vital to the safety of the users of a highway; however, there is no provision for such a facility in the proposed cross-sections.

Recommendation

As the proposed Category II road cross-section does not include dedicated emergency lanes, alternative provisions should be incorporated to facilitate safe stopping and access for emergency and broken-down vehicles. These should include suitably designed emergency stopping areas at appropriate intervals along the route and/or local shoulder widening at suitable locations (see Problem 2.2.2 – No provision for lay-bys). The spacing and provision of emergency stopping facilities should take account of the forecast traffic volumes, heavy vehicle composition, remoteness of the corridor and expected emergency response times.

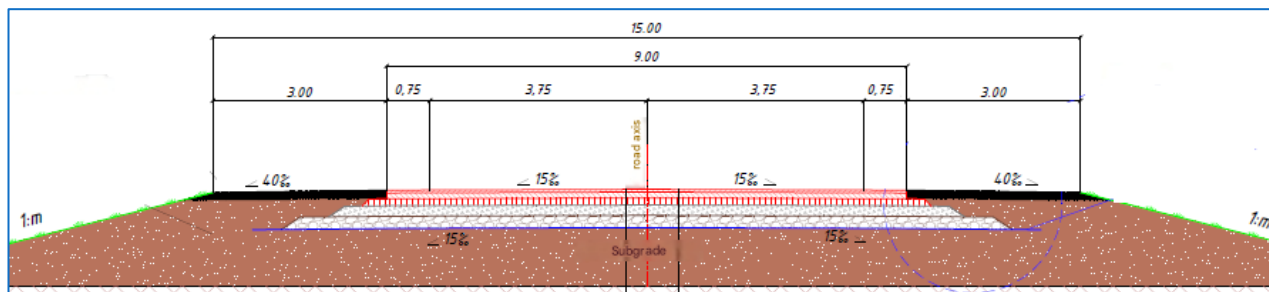


Figure 14 - Typical cross-section without emergency lanes provision

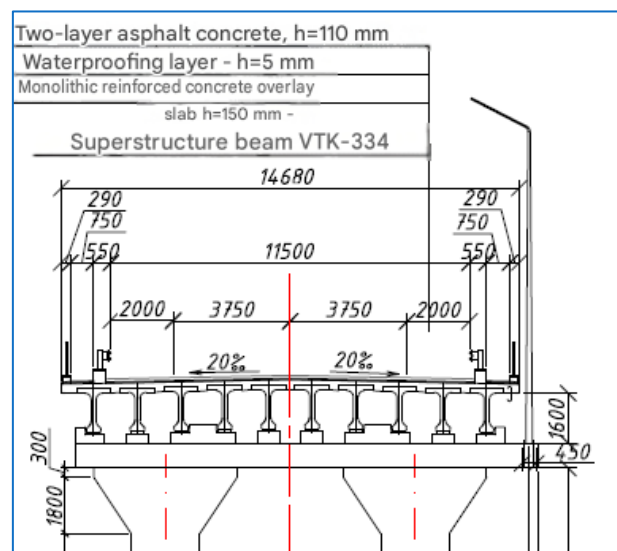


Figure 15 – Typical overpass cross-section without emergency lanes provision

2.6.2 Problem: Potential hazardous roadside features

Location: Various locations

Ranking: High

Summary: Risk of run-off-road collisions with hazardous fixed objects.

The proposed highway will include numerous roadside features, such as drainage structures, sign supports, lighting columns, utility installations and other fixed objects that may present a severe hazard to errant vehicles. Furthermore, several cross-sections in sand areas indicate elevated embankments without roadside protection. Given the high design speed (120 km/h) and the long rural sections, run-off-road crashes are likely to result in high impact speeds. The absence of an adequately maintained clear zone or appropriate vehicle restraint systems (VRS) may increase the severity of such crashes.

Recommendation

During detailed design review, the roadside design to maximise the provision of clear zones free from hazardous obstacles. Where fixed objects cannot reasonably be relocated outside the clear zone, their treatment should be assessed and, where appropriate, passive safety supports (frangible) or appropriate vehicle restraint systems should be provided in accordance with the applicable standards. In addition, review all elevated embankment sections to determine whether roadside protection is warranted based on embankment height, side slopes and the severity of the roadside hazard. Drainage structures, culvert headwalls, sign supports and utility installations should be designed or protected to minimise the severity of run-off-road crashes.

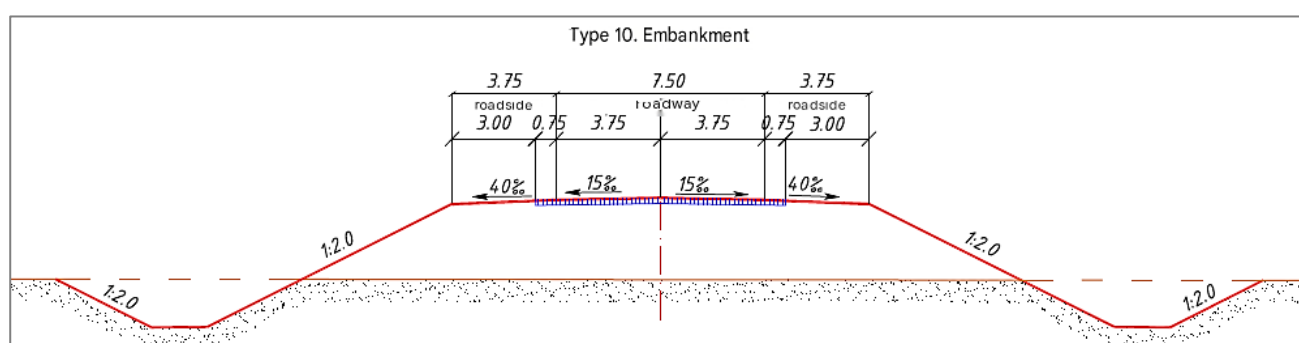


Figure 16: Elevated embankment in a sand area without roadside protection

2.7 Interchanges and Intersections

2.7.1 Problem: Potentially restricted stopping sight distance on the interchange loop ramp

Location: Grade-separated intersection at the beginning of the road (km 00+420)

Ranking: Medium

Summary: Risk of loss-of-control and rear-end collisions.

The trumpet interchange includes a loop ramp with relatively tight horizontal curvature. Depending on the final vertical alignment, roadside earthworks, safety barriers and vegetation, the available stopping sight distance (SSD) may be restricted. Drivers entering the loop ramp from the high-speed mainline may have insufficient visibility to identify unexpected hazards, slow-moving vehicles or stationary vehicles in sufficient time, increasing the risk of loss-of-control and rear-end collisions.

Recommendation

Review the speed transition from the mainline to the interchange loop ramp to ensure a gradual and appropriate reduction in speed. Avoid abrupt speed-limit reductions and provide adequate advance signing and visibility to allow drivers sufficient distance to reduce speed safely before entering the ramp.

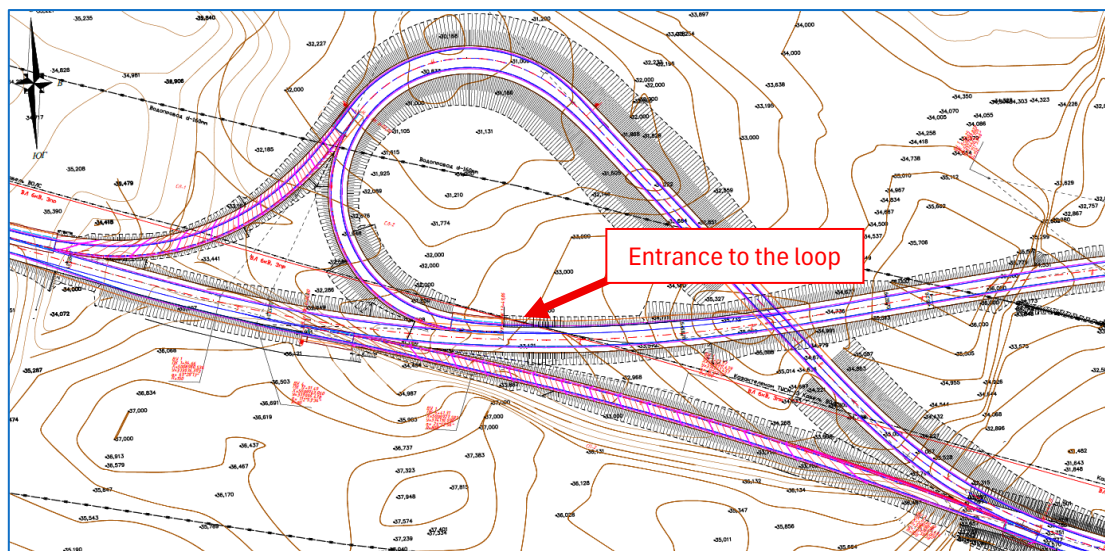


Figure 17 - Grade-separated intersection at the start of the project road

2.7.2 Problem: Uncontrolled left-turn movements at T-Junctions and absence of channelisation at four-leg intersections

Location: T-Junctions at km 75+220 and 78+610 and four-leg intersections at km 105+400 and 109+850

Ranking: Medium

Summary: Risk of rear-end and side collisions.

These proposed T-junctions do not include physical channelisation or positive control measures to regulate left-turn movements from the mainline into the side roads. If left-turn movements are intended to be permitted, the absence of dedicated channelisation may result in unexpected braking manoeuvres, increased rear-end collision risk and driver uncertainty on the high-speed mainline. It should be noted that the proposed deceleration lane provides adequate length. Similarly, at all other intersections where acceleration and deceleration lanes are proposed, the respective lane lengths appear to be adequate.

The proposed four-leg intersections do not incorporate channelisation to clearly separate turning movements and guide vehicles through the junction. On a high-speed rural highway, inadequate channelisation may reduce driver expectancy, increase decision-making workload and contribute to conflicting vehicle paths, particularly during periods of higher traffic demand or where heavy vehicles are present.

Recommendation

Review the operational strategy for the proposed T-junctions. Where left-turn movements from the mainline are intended to be permitted, provide appropriate channelisation (turn pocket) and auxiliary turning facilities. If such movements are not intended, install physical median islands, bollards or other positive guidance measures to clearly prohibit left-turn manoeuvres and minimise the potential for driver confusion.

Regarding the four-leg intersections, review the geometric layout and introduce appropriate channelisation measures in accordance with the applicable national design standards and legislation to positively guide vehicle movements and reduce conflict areas. The detailed design should include, as appropriate, suitably designed channelising islands, auxiliary turning lanes, pavement markings and

signing to improve guidance, enhance intersection legibility and minimise the potential for conflicting manoeuvres.

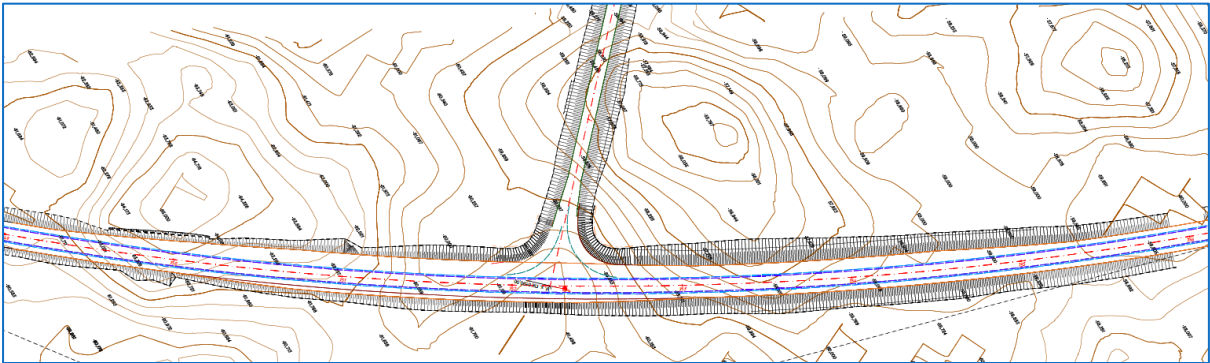


Figure 18 – T-junction that leads to a Road Maintenance Unit without channelization for left-turn from the main road

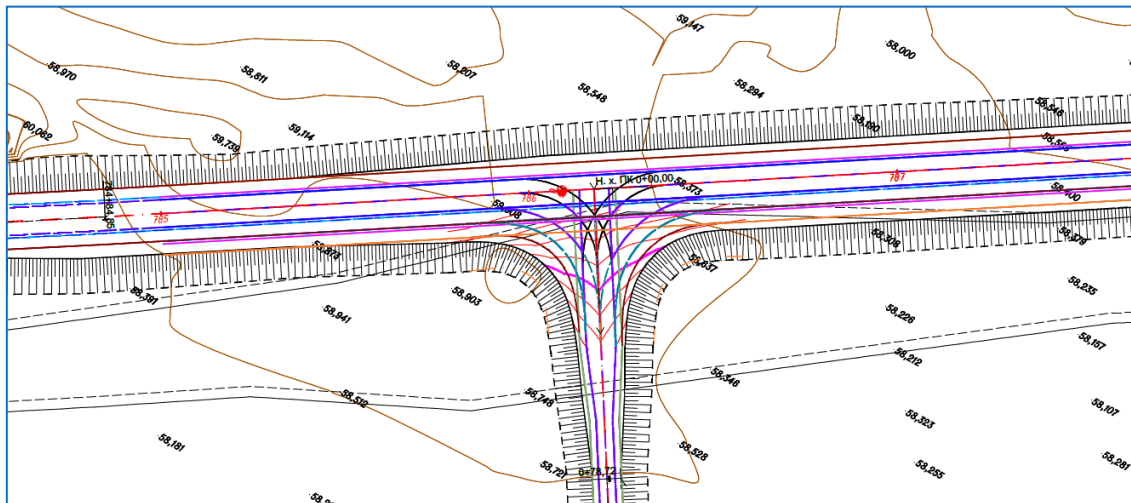


Figure 19 – T-junction without channelization for left-turn from the main road (km ~78+600)

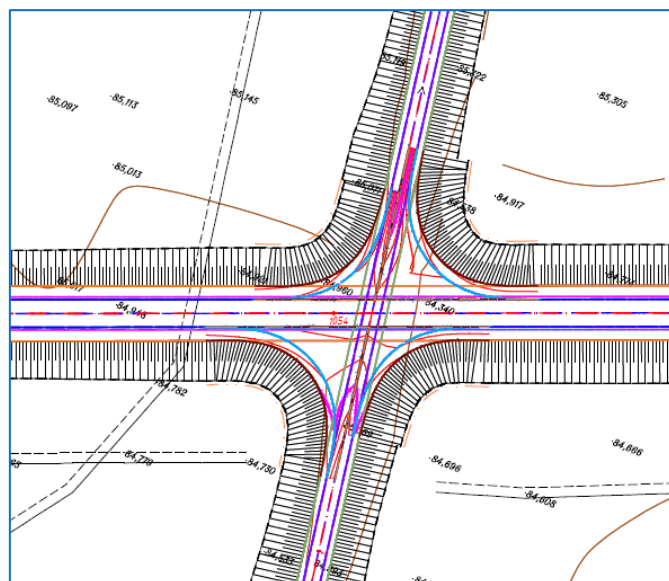


Figure 20 – Four-leg intersection without channelization (km ~105+400)

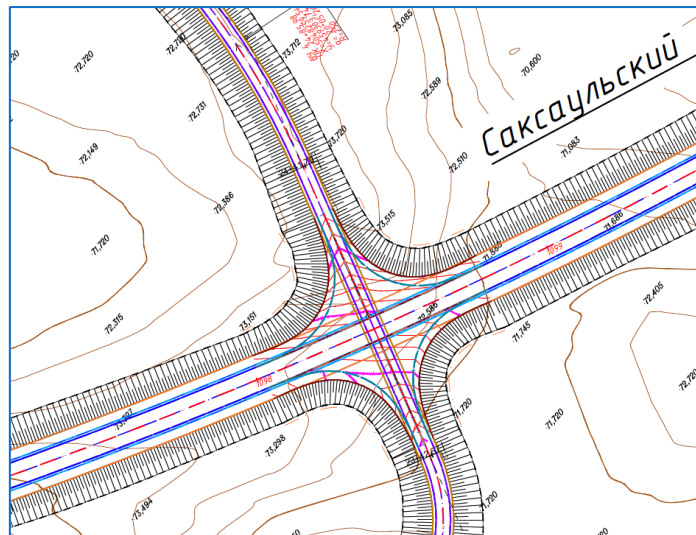


Figure 21 - Four-leg intersection without channelization (km ~109+850)

2.7.3 Problem: Insufficient provision for safe operation at intersections and interchanges

Location: All at-grade intersections and the interchange

Ranking: Medium

Summary: Risk of high-speed approach collisions.

The proposed highway consists mostly of long straight sections with a design speed of 120 km/h. Drivers approaching intersections and the interchange may require clear advance warning and adequate visual cues to recognise the change in the road environment and adjust their speed accordingly. At the preliminary design stage, the detailed arrangements for speed management, advance signing, pavement markings, delineation and lighting (where warranted) have not yet been developed.

Recommendation

During the detailed design stage, develop a coordinated strategy for intersection speed management and conspicuity. This should include appropriate advance warning signs, pavement markings, delineation, speed transition measures, and roadway lighting.

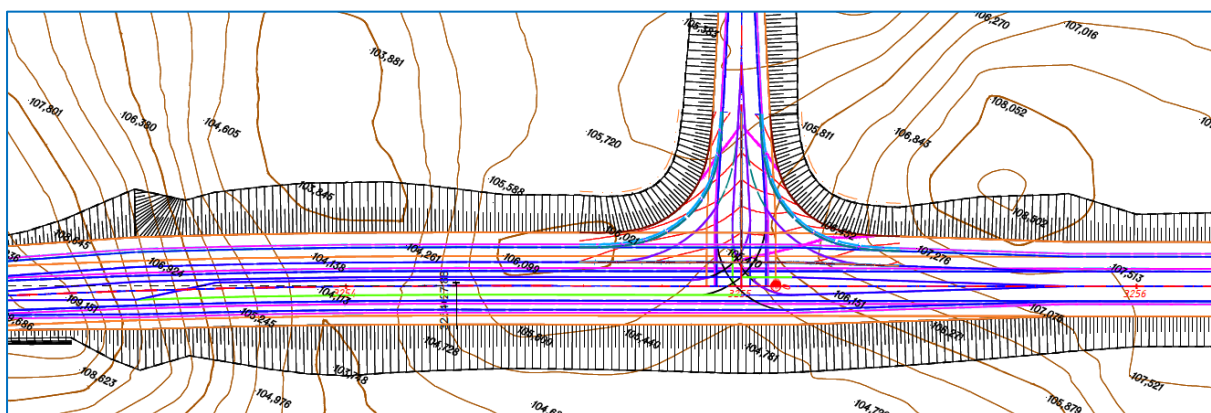


Figure 22 – Last intersection within the examined section of the project (km 325+500)

2.8 Traffic and Information Signs

2.8.1 Problem: Signing and road marking requirements have not yet been defined

Location: Entire length of the road

Ranking: Low

Summary: Risk of reduced driver guidance.

The reviewed documentation does not include a comprehensive plan for regulatory, warning, or directional signs, nor does it provide typical layouts for pavement markings, delineation elements, or retroreflective materials. Without a coordinated strategy, there is a possibility of insufficient night-time visibility, inconsistent driver expectations, and delayed hazard recognition, particularly on a long, high-speed rural corridor.

Recommendation

A complete signing and marking strategy should be developed during the detailed design phase. This strategy must define the placement, type, and retroreflective performance of all signs and pavement markings, ensuring consistency with national standards and international best practice. Special attention should be given to night-time visibility, hazard warning signs, curve delineation, and route guidance through areas with limited visibility or complex geometry. The final plan should be fully coordinated with roadside safety features, drainage structures, and access road connections to ensure clear and predictable driver information along the entire route.

2.9 Highway Lighting

2.9.1 Problem: Absence of roadway lighting planning

Location: Entire length of the road

Ranking: Low

Summary: Risk of side and rear-end impacts due to insufficient street lighting especially at intersections.

Although the corridor is predominantly rural and lighting is not expected along its full length, certain locations—such as intersections, maintenance areas, tolling points, access road junctions, and sections with limited visibility—typically require dedicated lighting to ensure safe night-time operation. The absence of a defined lighting strategy creates a risk of reduced night-time visibility, delayed hazard detection, and inconsistent driver guidance, particularly in areas with complex geometry or operational activity.

Recommendation

A comprehensive lighting strategy should be developed during the detailed design phase, identifying all locations where illumination is warranted based on traffic function, safety needs, operational requirements and all intersections. The strategy should specify lighting levels, pole placement, energy-efficient technologies, and integration with other roadside elements to ensure adequate night-time visibility and consistent driver guidance along the corridor.

2.10 Roadside Safety Provisions

2.10.1 Problem: Lack of roadside barriers in high-risk locations

Location: Various locations

Ranking: High

Summary: Risk of run-off-road collisions with hazardous fixed objects.

There is a significant risk in locations where the roadside environment presents severe side hazards such as steep embankment drops, culverts, water channels, or other non-forgiving features. In the current preliminary design, the placement of roadside safety barriers has been defined only for embankments over 3 metres and at overpasses. However, this criterion does not appear to address all locations where the roadside environment may present a severe hazard, such as steep embankment drops, culverts, water channels or other non-forgiving features. This issue is directly linked to a previous finding (2.6.2 – Potential hazardous roadside features).

Where hazardous fixed objects cannot be removed or relocated, the absence of barriers further increases crash severity, as errant vehicles may strike rigid obstacles or enter hazardous terrain without any containment or redirection.

Recommendation

During detailed design, all high-risk roadside locations should be systematically identified and assessed for the need for appropriate roadside protection. The assessment should consider, as applicable, embankment height and slope, culverts and drainage structures, water channels, hazardous fixed objects and other non-forgiving roadside features. Where a vehicle restraint system is warranted, it should be designed and installed in accordance with the applicable standards, including appropriate transitions and end treatments.

2.10.2 Problem: Roadside safety measures at bridges and overpasses require verification

Location: Various locations

Ranking: Medium

Summary: Risk of severe collisions and run-off-road crashes and vehicle falls at bridges and overpasses.

The project includes numerous bridges, railway overpasses, agricultural overpasses and interchange structures. At the preliminary design stage, the drawings do not provide sufficient information to confirm that bridge parapets, approach barriers, transitions, edge protection and roadside safety features have been designed and coordinated in accordance with the applicable standards. Inadequate transition details or incompatible restraint systems may increase the severity of crashes at structures.

Recommendation

Verify during the detailed design that bridge parapets, vehicle restraint systems, transition sections and end treatments are designed as an integrated roadside safety system in accordance with the applicable standards.

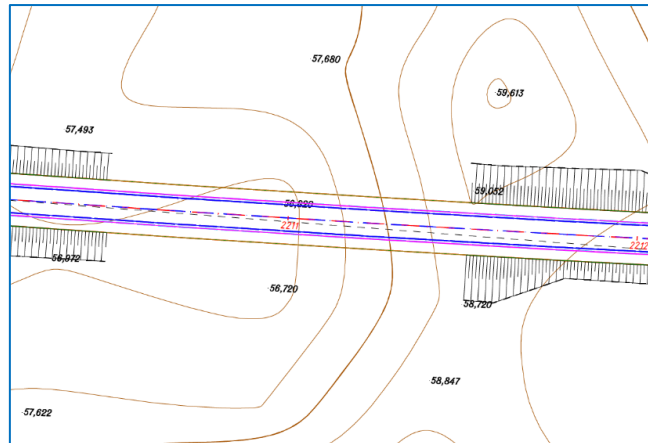


Figure 23 – Typical overpass requiring verification of roadside safety measures (km 221+100)

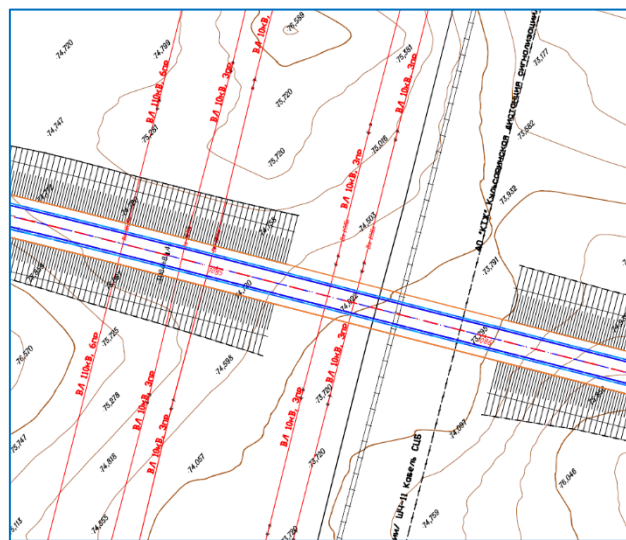


Figure 24 – Railway overpass requiring verification of barrier transitions and parapets (km 108+550)

2.10.3 Problem: Intermediate toll gantry layout and roadside safety require further development

Location: Three intermediate toll gantry locations (km 1+720, 125+000, 229+000)

Ranking: Medium

Summary: Risk of rear-end, lane-change and side-swipe collisions associated.

The preliminary design identifies three locations for intermediate toll gantries on the examined road section. The proposed tolling arrangement will be based on a Free-Flow Tolling / Open Toll Collection System, with no physical barriers and online payment. Consequently, vehicles are expected to pass through the tolling points without stopping or changing lanes specifically for toll collection.

Nevertheless, the introduction of toll gantries and associated roadside equipment represents a change in the road environment along an otherwise high-speed one lane per direction highway, and the available information does not demonstrate how the gantry support structures have been incorporated into the road layout design. The detailed arrangements should therefore ensure that the gantry locations, roadside equipment, signing, markings, delineation, lighting and visibility do not introduce new roadside hazards or adversely affect driver expectancy. Particular attention should also be given to

the safe provision and maintenance of any associated roadside equipment and to ensuring that the gantry arrangement is clearly visible and recognisable to approaching drivers.

Recommendation

During the detailed design stage, verify that the free-flow toll gantry structures are fully integrated into the road layout and roadside safety strategy. Particular attention should be given to the provision of appropriate road restraint systems, the treatment of fixed obstacles, clear zone requirements, gantry visibility, lighting, delineation, and maintenance access arrangements in accordance with the applicable standards and road safety principles.

2.11 Provisions for Special Road Users

2.11.1 Problem: Absence of facilities for vulnerable road users

Location: Various locations

Ranking: High

Summary: Risk of pedestrian accidents.

The delivered drawings do not include any typical cross-sections, layouts, or details that provide for pedestrian or cyclist movements. This creates a safety concern, particularly in areas where informal pedestrian activity may occur.

Although the corridor is new and largely remote, occasional pedestrian and cyclist movements are still expected, especially near settlements, industrial facilities, maintenance areas, and access road junctions.

In addition, several bus stops are already included in the preliminary design, which implies the presence of boarding/alighting pedestrians. Without designated pedestrian facilities or safe waiting areas, users accessing these bus stops may be exposed to high-speed traffic, increasing the likelihood and severity of pedestrian-vehicle conflicts.

Recommendation

During the next design stage, a pedestrian activity assessment should be undertaken if required, including counts and behavioural observations along existing access roads and near settlements. Sections with noticeable or expected pedestrian presence should be identified and prioritised. Preparation of typical cross-section designs with pedestrian facilities (at-grade or grade separated) for these sections should then be part of the next design stage, together with safe layouts for bus stops and pedestrian waiting areas.

2.12 Provisions for Wildlife Movements

2.12.1 Problem: Wildlife presence and animal–vehicle collision risk

Location: Various locations with potential wildlife presence

Ranking: High

Summary: Risk of animal–vehicle collisions.

The Project identifies locations where the presence or crossing of animals may occur and proposes an 80 km/h speed limit in these areas, together with appropriate warning signage. However, given the potential for wildlife, including Saiga antelope, to enter or cross the carriageway, the overall mitigation strategy should be reviewed to confirm that the proposed crossing arrangements and speed-

management measures are appropriate for the anticipated animal movements. Higher vehicle speeds reduce the time available for drivers to detect and react to animals and increase the severity of animal–vehicle collisions.

Recommendation

During the detailed design, review the speed-management strategy at locations with a significant potential for wildlife presence or crossing. Consider whether a lower speed limit, potentially 60 km/h at the highest-risk locations, is warranted based on the characteristics of each site, wildlife movement patterns, the extent of identified migration zones, visibility, fencing and crossing arrangements. In addition, verify that an appropriate wildlife-mitigation strategy is developed, including updated route migration maps, exclusion fencing, escape measures, wildlife guidance systems, and monitoring provisions where required, to maximise the effectiveness of crossing structures and minimise wildlife-vehicle collisions.



Figure 25: Wildlife crossing warning signage and 80 km/h speed limit

3 Summary of Problems Identified and Corresponding Recommendations

The following table summarizes the problems identified by the RSA Team along with the corresponding recommendations aimed at improving the road's safety during detailed design, construction, and subsequent operation.

Table 5 - Problems identified and recommendations

Ref.	Problem	Recommendation	Ranking
2.1.1	Lack of speed limit strategy	Incorporate a clear speed-management plan in detailed design, ensuring speed-limit signs are placed at appropriate intervals and positioned before and after intersections, curves, and other critical locations to support consistent driver compliance and reduce speed-related crash risk.	Medium
2.1.2	High proportion of HGVs	Confirm that the detailed design provides suitable facilities and geometry for the safe operation of forecast HGV traffic, including overtaking opportunities, auxiliary lanes, and speed management measures.	High
2.1.3	Numerous utility crossings	Review all utility crossings during the detailed design to ensure compliance with the relevant standards and minimise roadside hazards.	Low
2.1.4	Protection of communities adjacent to the highway	Review all sections adjacent to settlements to ensure appropriate access management, roadside protection and safe facilities for local road users, thereby minimising conflicts with high-speed through traffic.	Medium
2.1.5	No provision for overtaking opportunities	During the detailed design stage, assess the need for overtaking facilities and provide appropriate overtaking opportunities, where warranted, to reduce platooning and unsafe overtaking manoeuvres.	High
2.2.1	Long distances to emergency services	Provide emergency communication facilities and safe stopping areas to support rapid incident reporting and emergency response.	High
2.2.2	No provision for lay-bys	The detailed design should incorporate lay-bys in both directions at regular intervals (approximately one every 5 km), supported by appropriate warning and informational signage and adequate lighting.	High
2.2.3	Access arrangements to rest and service areas	During the detailed design stage, develop safe access arrangements for rest and service areas to accommodate forecast traffic demand and minimise impacts on mainline operations.	High
2.2.4	Absence of speed enforcement	Incorporate a speed management and enforcement strategy in detailed design, including appropriate speed signage and enforcement measures at high-risk locations.	High
2.2.5	Safe access to maintenance facilities requires verification	Ensure that maintenance facilities are provided with safe, all-weather access suitable for heavy maintenance vehicles, with appropriate geometric design and visibility to support reliable year-round operation.	Medium
2.3.1	Extreme weather and temperature conditions	Include a maintenance plan in detailed design, ensuring frequent inspection of pavement, signage, and safety devices in weather-sensitive areas, with timely replacement of damaged signs and lighting to maintain safe operating conditions.	High

Ref.	Problem	Recommendation	Ranking
2.3.2	Flood prone areas and potential roadway overtopping	Conduct a detailed hydrological assessment using updated IDF curves to confirm flood-prone segments, and adjust culvert sizing, spacing, and embankment levels where needed to prevent overtopping.	High
2.3.3	Wind-blown sand encroachment onto the carriageway	Identify sections exposed to sand movement and include fencing, windbreaks, or other engineering controls, along with a regular cleaning programme to ensure timely removal of sand from pavement and shoulders after wind events.	Medium
2.4.1	Potential visibility impairment due to low sun glare	Review alignment orientation against seasonal sun positions and apply mitigation measures such as enhanced delineation, high-performance markings, and warning signs where needed.	Medium
2.4.2	Long monotonous sections may contribute to driver fatigue and reduced driver alertness	Review opportunities for fatigue-mitigation measures, including strategically located rest facilities, enhanced delineation and traffic-management features that help maintain driver alertness.	High
2.5.1	Minimum longitudinal gradient criteria have not been specified	Define and apply minimum longitudinal gradient criteria consistent with the applicable design standards and drainage requirements.	Medium
2.6.1	Lack of emergency access/ stopping areas	During the detailed design stage, provide emergency stopping and refuge areas at appropriate intervals, taking into account the remote nature of the corridor and forecast traffic demand.	High
2.6.2	Potential hazardous roadside features	Review the roadside design to maximise clear zones and minimise hazardous roadside features. Where clear zones cannot be achieved, provide appropriate roadside protection (e.g. passively safe – frangible – supports or VRS).	High
2.7.1	Potentially restricted stopping sight distance on the interchange loop ramp	Review the speed transition and signing at the interchange loop ramp to ensure adequate stopping sight distance and safe speed reduction.	Medium
2.7.2	Uncontrolled left-turn movements at T-Junctions and absence of channelisation at four-leg intersections	Review junction layouts and provide appropriate channelisation, turning facilities, signing and guidance measures to safely manage vehicle movements and minimise conflicts.	Medium
2.7.3	Insufficient provision for safe operation at intersections and interchanges	Develop an integrated design for all junctions incorporating appropriate speed management, advance signing, pavement markings, delineation and lighting to enhance driver awareness.	Medium
2.8.1	Signing and road marking requirements have not yet been defined	Develop a complete signing and marking strategy defining placement, type, and retroreflective performance of all signs and markings, with emphasis on night-time visibility, hazard warnings, curve delineation, and route guidance.	Low
2.9.1	Absence of roadway lighting planning	Street lighting provision/installation to ensure maximum road safety level on the highway.	Low
2.10.1	Lack of roadside barriers in high-risk locations	During the detailed design stage, identify high-risk roadside hazards and provide appropriate vehicle restraint systems where required.	High
2.10.2	Roadside safety measures at bridges and overpasses require verification	Verify during the detailed design that all bridges and overpasses incorporate appropriate bridge parapets, vehicle restraint systems, barrier transitions and end treatments in accordance with the applicable standards.	Medium

Ref.	Problem	Recommendation	Ranking
2.10.3	Intermediate toll gantry layout and roadside safety require further development	Integrate the free-flow toll gantries into the roadside safety strategy, including appropriate obstacle protection, visibility, lighting, and delineation measures.	Medium
2.11.1	Absence of pedestrian facilities	In the next design stage, assess pedestrian demand near settlements and develop appropriate pedestrian crossing and waiting facilities where required.	High
2.12.1	Wildlife presence and animal-vehicle collision risk	During the detailed design stage, review wildlife collision risks and implement appropriate speed management, fencing, crossing, and mitigation measures.	High

Upon request by JSC KazAvtoZhol to provide further prioritisation within the High-risk findings and facilitate their consideration during the subsequent stages of design development, the issues have been grouped into two priority categories based 1) on their systemic/ route-wide implications and potential contribution to crash severity, and 2) on their local or operational nature.

Priority 1 comprises systemic issues that may affect the entire route and/or have the potential to contribute to higher-severity crashes, while Priority 2 comprises other High-risk findings of a more localised or operational nature. The following table presents the highest-risk issues grouped by priority category.

Table 6 - Prioritisation of High-Risk Findings

Priority 1 – Systemic / Route-wide and Severity-related Issues	
2.1.2	High proportion of HGVs
2.1.5	No provision for overtaking opportunities
2.2.1	Long distances to emergency services
2.6.1	Lack of emergency access/stopping areas
2.6.2	Potential hazardous roadside features
2.10.1	Lack of roadside barriers in high-risk locations
2.12.1	Wildlife presence and animal-vehicle collision risk
Priority 2 – Local / Operational Issues	
2.2.2	No provision for lay-bys
2.2.3	Access arrangements to rest and service areas
2.2.4	Absence of speed enforcement
2.3.1	Extreme weather and temperature conditions
2.3.2	Flood prone areas and potential roadway overtopping
2.4.2	Long monotonous sections may contribute to driver fatigue & reduced driver alertness
2.11.1	Absence of pedestrian facilities

APPENDIX A – Design Reports and Drawings Provided for Road Safety Audit

ТЭО Бейнеу-Саксаульский -

Technical and Economic Feasibility Study for Beineu-Saksaulsk Highway

Russian	English
Паспорт_проекта	Project profile
Заключение №15-0005-26 от 08.01.2026г. _ТЭО_ Бейнеу-Саксаульский_Икатер	Expert Opinion No. 15-0005-26 dated 8 January 2026 – Feasibility Study: ‘Beineu–Saksaulsky Highway, II Technical Category Road
Том 1. Резюме ТЭО	Volume 1. Executive Summary
Том 1-4 Разделы (Паспорт, Введ, Инст, Маркет)	Volumes 1–4 (Project passport, Introduction, Institutional section, Marketing section)
Том 2. Маркетинговый раздел)	Volume 2. Marketing Section
Том 3. ТТР_Книга 3.1. Пояснительная записка, ведомости	Volume 3. Technical and Technological Section Book 3.1. Design Report and Schedules
Том 3. ТТР_Книга 3.2. Чертежи	Volume 3. Technical and Technological Section Book 3.2. Drawings
Том 3. Книга 3.3 Мосты и путепроводы ТЭО	Volume 3. Technical and Technological Section Book 3.3. Bridges and Overpasses
Том 3. Техничко-технологический раздел Книга 3.3 Мосты и путепроводы (с учетом замечаний Госэкспертиза)	Volume 3. Technical and Technological Section Book 3.3 Bridges and Overpasses (incorporating comments from the State Expert Review)
Том 3. ТТР_Книга 3.4.1. Переустройство кабеля ВОЛС	Volume 3. Technical and Technological Section Book 3.4.1. Fiber-Optic Communication Cable Relocation
Том 3. ТТР_Книга 3.4.2 Переустройство ВЛ 6-10-35-110кВ и Освещ.	Volume 3. Technical and Technological Section Book 3.4.2. Relocation of 6–10–35–110 Kv Overhead Power Lines and Lighting.
Том 3. ТТР_Книга 3.4.3. Переустройство газопровода. Линейная часть. Электхим. защита	Volume 3. Technical and Technological Section Book 3.4.3. Relocation of Gas Pipelines – Linear Section and Electrochemical (Cathodic) Protection
Том 3. ТТР_Книга 3.4.5. АСУДД_СКС	Volume 3. Technical and Technological Section Book 3.4.5. Intelligent Transportation System (ITS) and Structured Cabling System
Том 3. ТТР_Книга 3.4.6. АСУДД. Электроснабжение АПК	Volume 3. Technical and Technological Section Book 3.4.6. Intelligent Transportation Systems (Its) – Power Supply for Intermediate Control Gantries
Том 3. ТТР_Книга 3.5. АПК. Конструктивные решения	Volume 3. Technical and Technological Section Book 3.5. Intermediate Control Gantries – Structural Design
Том 3. Книга 3.5.4. Переустройство водопровода	Volume 3. Book 3.5.4. Water Supply Pipeline Relocation
Том 3. ТТР_Книга 3.6. Строительство.Капитальный ремонт ДЭУ	Volume 3. Technical and Technological Section Book 3.6. Construction and Major Rehabilitation of Road Maintenance Facilities
Том 3. ТТР_Книга 3.7. Подъездные дороги к населенным пунктам	Volume 3. Technical and Technological Section Book 3.7. Access Roads to Settlements
Том 3. Книга 3.8. СВОР	Volume 3. Book 3.8. Summary Bill of Quantities (BoQ)
Том 3. водная ведомость объемов работ	Volume 3. Book 3.8. Summary Schedule of Work Volumes
Том 4. Книга 4.1 ОВОС	Volume 4. Environmental Section Book 4.1. Environmental Impact Assessment (EIA)
Том 4. Книга 4.2. Приложение ОВОС начало(пуск)	Volume 4. Environmental Section Book 4.2. Appendices to the Environmental Impact Assessment (EIA) – Phase 1
Том 4. Книга 4.3. Приложение ОВОС (конец)	Volume 4. Environmental Section Book 4.3. Appendices to the Environmental Impact Assessment (EIA) – End
Том 4. Книга 4.3.1 Приложение (проекты СЗЗ)	Volume 4. Environmental Section Book 4.3. 1. Appendices to the to the EIA (projects of sanitary protection zones / SPZ projects)
Том 5. Институциональный раздел	Volume 5. Institutional Section

Russian	English
Том 5. Книга 1. Пояснительная записка (Технико-технологический раздел. Пояснительная записка)	Volume 5. Book 1. Explanatory note (Technical and technological section. Explanatory note)
Том 5 ТТР Книга 2 Приложение к ПЗ	Volume 5. TTR. Book 2. Appendix to the Explanatory Note
Том 5 ТТР Книга 3 Чертежи	Volume 5. Book 3 (Technical and Technological Section. Drawings)
Том 6. Книга 1. Сводка и сводный сметный расчет. Объектные сметы	Volume 6. Cost Estimate Documentation Book 1. Summary and Consolidated Cost Estimate Object Estimates
Том 6. Книга 1. Сметная документация	Volume 6. Book 1 Cost estimate documentation
ТОМ 6. Сметная документация Книга 2. Локальные сметы	Volume 6. Cost Estimate Documentation Book 2. Detailed Cost Estimates
Том 6. Книга 4. Организация строительства по зам ГЭ	Volume 6. Cost Estimate Documentation Book 4. Construction Organization (<i>taking into account comments from the State Expert Review</i>)
Том 7. Финансово-экономический раздел	Volume 7. Financial and Economic Section
Том 8. Социальный раздел	Volume 8. Social Section
Том 9. Анализ рисков	Volume 9. Risk Analysis
Том 10. Общие выводы	Volume 10. General Conclusions
Том 8-11 (Фин, ФЭМ, Соц-эк, Риски, Выводы)	Volumes 8–11 (Financial section, Financial-Economic Model, Socio-economic section, Risk assessment, Conclusions)
Том 11. Приложения к ТЭО_ Инженерно-геодезический отчет. Книга 1	Volume 11. Annex to the Feasibility Study Engineering and Geodetic Section Book 1. Explanatory note, schedules
Том 11_ Приложения к ТЭО_ Инженерно-геодезический отчет. Книга 2	Volume 11. Annex to the Feasibility Study Engineering and Geodetic Section Book 2. Route Plan
Том 11_ Приложение к ТЭО_ Инженерно-геологический отчет. Книга 2 Инженерно-геологический отчет	Volume 11. Annex to the Feasibility Study Book 2. Engineering-Geological Report (<i>taking into account comments from the State Expert Review</i>)
Том 11_ Приложение к ТЭО_ Инженерно-гидрологический отчет	Volume 11. Annex to the Feasibility Study Engineering and Hydrological Report
Приложение 2 (Консультанты по управлению проектом, Консультанты по надзору за строительством)	Appendix 2 (Project Management Consultants, Construction Supervision Consultants)
Приложение 3. (Стратегические документы)	Appendix 3. Strategic documents
Приложение 4. (Док КАЖ)	Appendix 4 (KazAvtoZhol documents)
Материалы согласования	Approval documents
Расчеты по мостам и путепроводам Camel Overpass	Calculations for bridges and overpasses
Варианты трассы ТЭО	Feasibility Study Route Options
Типовые на балки 21 и 24м, 33 м, 42м	Standard designs for 21m, 24m, 33m, and 42m beams
Конструкция ДО объездной дороги ТЭО	Design of the bypass road (Feasibility Study stage) - Drawings
Сетчатое ограждение	Mesh fencing – Drawings
Снегозадерживающие ограждения_ 4,2м	Snow retention barriers_ 4.2m - Drawings
Типовые поперечники ТЭО (с песками)	Typical cross-sections for the feasibility study (with sand) - Drawings
Протокола общественных слушаний (2023,2025)	Minutes of public hearings (2023, 2025)
Консультация с местным населением	Consultation with the local population
По миграции диких животных Путепровод для верблюдов Акт обл. по миграции - Актюбинская область Акт обл. по миграции - Аральский район Акт обл. по миграции - Мангистауская область	Wild animal migration Camel Overpass Migration inspection report – Aktoke Region Migration Inspection Report – Aralsk District Migration Inspection Report – Mangystau Region
Письмо АСБК по миграции сайгаков	Letter from the Association of Wildlife Conservationists of Kazakhstan on saiga migration
Археологические изыскания: Заключение АЭ № АЕС-521 от 30.06.2025 г. Согл. сокращенный план археология (2)	Archaeological investigations: Expert Opinion No. AES-521 dated June 30, 2025 Approved: Abbreviated Archaeology Plan (2)
Сокращение пути и варианты трассы	Route shortening and route options