Research Journal of Agricultural Science, 57 (3), 2025; ISSN: 2668-926X

http://doi.org/10.59463/RJAS.2025.3.34

MODERNIZATION OF DC 115A (ULM), DC 121 (ARĂNIEȘ), DC 118 (MERIȘORU DE MUNTE), AND STREETS IN CERBĂL COMMUNE – LOT 1

R.A. NISTOR[1], V.M. CIOABA[1], E. MIHAIESCU[1], .M NISTOR[1],
[1] University Of Petrosani, Faculty Of Mining
Corresponding author: nistor.raducualexandru@gmail.com

presents one of the fundamental elements of the sustainable y influencing the quality of life of residents, accessibility, the national transportation network. This study addresses the in Cerbăl Commune, Hunedoara County, with a focus on The aim is to evaluate the current technical condition of olutions aligned with national and European standards to The analysis includes geotechnical, hydrological, and s well as assessment of local conditions and terrain stability. ns include pavement upgrade, foundation reinforcement, plementation of road safety and signage measures. The safety and comfort, reduce maintenance costs, and improve phasis is placed on sustainability through durable materials, involvement in decision-making. The research contributes to arding the design and construction of communal roads in cal foundation for future similar investments in rural

ure, road modernization, geotechnical analysis, drainage, ăl Commune

the design, modeling, and functional analysis of a t of an industrial technological system. The topic was pplying modern engineering principles in the design of sses.

This project aims to integrate both theoretical and practical knowledge acquired in fields such as strength of materials, mechanisms, manufacturing technology, and computer-aided design (CAD), in order to develop an optimal structural solution from technical, functional, and economic perspectives.

The paper addresses the essential stages of the engineering design process, including:

- Defining the design requirements and functional specifications,
- Selecting the optimal structural solution,
- Three-dimensional modeling of the assembly and its components,
- Followed by strength analysis and functional verification.

In this context, modern simulation and validation methods are applied through specialized CAD/CAE software, allowing a realistic evaluation of mechanical behavior under various loading conditions.

http://doi.org/10.59463/RJAS.2025.3.34

Location Context

The Cerbăl Commune, located in the Poiana Ruscă Mountains at an average altitude of 815 m, borders the communes of Vețel and Bătrâna to the north, Peștișu Mic and Hunedoara to the east, Lelese and Bunila to the south, and Timiș County to the west.

Project Scope

[redacted] modernization of two communal roads under the [redacted]h a total length of 3,749 meters, both located within the [redacted]

[redacted]ge) – 2,329 m

[redacted]age) – 1,420 m

[redacted]ulation and access to the main public roads. Currently, [redacted]ion, with sections covered by soil and vegetation.

[redacted] worn and deteriorated, showing potholes (10–20 cm [redacted]n surfaces;

[redacted]h is approximately 2.6 meters, with variable platform [redacted]

[redacted]vary between 0.5% and 20%, often without proper [redacted]

[redacted]is nonfunctional or missing — ditches and culverts are [redacted]

[redacted] reconfiguration to ensure proper water runoff and [redacted]ment structure;

[redacted]cess is difficult and slow.

[redacted] the requirements of Normative NE 021-2003 on road [redacted]r Assessing the Technical Condition of Public Roads, [redacted]ilitation works necessary for the road system, culverts, and drainage network.

Table 1

Road Distances

Municipality/City	**Road Distances**
Municipality of Hunedoara	23 km – DJ 687J – 37 minutes
Municipality of Deva	38 km – DJ 708D și DN 7/E 68 – 56 minutes
City of Simeria	48 km – DJ 708D – 1 hour & 11 minutes
City of Călan	65 km – DJ708D – 1 hour & 16 minutes
City of Hațeg	58 km – DJ 687J și DN 66/E 79 – 1 hour & 22 minutes
City of Geoagiu	78 km – DJ 708D și A1 – 1 hour & 29 minutes
Municipality of Petroșani	106 km – DJ 687J și DN 66/E 79 – 2 hour & 3 minutes

Geotechnical Study

The geotechnical study was conducted with the purpose of characterizing the foundation soil and determining the specific geotechnical conditions of the site located in Cerbăl Commune, Hunedoara County, in order to ensure the accurate design of road infrastructure works.

The site is located in a seismic zone with ag = 0.10 g and Tc = 0.7 s, corresponding to an intensity of 6 degrees on the Mercalli scale, according to P100-1/2013 regulations. The road

http://doi.org/10.59463/RJAS.2025.3.34

alignment lies in a hilly–mountain area, with moderate plan complexity and medium to steep longitudinal slopes.

Geological and Hydrogeological Characteristics

From a geological standpoint, the site belongs to the Poiana Ruscă Massif, consisting [redacted] rmations — mica schists, amphibolites, and gneisses,

[redacted] cal of mountainous regions.

[redacted] drained by the Cerna River, a tributary of the Mureș [redacted] me indicates moderate soil permeability, with no [redacted] oreholes.

[redacted] ed six geotechnical boreholes (F1–F6) and six dynamic [redacted] d out using the PAGANI DPM 20–30 dynamic

[redacted] ed using the Dynamic Probing (Geostru) software, in [redacted] 4-2014 standards.

[redacted] sists of:

[redacted],

[redacted] d with boulders.

[redacted] od bearing capacity of the soil, suitable for direct

[redacted] **arameters**

[redacted] Pa

[redacted] N/m²

[redacted] g, Tc = 0.7 s

Geotechnical category: 1 (low complexity, low risk)

The soil exhibits satisfactory overall stability, though some localized areas may be temporarily exposed to high moisture or minor flooding.

The study concludes that the site provides favorable foundation conditions, requiring only minimal compaction and localized drainage measures.

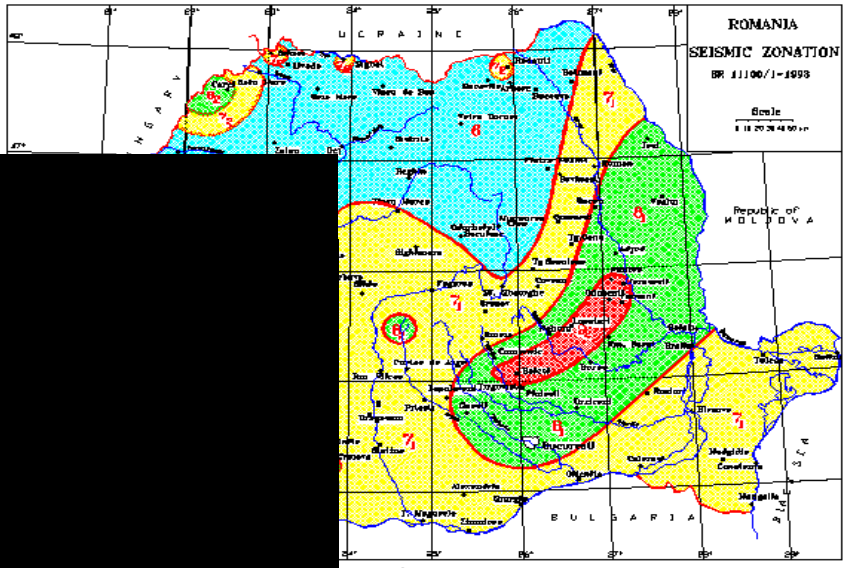
These findings confirm the technical feasibility and stability of the site for the execution of the proposed road infrastructure works.

From a seismic perspective, in accordance with Law no. 575/2001 on the National Spatial Planning Plan – Section V: "Natural Risk Zones", Cerbăl Commune is located in a seismic intensity zone of grade 6 MSK, indicating a moderate seismic activity that must be duly considered in both design and execution phases of the infrastructure project.

According to Normative P100-1/2013 on the seismic design of structures, Cerbăl Commune is located in a seismic zone characterized by a peak ground acceleration (ag) of 0.10 g and a control period of the response spectrum (Tc) of 0.7 seconds.

These parameters indicate a moderate level of seismicity, which must be taken into account in the design and structural dimensioning process to ensure the stability and safety of constructions in the event of an earthquake.

Research Journal of Agricultural Science, 57 (3), 2025; ISSN: 2668-926X
http://doi.org/10.59463/RJAS.2025.3.34



ure 1. Seismic zoning

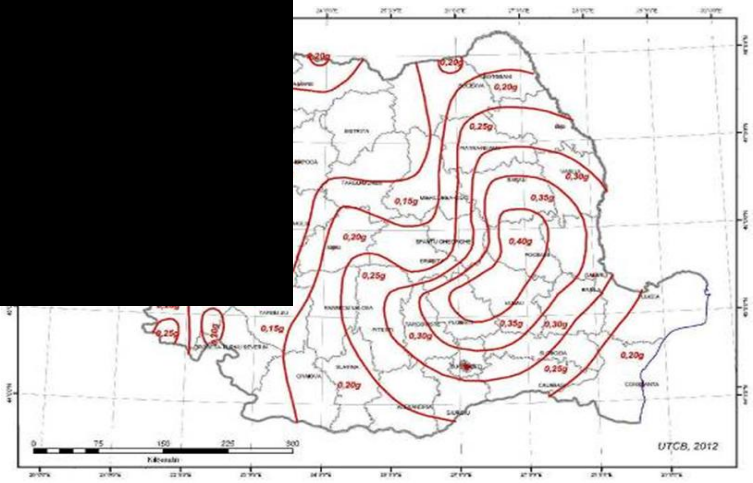


Figure 2. Zoning of the peak value of the ground acceleration for earthquakes with IMR = 225 years

MATERIAL AND METHODS

TECHNICAL DESIGN SOLUTION

The construction works fall under importance category "C", according to Government Decisions no. 261/1994 and no. 766/1997, and are subject to verification under Law no. 10/1994 for compliance with the following essential requirements: A4 – Structural stability, B2 – Operational safety, and D – Health and environmental protection.

General Characteristics of the Construction

The communal roads in Cerbăl Commune (DC 115A – Ulm Village and DC 121 – Arănieș Village) have the following main characteristics:

http://doi.org/10.59463/RJAS.2025.3.34

- Technical class: V (single-lane road)
- Category: Communal roads
- Design speed: 25 km/h
- Total length: 3.749 m

[redacted]

0 m

y), 4% (shoulders)

e existing configuration, with minor adjustments to

ransport Order no. 1296/2017 and STAS 863,
s with a design speed of 25 km/h.
687J, with connection curve radii ranging between 6
ons and compliance with rural road geometry standards.

Table 2

lizer with long roads

lage	Road	Lenght
LM	DC 115A	**2.329,00**
NIEȘ	DC 121	**1.420.00**
TAL		**3.749,00**

d in accordance with STAS 863-85 and Order no.
nciples below:

- Preservation of existing gradients where feasible;
- Avoidance of steep slopes over short distances;
- Proper connections to existing roads;
- Optimization of the pavement structure thickness;
- Design speed maintained at 25 km/h.

Cross-Section Profile

A total of seven types of cross-sectional profiles were defined, according to terrain conditions and the functional importance of each road segment.

http://doi.org/10.59463/RJAS.2025.3.34

Table 3

Types of cross-sectional profiles

Profile	Section (road, km, L)	Total length (m)	Platform width (m)	Roadway width (m)	Shoulders	Transverse roadway slope	Cross slope abutments	Drainage channel	Parapet / Observations
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	2 × 0,375 m	2.50 % (left)	4.00 %	riangular walled gutter 0.80 m (left))	—
TYPE 2	[redacted] la Km 1+125,00 → L = 25,00 mde la Km 1+825,00 la Km 1+875,00 → L = 50,00 mDC 121 (sat Arănieș): from Km 0+208,00 to Km 0+253,00 → L = 45,00 m	160	3,75	3	2 × 0,375 m	2.50 % (left)	4.00 %	Triangular walled gutter 0.80 m (left side)	L-shaped parapet on foundation 0.40 m (right)
TYPE 3	DC 115A (Ulm village): from Km 1+125,00 la Km 1+825,00 → L = 700,00	1.280,00	3,75	3	2 × 0,375 m	2.50 % (left)	4.00 %	Triangular walled gutter 0.80 m (left)	Parapet installed by driving (right)

http://doi.org/10.59463/RJAS.2025.3.34

	mde la Km 1+875,00 la Km 1+900,00 → L = 25,00 mDC 121 (sat								
					2 × 0,375 m	2.50 % (right)	4.00 %	Roadside gutter 0.65 m (right)	—
					2 × 0,375 m	2 × 2.50 % (roof)	4.00 %	Triangular walled gutter 0.80 m (left)	—
					2 × 0,375 m	2.50 % (right)	4.00 %	Triangular walled gutter 0.80 m (right)	Protective parapet installed by driving (left)
TYPE 7	(Arămeș village): from Km 0+735,00 la Km 1+420,00 → L = 685,00 m	685	3,75	3	2 × 0,375 m	2.50 % (right)	4.00 %	Triangular walled gutter 0.80 m (right)	L-shaped parapet on foundation 0.40 m (left)

Pavement Structure

Two types of pavement structures have been designed for the project:

SR1 – Standard Structure

- 4 cm stabilized asphalt mixture (MAS 16);
- 6 cm open-graded asphalt concrete (BAD 22.4);
- 15 cm crushed stone – upper base layer;
- 10 cm scarified and supplemented crushed stone layer;
- 20 cm existing road layer.

SR2 – Box Structure

- 4 cm MAS 16;

http://doi.org/10.59463/RJAS.2025.3.34

- 6 cm BAD 22.4;
- 15 cm upper base layer of crushed stone;
- 30 cm lower base layer of crushed stone.

Shoulders

[redacted]structed as follows:

[redacted]) where no drainage ditches are present;

[redacted]structure as the main road where gutters are installed [redacted]

[redacted]ssage of two vehicles, passing bays of 30 meters in [redacted]f:

[redacted]ransition wedges with variable width;

[redacted]section, with an additional width of 2.50 m.

Table 4

[redacted] Register of Crossing Stations

[redacted]station / [redacted]rossing		kilometric position	Part
[redacted]	1	Km 0 + 395.00	Right
[redacted]	2	Km 0 + 625.00	Right
[redacted]	3	Km 0 + 860.00	Right
[redacted]	4	Km 1 +460.00	right
[redacted]	5	Km 1 + 660.00	right
[redacted]	6	Km 2 + 120.00	right
Pe DC 121 - village Arănieș:	1	Km 0 + 150.00	Left
	2	Km 0 + 525.00	Left
	3	Km 0+ 855.00	Left
	4	Km 1 + 360.00	left

Drainage System

The drainage system plays a crucial role in ensuring the protection and durability of the road infrastructure. The proposed works include:

- Triangular concrete gutters (C30/37) – total length 3,590 m;
- Carriageway gutter (176 m on DC 115A) for capturing natural springs;
- 22 m gutter at the junction with DJ 687J;
- Culverts designed according to Normative PI 9-2003 to ensure proper stormwater evacuation.

http://doi.org/10.59463/RJAS.2025.3.34

Traffic Safety: To enhance road safety, metal guardrails type N2 will be installed, mounted on C25/30 reinforced concrete foundations with Bst 500 reinforcement steel.

Standard "L"-shaped foundation dimensions:

- Top width: 40 cm

[redacted]

crete

nd safety, the project provides:

ith glass microbeads;

SR 1848-1/2011 and SR 1848-7/2015;

construction, according to Order M.I. & M.T. no.

ed out by an authorized contractor, in full compliance

orizations will be obtained prior to the commencement

s needed, avoiding storage on green spaces or the

Protection

fire prevention, occupational safety, and traffic safety

ensure rapid access for emergency and intervention

l be verified by the beneficiary, in accordance with

s.

- All materials must be accompanied by quality certificates;
- Testing will be performed in authorized laboratories;
- Noncompliant materials are strictly prohibited.

Project Summary

The modernization project for communal roads DC 115A (Ulm Village) and DC 121 (Arănieș Village) in Cerbăl Commune, Hunedoara County, aims to improve the local road infrastructure and ensure safe and comfortable travel conditions for residents.

The proposed road alignments follow the existing routes, adapted to the mountainous terrain, and are classified as technical class V roads, corresponding to a design speed of 25 km/h.

The total road length is 3.749 km, with a platform width ranging between 3.75 m and 7.00 m.

The designed works include:

Full reconstruction of the pavement structure with asphalt and crushed stone layers;

Construction of shoulders, gutters, and culverts for stormwater management;

Installation of guardrails and road signage in compliance with national standards;

http://doi.org/10.59463/RJAS.2025.3.34

Passing bays for two-way vehicle movement, ensuring a smooth traffic flow.

These interventions will result not only in the modernization of the existing infrastructure, but also in enhanced road safety, increased durability, and improved accessibility for the local population.

The project fully adheres to the applicable technical regulations (Order 1296/2017, [redacted] tes to the economic and social development of Cerbăl [redacted] ions for transport, emergency response, and local [redacted]

[redacted]ON

[redacted] prehensive assessment of the current condition of the [redacted] the investment.

[redacted] posed solutions are relevant and well adapted to the [redacted]

[redacted] ere identified:

[redacted] proximate and require validation through a feasibility [redacted]

[redacted] th socio-economic analysis;

[redacted] influence the assessment of the roads' actual condition. [redacted] ges

[redacted] easibility study with phased implementation planning;

[redacted] mental and social impact assessment;

[redacted] anisms for post-implementation evaluation;

[redacted] ment of local authorities and the community in the [redacted]

[redacted] After Modernization

[redacted]

- [redacted] Severely deteriorated pavement with cracks, potholes, and unevenness;
- Unstable, water-infiltrated subgrade;
- Absence of drainage and road safety elements;
- Difficult traffic conditions, high maintenance costs, and restricted economic activity.

After modernization:

- Smooth carriageway, reinforced foundation, and efficient drainage;
- New gutters, culverts, road markings, and proper signage;
- Increased safety and reduced travel time;
- Improved agricultural, tourism, and residential access;
- Stimulated local economic development and enhanced quality of life.

http://doi.org/10.59463/RJAS.2025.3.34

CONCLUSIONS

The modernization of communal roads DC 115A (Ulm Village) and DC 121 (Arănieș Village) in Cerbăl Commune represents an essential intervention for improving local road infrastructure and promoting the sustainable development of the area.

The analysis confirms that the current state of the roads is severely degraded, with [redacted] and lack of safety features, which limit mobility, safety,

[redacted] tions—complete pavement reconstruction, foundation [redacted] systems, culverts, and modern signage—are compliant [redacted] the geographical characteristics of the mountainous

[redacted] will deliver tangible benefits, such as:

[redacted] ,

[redacted] lture, tourism, and local economy.

[redacted] nvironmental impact through controlled stormwater [redacted] construction solutions.

[redacted] zation project depends on an integrated approach, [redacted] ity, and technical experts.

[redacted] e the preparation of a complete feasibility study, a [redacted] n for monitoring long-term impacts.

[redacted] on of DC 115A and DC 121 is not merely a technical [redacted] sustainable development of Cerbăl Commune.

[redacted] ity of life, stimulate local economic growth, and serve [redacted] l infrastructure projects in Romania.

[redacted] 9 - Possibilities of using the UAV photogrammetry in the realization of the topo-cadastral documentation.

COMPANIA NAȚIONALĂ DE ADMINISTRARE A INFRASTRUCTURII RUTIERE – CNAIR. 2021 - Raport anual privind starea tehnică a drumurilor publice. București: CNAIR.

CONSILIUL JUDEȚEAN HUNEDOARA. 2022 - Planul de dezvoltare județeană 2021–2027. Deva.

DUMITRAȘCU, C.T., NISTOR, M.C., RADERMACHER, L. 2019 - Îndrumar de proiectare și aplicații practice pentru fundații. Petroșani: Editura Universitas. ISBN 978-973-741-653-7.

DURA, C., NISTOR, M.C. 2014 - Elemente de arhitectură – Îndrumător de laborator. Petroșani: Editura Universitas. ISBN 978-973-741-356-7.

EUROPEAN COMMISSION. 2020 - EU rural development and infrastructure: Policy overview 2021–2027. Brussels: Publications Office of the European Union.

HERBEI, M., SALA, F. 2016 - Classification of land and crops based on satellite images Landsat 8: case study SD Timisoara.

HERBEI, M.V., HERBEI, R.C., RADULOV, I. 2015 - Topology of spatial data. International Multidisciplinary Scientific GeoConference: SGEM, 2(2), 1175-1181.

ISTRATE, M., DINU, R. 2017 - Dezvoltarea infrastructurii de transport rutier în mediul rural din România. Revista de Transporturi și Infrastructură, 12(3), 45–58.

LUPU, D. 2016 - Drumuri și poduri: Elemente de proiectare și execuție. Iași: Editura Performantica.

MINISTERUL DEZVOLTĂRII REGIONALE ȘI ADMINISTRAȚIEI PUBLICE. 2020 - Strategia Națională pentru Dezvoltare Teritorială și Infrastructură Locală. București.

http://doi.org/10.59463/RJAS.2025.3.34

MINISTERUL TRANSPORTURILOR. 2019 - Normativ privind proiectarea și executarea drumurilor de interes local – AND 540-2019. București: Editura MT.
NISTOR, C. M. 2022 - Explozivi industriali. Petroșani: Editura Universitas. ISBN 978-973-741-846-3.
NISTOR, M.C. 2014 - Căi de comunicații – Îndrumător de laborator. Petroșani: Editura Universitas. ISBN 978-973-741-373-4.
[redacted]Note de curs. Petroșani: Editura Universitas. ISBN 978-973-
[redacted]CIOLAC, V., HERBEI, M. 2017 - Using the GNSS technology [redacted] county, Romania. Research Journal of Agricultural Science,