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Federal Department of the Environment, Transport, Energy and Communications DETEC

Federal Roads Office FEDRO
Research on Roads Working Group Trassee und Umwelt

Call for research proposals (Form 2 and project description)

Project No	**TRU_25_03K**
Title	**AI-driven 3D road surface data analysis for reliable road condition indexing**
Publication date	13.03.2026
Submission date	**10.05.2026** at the latest
Funding request	CHF 250'000.- (incl. VAT)
Underlying documents	• Handbook – Research on Roads • Instructions for completing Form 2 These documents are available in German, French and Italian on the FEDRO website at guides, forms, factsheets.
Related projects	• *TRU_20_02B_01* "COEUS" Removing the Unexplained Variability in Road Condition Indicator Values
Questions	Questions in relation to this call for proposals must be formulated in writing in one of Switzerland's national languages or in English. The answers will be made available to all interested parties on the FEDRO website at current calls for proposals. • Deadline for submitting written questions: 29.03.2026. Questions received after this date will not be answered. • Questions should be submitted to: Office of the Working Group Trassee und Umwelt (tru@holinger.com) • Questions submitted before the deadline will be answered no later than: 10.04.2026
Submission	Interested research teams are invited to submit their research proposal to the office of the Working Group Trassee und Umwelt (WG TRU*)* at tru@holinger.com with the reference 'Forschungsgesuch TRU_25_03K' The proposal should contain: • The completed Form 2 (as an Excel file): 'TRU_25_03K (Form 2) AI-driven 3D road surface data analysis for reliable road condition indexing.xlsx'. This form must be downloaded from the FEDRO website at Current calls for proposals; • The project description (as a PDF and Word file). Proposals received after the deadline will not be considered. For instructions on completing Form 2 and preparing the project description, please see the Instructions for completing Form 2. Language: Form 2 and the project description must be submitted in one of Switzerland's national languages or in English.
Correspondence	All correspondence in relation to this call for proposals should be sent by email to the office of the Working Group TRU (tru@holinger.com).

Composition of the Advisory Committee	The members of the Advisory Committee (MC) (cf. Form 2) are only selected and appointed by the Research Centre once the research application has been successfully selected. The working group provides feedback and recommendations when determining the BK. Furthermore, the rules formulated by FEDRO must be taken into account. The costs of an Advisory Committee are to be included in the application at a flat rate of CHF 5,000.
Evaluation of research proposals	**Formal check:** The office of the Working Group TRU will check compliance with the following formal requirements: • Form 2 is completed correctly and in full. • The project description contains all sections with the required content. • The project description does not contain more than the maximum number of words permitted. Proposals not meeting the formal requirements will be excluded from the rest of the procedure, with appropriate justification. **Content evaluation and weighting:** The Working Group TRU will evaluate the research proposals submitted on the basis of the following criteria and their weighting: • Amount of the funding request: 25% • Form 2: 20% • Project description: 55% The **amount of the funding request** is evaluated using the following formula (this creates a symmetrical treatment of the percentage difference): $Z_i = 3 + 4 * \text{Sign}(Y - X_i) * [\text{Abs}(Y - X_i) / Y]$ where: $Z_{i,Max} = 5$ $Z_{i,Min} = 1$ with: Z_i = Evaluation of the amount of the funding request in proposal i Y = Average funding request of all proposals X_i = Amount of the funding request in proposal i The **other criteria** are assessed on a scale from 0 to 5: 0 Cannot be assessed; no data available 1 Very poorly addresses the criterion; insufficient, incomplete information 2 Poorly addresses the criterion; does not adequately refer to the project 3 Addresses the criterion; broadly meets the requirements of the call for proposals 4 Addresses the criterion well; good quality 5 Addresses the criterion very well; excellent quality

Selection of the research proposal	The research proposal that optimally fulfils the specified criteria will be forwarded by the Working Group TRU to FEDRO for further processing/evaluation by the Commission for Research on Roads. Based on the recommendation of the Commission for Research on Roads, FEDRO will make the final decision on how to proceed with the selected research proposal. In both the Working Group TRU and the Commission for Research on Roads, recusal rules apply to members who work in the same company or institution as the applicant.
Reservation	Both the Working Group TRU and FEDRO may decide not to award a research contract if they consider all the research proposals to be unsatisfactory. The decision on the funding of research is taken exclusively by FEDRO in the form of a ruling.

Information on the research project

1 Background

Swiss road agencies spend several billion CHF on maintenance. The current maintenance priorities are based on profile scans and visual ratings. Priority-setting factors such as crack depth, structural cracking, rutting or trapped-water risk that directly trigger interventions are challenging to assess. A unified, sensor-agnostic method that extracts both I-values and demand-based key damage triggers from high-resolution 3D models already collected for inventory purposes would transform descriptive assessments into predictive, priority-aware asset management and unlock AI-enabled optimisation of the ageing 1980s network. Optimising the maintenance priorization is a critical factor in reducing maintenance costs.

2 Research needs and objectives

Current standards focus on how to collect data, not how differing sensor types, resolutions, scan angles or vehicle dynamics bias derived indices or discrete damage metrics. COEUS quantified the variability of current index values but stopped short of proposing a replacement framework. Commercial 3D surveys supply point clouds and 3D-road-models, yet no open algorithm maps them to I0–I4 plus other key damage triggers, and agencies lack in-house AI capacity to experiment. Hence, the potential to assess both index reliability and priority-setting damage cues from 3D-models remains untapped.

In comparison to conventional approaches, direct 3D-AI analysis may be able to better capture the true surface geometry and texture under varying lighting and angle conditions, while demand-based scoring targets critical damage modes. This reduces variability without new hardware. AI on multi-resolution 3D inputs plus specialist-guided priorities has the potential to yield higher accuracy, actionable maintenance rankings, and seamless prognostics—whereas existing workflows remain siloed and non-prioritized. By emphasizing validated ground truth and scalable AI, it addresses both consistency and predictive capability.

3 Expected content and deliverables

We propose developing and benchmarking AI models that estimate Road Condition Index values I_0 through I_4 directly from 3D road surface data with existing scanning technologies while simultaneously identifying damage types and prioritizing interventions. The study will: (1) curate multi-resolution datasets from LiDAR, stereo-imaging and photogrammetry measurements. Different resolutions across LiDAR, stereo-imaging or structured-light scans will be benchmarked; (2) conduct early-stage interviews with maintenance specialists to define key damage triggers; (3) perform ground-truth evaluation on an extensive mixed-pavement test section—specialists will rate actual cracks, rut depths, water retention among other key damage triggers; (4) train convolutional and point-cloud networks for index prediction plus demand-based damage scoring; (5) analyze resolution–accuracy–prioritization trade-offs and model performance. The outcome is a validated, open-source workflow for AI-driven 3D pavement evaluation and decision support.

The following materials and data are required for this research:

- High-resolution 3D surface models (LiDAR, stereo-imaging, photogrammetry) at varying densities;
- Rich ground truth: specialists' evaluations of I1 and key damage triggers such as crack depth, structural cracks, rutting, water levels on two larger test sections (a national and cantonal road section, each of >30 km length);
- Road condition data from recent campaigns (indices I0-I4, raw data);
- Metadata on pavement type, age, and environmental conditions;

- GPU servers and AI frameworks (PyTorch, TensorFlow);
- Tools for 3D data preprocessing, visualization, and interview transcripts.

The expected results include:

- Reliable condition indices (I0-I4) and damage indicators directly from 3D data;
- Identification of maintenance-critical damage features like structural cracking and rutting;
- Improved consistency across campaigns and road owners;
- Foundation for a standardized, AI-based decision-support system for Swiss road maintenance;
- Understanding of potential limitations of the approach.