Name of subject	FUNDAMENTALS OF HIGHWAY INVENTORY AND TECHNICAL RECORDS (9 ECTS)
Subject/module code	**AYTHOA27809**
Science taught semester (s).	7th and 8th semesters
Module leader	Professor Inomjon G‘aniyev, Candidate of Technical Sciences, Head of the Department of Road Engineering
Education language	Uzbek
Connection to the curriculum	Elective
Training hours (this including independent education)	**Total hours – 270 hours** **Contact hours – 108 hours** Lecture training hours – 48 hours Practical training hours – 60 hours **Independent education – 162 hours**
Course work	No
ECTS	9
The purpose and tasks of subject / learning outcomes	**The purpose of teaching the subject is** to identify roads and their assets, record quantities and technical characteristics against reliable sources, maintain an electronic inventory, and prepare a technical report that preserves the history of changes. **The objectives of teaching the subject** are to define asset boundaries and unique identifiers. Link chainage, coordinates, geometry and attributes. Reconcile documents, as-built drawings and observations. Total lengths, areas and item counts without duplication. Check GIS and tabular data, trace additions, changes and retirements to their sources, and reconcile the register, asset record sheets and summary report. **Learning outcomes:** 1. Explain the purposes of technical records, inventory registers, road passports, the state cadastre and financial accounts. Describe the scope of a training inventory. 2. Define a hierarchy of roads, sections and assets, assigning a unique identifier, inventory boundary, direction and status to each record. 3. Link chainage intervals to coordinates and record source, date, coordinate reference system and accuracy. Plan checks for discrepancies in linear referencing. 4. Use documents and observations to record quantities, units and technical characteristics for roads, pavements, drainage, structures and roadside equipment. 5. Create a data dictionary and set up keys and relationships in tables and GIS layers. Identify duplicates and records without a source. 6. Check completeness, consistency and spatial and temporal quality. Distinguish an unknown value, a measured zero and a field that does not apply. 7. Document the addition, replacement, alteration, split or merger of an asset. Record the evidence, date and link to its predecessor. 8. Reconcile opening quantities, additions, retirements and closing quantities within a consistent inventory boundary. Resolve double counting. 9. Generate maps, asset lists and summary reports from the register. Link diagnostic findings and identify information still needed for a decision. 10. Submit a data dictionary, register, evidence files, metadata, version history and validation records. Defend the individual contribution.
Course content (topics)	**I. Main Theoretical Part (Lecture Sessions).** Topics:

	1. Purpose and scope of technical records. 2. Legal and organisational framework. 3. Asset hierarchy and identification. 4. Linear referencing. 5. Coordinates and distance. 6. Data dictionary. 7. Source documents. 8. Inventory quantities. 9. Road geometry and cross-section. 10. Pavement and layer attributes. 11. Roadbed, drainage and structures. 12. Roadside equipment and junctions. 13. Electronic register design. 14. Collecting and checking data. 15. Attribute quality. 16. Spatial quality. 17. Dates and versions. 18. Additions, retirements and replacements. 19. Splits and mergers. 20. Conflicting data. 21. Combining datasets. 22. Summary reporting. 23. Using inventory data. 24. Handover and data management. **II. Instructions and recommendations for organizing laboratory exercises** Laboratory work is not included in the curriculum **III. Practical training instructions and recommendations** The instructor's preparation for a practical session begins with the study of initial documents (such as the curriculum, topic schedule, etc.) and concludes with the development of a detailed lesson plan. The instructor must have a clear understanding of the objectives and tasks of the practical session, as well as the amount of work each student is expected to perform. Methodological guidelines serve as the primary instructional document for instructors in preparing and conducting practical sessions. The purpose of the practical session is to facilitate the comprehension of theoretical material, the acquisition of practical skills, the ability to consciously apply knowledge in academic and professional activities, and the development of critical thinking and confidence in forming personal viewpoints. *Recommended Practical Topics:* 1. Define the training network and its inventory boundary. Compile an initial list of roads, sections and assets. 2. Identify sources for baseline records and current updates. Tabulate document types, dates, authority and gaps. 3. Assign unique road and asset codes. Diagram the hierarchy, asset types, directions and links. 4. Build a register of point and linear events using chainage intervals, side of road and direction. 5. Check coordinate reference systems and units. Record discrepancies between GNSS points, chainage and GIS locations. 6. Verify lengths, areas and counts. Identify overlapping records using consistent boundaries and units. 7. Compile a data dictionary with field names, definitions, types, units, sources, permitted values and rules for missing data.

	8. Compare as-built drawings with the earlier register and site observations. Attach an evidence reference to each value. 9. Complete an asset record from supplied photographs and observations. State the accuracy and identify unmeasured values. 10. Record road cross-sections and lanes. Check the relationship between length, width and area. 11. Build a pavement and layer table. Distinguish documented and measured thicknesses from unknown values. 12. Prepare asset sheets for bridges, culverts and drainage. Record location, quantity, dimensions, units and source documents. 13. Inventory signs, markings, barriers and lighting. Produce separate summaries for item counts and linear quantities. 14. Cross-check access points, junctions and directional records. Find assets counted more than once across lists. 15. Record whether an asset is in service, under construction or retired, citing the date of the source. 16. Prepare a verification sheet for two conflicting sources. Retain the original value and specify the correction and approval required. 17. Assemble the initial electronic register and map. Check consistency of codes, quantities, sources and dates. 18. Defend the semester 7 inventory, explain unresolved issues and justify the semester 8 update plan. 19. Separate the asset, observation and document tables. Define primary and foreign keys and set up one-to-many relationships. 20. Join a table to a GIS layer by code. Check unmatched, one-to-many and duplicate records. 21. Audit data types, units, ranges, missing values, genuine zeros and non-applicable fields. Log the errors. 22. Check geometry and topology. Distinguish a valid grade-separated crossing from an unintended break. 23. Log an addition, retirement and replacement, recording evidence, dates and links to earlier codes. 24. Trace segment splits, mergers and changes in chainage. Link former and current records and reconcile quantities. 25. Compare the registers for two dates. Reconcile opening quantities, additions, retirements and closing quantities over the same area. 26. Link a diagnostic result to its asset. Record unit, method, date and test file separately from inventory attributes. 27. Validate mobile imagery or automated detections against a control sample. List unconfirmed assets. 28. Prepare a summary by road and asset type. Reconcile lengths, areas and item counts with the map. 29. Export the register in an exchange format and reopen it. Verify codes, units, dates, geometries and file links. 30. Submit the final inventory and defend it individually. Demonstrate a query, an asset's change history and the derivation of an aggregate quantity. **IV. Independent learning and independent work** Independent learning competency helps students to develop self-improvement skills and increase the efficiency of their professional activities. Students perform independent tasks on their mobile devices under the guidance of a teacher, either in traditional or electronic form. Recommended topics for independent work: 1. Define network coverage, asset hierarchy, unique codes and data sources. Explain the respective purposes of technical records, legal documentation and financial accounts.

	2. Compile the baseline inventory. Code roads, structures and equipment, reconcile chainage and coordinates with documentation, and record duplicates. 3. Prepare the quantity summaries and data dictionary. Justify measurement units, reasons for missing values and rules for aggregating lengths, areas and counts. 4. Audit documents and observations for selected assets. Record technical attributes, source, date, accuracy and conflicting values. 5. Review the 2023 mobile mapping accuracy study, examining its experiment and control points. Explain how far its results apply locally and submit an interim register. 6. Build linked asset, observation, document and geometry tables. Specify keys, log errors and write validation queries. 7. Update records for added, replaced, retired or split assets. Document their previous and current states in an evidence-linked change log. 8. Audit the inventories for two dates. Compare scope, quantities, sources, versions and maps, check and correct the records together, and assemble the handover package. 9. Submit and defend the individual report, including the register, asset sheets, aggregate quantities, metadata, evidence and update procedure.
Exam form	Written
Teaching/learning and examination requirements	Complete mastery of theoretical and methodological concepts and practical knowledge of the discipline, the ability to correctly reflect the results of analysis, independently reason about the processes being studied and carry out tasks in the current, intermediate forms of control and independent work, pass written work on the final control. When drawing up final exam questions, deviations from the content of the discipline program are not allowed. The bank of final exam questions for each discipline is discussed at the meeting and approved by the head of the department. No later than 1 week before the start of the final control, tickets signed by the head of the department, enclosed in an envelope, are sealed by the Dean’s office and opened 5 minutes before the start of the exam in the presence of students. Final exam duration is 80 minutes. Answers to final exam questions are recorded in copybooks with the seal of the Dean’s office. After completion of the final work, the work is immediately encrypted by a representative of the Dean’s office, and the copybooks are handed over to the commission for verification. From the moment of completion of the final exam, a period of 72 hours is allotted for checking and posting the results on the electronic platform. The teacher who taught the students in this discipline is not involved in the process of conducting the exam and checking the students' answers. Student(s) who are dissatisfied with the final exam results may submit a written or oral appeal within 24 hours of the publication of the final exam results. Complaints submitted after 24 hours from the publication of the final exam results will not be accepted.
Scope of assessment criteria and procedure	CURRENT CONTROL Purpose: Determining and assessing the student's level of knowledge, practical skills, and competencies on course topics. Instructions: The student's activity in daily classes is assessed through the student's mastery of course topics, as well as constructively interpreting and analyzing the educational material, developing module specific skills, acquiring practical skills (in terms of quality and the specified number) and competencies, solving problem situations aimed at applying professional practical skills, working in a team, preparing presentations, etc.

Current control form: Activity in lessons; Preparing educational materials; Working with sources within the subject; Using educational technologies; Working in a team Preparing presentations; Working with projects.

MIDTERM CONTROL

Purpose: Assessing the student's knowledge and practical skills and level of mastery of lecture material after completing the relevant section of the course.

Form and procedure of intermediate control: Midterm examination is held during the semester during the training sessions after the completion of the relevant module of the curriculum of the subject. Midterm examination is held once in written form within the framework of this subject. Midterm examination questions cover all topics of the subject.

INDEPENDENT LEARNING

Purpose: Independent learning is aimed at fully covering the content of this course, expanding the theoretical knowledge acquired, and establishing independent learning activities for students.

Form and procedure of independent education: independent work assignments are completed in the form of an educational project, presentation, case study, problem solving, information search, digest, colloquium, essay, article, abstract, etc. Completed assignments for independent study are placed in the electronic system and checked based on the anti-plagiarism program and evaluated by the subject teacher.

In this case, the uniqueness of the completed assignment should not be less than 60%, otherwise the assignment will not be accepted for assessment. The number of independent work assignments, depending on the nature of the subject, should not be less than 3 for one subject (module). Independent work assignments account for 60% of the points allocated for current and intermediate control.

FINAL CONTROL

Purpose: The final examination is held at the end of the semester to determine the level of mastery of the student's theoretical knowledge and practical skills in the relevant subject. The final examination is held at a specified time according to the examination schedule created by the Registrar's Office on the electronic platform.

Requirements: The student must have passed the current control, intermediate control and independent learning assignments by the deadline for the final control type in the relevant subject. A student who has not passed the current control, intermediate control and independent learning assignments, as well as who has received a score in the range of “0-29,9” for these assignments and control types, is not included in the final control type. Also, a student who has missed 25 percent or more of the classroom hours allocated to a subject without a reason is excluded from this subject and is not included in the final control type and is considered not to have mastered the relevant credits in this subject. A student who has not passed or was not included in the final control type and has received a score in the range of “0-29.9” for this type of control is considered to be an academic debtor.

Final control form: The final examination in this subject will be conducted in written form. If the final examination is conducted in written form, the requirements for assessment must also be reflected.

Criteria for assessing student knowledge

5 grade	100 points		Assessment criteria
5	90-10	Excellent	When a student is considered to be able

				to make independent conclusions and decisions, think creatively, observe independently, apply the knowledge he has gained in practice, understand, know, express, and narrate the essence of the subject, and have an idea about the subject.
	4	70-89,9	Good	When the student is considered to be able to observe independently, apply the knowledge he has gained in practice, understand, know, express, and narrate the essence of the subject, and has an idea about the subject
	3	60-69,9	Satisfactory	When the student is found to be able to apply the knowledge he has gained in practice, understands, knows, can express, and narrate the essence of the subject, and has an idea about the subject.
	2	0-59,9	Unsatisfactory	When it is determined that the student has not mastered the science program, does not understand the essence of the subject, and does not have an idea about the science.

Course assessment criteria and procedure

Assessment type	Total points allocated	Control (task) form	Distribution of points	Qualifying score
Current assessment	30 points	System tasks	20 points (divided by number of tasks)	18 points
		Student activity (in seminars, practical, laboratory classes)	10 points	
Midterm assessment	20 points	Supervision: writing work	10 points	12 points

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<tr><td></td><td></td><td>System tasks</td><td>10 points (divided by number of tasks)</td><td></td></tr>
<tr><td>Final assessment</td><td>50 points</td><td>Written assignment (5 questions)</td><td>50 points (10 points per question)</td><td>30 points</td></tr>
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* Note: 60% of the points allocated for current and intermediate control are allocated to independent work assignments. Independent work assignments are evaluated as system assignments through the electronic platform.
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<tr><td>Recommended Literature</td><td>
1. Cabinet of Ministers of the Republic of Uzbekistan. Resolution No. 152 of 30 June 2005, Annex 1. Regulations on maintaining the State Cadastre of Highways. The syllabus cites paragraphs 20–24 of the consolidated text dated 23 June 2026. lex.uz
2. Hamilton, I., Richey, D., Himes, S., Chestnutt, C. Model Inventory of Roadway Elements 2.1. Federal Highway Administration, August 2024. FHWA-SA-24-052. rosap.ntl.bts.gov
3. National Academies of Sciences, Engineering, and Medicine. Ancillary Asset Data Stewardship and Models. NCHRP Synthesis 628. The National Academies Press, Washington, DC, 2024. DOI 10.17226/27821.
4. QGIS Project. QGIS User Guide, version 3.44. docs.qgis.org
5. Lukasic, D., Belella, P., MacAdam, J., Sanchez, R. Inventorying, Documenting, and Configuring Traffic Management System Assets and Resources—Current Practices. Federal Highway Administration, August 2024. FHWA-HRT-24-145. DOI 10.21949/1521589. rosap.ntl.bts.gov
6. Kurşun, H. Accuracy comparison of mobile mapping system for road inventory. Mersin Photogrammetry Journal, 5(2), 2023, 55–66. DOI 10.53093/mephoj.1334286. dergipark.org.tr
7. Chang, G. K., Gilliland, A. L., TaghaviGhalesari, A., Rada, G. R., Serigos, P. A., Simpson, A. L., Kouchaki, S. Successful Practices for Quality Management of Pavement Surface Condition Data Collection and Analysis: Final Report. FHWA, February 2023. FHWA-RC-23-0002. www.fhwa.dot.gov
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