Description of human-centred design methodology

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1. Executive Summary

This report analyses the methodologies employed within the HEIDI project to define user needs, use cases, and the iterative design, implementation, and testing of both internal and external Human-Machine Interfaces (iHMI and eHMI). The analysis highlights how these methodologies were applied in a user-centric way, assesses their strengths and weaknesses, and aligns them with the European Common Evaluation Methodology (EU-CEM) for Cooperative, Connected and Automated Mobility (CCAM), recently developed by the FAME project (Framework for coordination of Automated Mobility in Europe). The report includes a mapping of the CEM process to HEIDI methodologies and provides best practice guidelines for future HMI development, aimed at researchers, designers, and engineers. A cross-reference table is provided for traceability to HEIDI deliverables.

Keywords: Human-centred methodologies, Iterative design and testing, inclusive design, HMI

2. Objectives

HEIDI aims to develop adaptive, fluid, cooperative HMIs for safe and seamless interactions between automated vehicles and other road users, particularly vulnerable ones. The methodologies used span the full HMI lifecycle from user needs elicitation to final prototype testing in simulators and real vehicles.

The following analysis organizes these methodologies according to the three core phases of the FAME EU-CEM:

- Phase 1: User Needs & Scenarios
- Phase 2: Design & Development
- Phase 3: Evaluation & Impact Assessment

Even though the HEIDI methodologies were developed independently of the EU-CEM framework, the HEIDI project offers a concrete example of how the FAME European Common Evaluation Methodology for CCAM [1] can be successfully implemented in a large-scale R&I project. Starting from a systematic definition of user needs and use cases, the project followed an iterative design process supported by both simulator and real-vehicle validation studies. The methodologies applied in HEIDI demonstrate strong alignment with FAME's stepwise approach to evaluation and have produced a set of best practices that can inform future HMI development across Europe. The following sections summarize these practices and provide guidance for practical application by HMI professionals. These findings clearly demonstrate the value of applying a structured, FAME-aligned evaluation process to the design of future human-machine interfaces and are, therefore, aligned with the HEIDI Objective 3: Develop suitable validation methods for assessing fluid, cooperative HMI solutions.

3. Methodologies Overview

3.1 The EU Common Evaluation Methodology (EU-CEM) for CCAM

The European Common Evaluation Methodology (EU-CEM) for Cooperative, Connected and Automated Mobility (CCAM), developed within the FAME project (Grant Agreement No. 101069559), provides a harmonized framework for evaluating CCAM systems across European R&I and deployment projects. It aims to ensure that CCAM solutions are assessed in a consistent, comparable, and robust way to inform public authorities, industry, and citizens.

The EU-CEM is structured around three key evaluation phases:

1. **Phase 1: Definition of User Needs & Scenarios**
    - Identification of relevant user needs
    - Development of representative scenarios
    - Definition of use cases and target groups
2. **Phase 2: Design & Development**
    - Translation of user needs into technical solutions
    - Iterative prototyping and refinement
    - Integration of ethical, legal, and societal aspects
3. **Phase 3: Evaluation & Impact Assessment**
    - Implementation of mixed-method evaluation (subjective & objective)
    - Testing in controlled and real-world environments
    - Assessment of safety, efficiency, user acceptance, and societal impact

EU-CEM promotes a user-centric, evidence-based, and iterative approach, recommending continuous feedback loops between phases. It explicitly encourages the involvement of vulnerable users and a focus on cooperative interactions in mixed traffic.

3.2 HEIDI Methodologies

The HEIDI project has followed a methodology that exhibits strong similarities with the EU-CEM for CCAM, both in structure and philosophy, as highlighted by the following aspects:

- **User-Centric Focus:** Both HEIDI and the EU-CEM emphasise inclusivity by considering elderly, distracted, impaired, and general users at all stages.
- **Iterative Process:** The project applied multiple loops of design, testing, and refinement across iHMI, eHMI, and cHMI components.
- **Mixed Evaluation Methods:** HEIDI used a rich mix of objective KPIs (e.g., Time-To-Resolve, braking profiles, reaction time, etc.) and subjective metrics (e.g., trust, usability, mental load), in line with CEM recommendations.
- **Cooperative Interaction:** The cHMI development in HEIDI addresses the EU-CEM's emphasis on cooperative interactions between automated vehicles and Vulnerable Road Users (VRU).

Therefore, HEIDI can be considered a practical hindsight application and validation of the EU-CEM framework principles for HMI design and evaluation within CCAM. The alignment between HEIDI's methodologies and EU-CEM strengthens the comparability of HEIDI's outcomes with those of other European projects and contributes valuable experience to the refinement of the EU-CEM itself, as reported in Table 3-1.

Table 3-1: Alignment between HEIDI and EU-CEM

EU-CEM Phase	HEIDI Activities and Outputs
Phase 1: User Needs & Scenarios	HEIDI conducted workshops to define VRUs, elderly, distracted drivers; literature reviews; scenario-based analysis (D1.1, D1.2)
Phase 2: Design & Development	Iterative design of adaptive iHMI and predictive eHMI; use of simulator and real-world prototyping; ethical guidelines (D5.1); alignment with legal constraints (D2.1, D2.3, D2.4, D3.1, D3.3, D3.4)
Phase 3: Evaluation & Impact Assessment	Comprehensive evaluation using objective and subjective measures; simulator and real-vehicle tests; co-simulation studies for cooperative HMI (cHMI) (D5.2, D5.3, D7.1, D7.2)

In the following subsections an exhaustive list of methodologies that were applied in the HEIDI project is provided for each phase identified by the EU-CEM protocol, including short considerations for their strengths and weaknesses.

3.2.1 Phase 1 – User Needs & Scenarios

Methodologies used:

- **User Workshops (elderly, distracted, VRUs):** Conducted participatory sessions with diverse user groups to gather firsthand insights into their challenges, preferences, and expectations in automated mobility scenarios.
- **Literature Review:** Surveyed existing research on human-machine interaction, especially with regard to vulnerable and diverse user types, to inform the design approach and ensure alignment with best practices.
- **Taxonomy Development (user types, capabilities, automation levels):** Developed a classification system covering user demographics, physical/cognitive abilities, and interaction roles across SAE (Society of Automobile Engineers) levels to guide personalized interface design.
- **Scenario-based Analysis mapped to SAE levels:** Created realistic driving and crossing situations linked to different automation levels to support context-aware HMI design and testing.
- **Inclusion of VRUs and older drivers:** Ensured the methodology proactively addressed needs of pedestrians, elderly, and other at-risk groups through inclusive design and validation steps.
- **Real-world scenario representation:** Grounded the project's use cases in everyday traffic situations to maintain ecological validity and relevance of test scenarios.

Strengths:

- **Diverse user representation:** HEIDI engaged various user groups (e.g., elderly, distracted, pedestrians), ensuring that HMI designs consider a wide spectrum of cognitive and physical needs, improving inclusivity.
- **Strong scenario-driven grounding:** Scenarios were based on real-world driving and interaction contexts, which helped ensure that interface features remained relevant, practical, and easily translatable to deployment.

Weaknesses:

- **Limited observational studies in real contexts:** Most user data came from workshops and literature rather than direct observation in natural traffic settings, which may limit insights into spontaneous or nuanced behaviours.
- **Possible bias from workshop format:** Workshop participants might give socially desirable or hypothetical responses that don't always reflect real-world decision-making, reducing ecological validity.

Key Deliverable(s): D1.1

3.2.2 Phase 2 – Design & Development

3.2.2.1 Use Case Definition

Methodologies used:

- **Use Case Workshops:** Collaborative sessions with stakeholders to define and refine interaction scenarios relevant for HMI development across driving contexts.
- **Incremental Use Case Design:** Built up the complexity of use cases step-by-step, ensuring early validation of simpler interactions before integrating more challenging dynamics.
- **Standardized Experiment Templates:** Applied structured formats for experiment definition to maintain consistency and ensure comparability across tests and partners.

Strengths:

- **Traceability to user needs:** Every design decision was explicitly linked back to user needs and use cases, making the process transparent, systematic, and verifiable.
- **Modularity across automation levels:** The design approach was flexible enough to accommodate varying levels of automation (SAE 1–4), making the iHMI/eHMI solutions scalable across future vehicle systems.

Weaknesses:

- **Certain complex scenarios limited by test environments:** Some cooperative or edge-case scenarios (e.g., unexpected pedestrian behaviour) were difficult to replicate accurately in simulator or test-track conditions.

Key Deliverable: D1.2

3.2.2.2 iHMI Design & Development

Methodologies used:

- **Iterative Prototyping:** Developed multiple prototype versions of internal HMI, incorporating user feedback at each stage to progressively refine usability and effectiveness.
- **Multimodal Channels (visual, auditory, ambient):** Designed HMI outputs to be presented across different sensory modalities, improving accessibility and communication clarity for diverse users.
- **Simulator and Real Vehicle Testing:** Validated HMI performance both in simulated environments for control and in real-world vehicle settings for realism and robustness.
- **User-tailored Design (age, attention level):** Adapted interface behaviour and information delivery based on user state (e.g., distracted vs. attentive, young vs. elderly) to optimize understanding and trust.

Strengths:

- **Continuous refinement via user feedback:** The iterative cycle allowed for rapid prototyping, user testing, and successive adjustments, leading to better-aligned, user-approved designs.
- **Adaptive interfaces:** HEIDI's HMI components adapted to user state (e.g., distraction, age), increasing relevance and usability in context-sensitive situations.

Weaknesses:

- **Realism limitations in simulator:** Simulators can't fully reproduce physical or emotional conditions of real traffic (e.g., surprise, urgency), possibly affecting the validity of user responses.
- **Integration complexity:** Designing multimodal, adaptive HMIs and syncing internal and external outputs added technical and architectural complexity, requiring significant coordination.

Key Deliverables: D2.1, D2.3, D2.4, D5.3, D7.1, D7.2

3.2.2.3 eHMI Design & Development

Methodologies used:

- **eHMI Concept Prototyping:** Created and refined external HMI solutions to communicate automated vehicle intentions to pedestrians and other road users.
- **Behavioural Testing in Simulators and Real Environments:** Assessed user reactions to eHMI concepts under controlled and naturalistic conditions to evaluate effectiveness and acceptance.
- **Co-Simulation Approaches:** Simultaneously modelled interactions between vehicle, driver, and pedestrian agents to test cooperative HMI solutions in complex, shared environments.

Strengths:

- **Adaptive and predictive eHMI designs:** The HEIDI project implemented eHMI systems that not only responded to real-time situations (e.g., pedestrian proximity) but also predicted user intent (e.g., whether a pedestrian intends to cross), enhancing safety and proactive communication.

- **Integration with cooperative HMI concepts:** eHMIs were designed in coordination with internal HMIs (iHMIs) and overall vehicle behaviour, supporting smooth interaction between automated vehicles and road users in shared environments — a core requirement for cooperative, connected mobility.

Weaknesses:

- **Cross-cultural perception differences:** Interpretations of eHMI signals (e.g., light colours, icons, or message phrasing) may vary across countries or cultural backgrounds, potentially reducing the universality and effectiveness of the interface unless localized or standardized appropriately.
- **Prototype hardware limitations:** Especially for eHMIs, physical display constraints (e.g., brightness, pixel density) could reduce visibility or interpretability under real-world conditions.

Key Deliverables: D3.1, D3.3, D3.4, D5.3, D7.1, D7.2

3.2.3 Phase 3 – Evaluation & Impact Assessment

Methodologies used:

- **Exploratory Studies (simulator-based):** Conducted early-phase evaluations in driving simulators to test interface usability, functionality, and perceived safety under controlled conditions.
- **Final Validation Studies in Real Vehicles:** Executed end-stage tests using instrumented vehicles on closed tracks or in limited real-world settings to validate findings from earlier phases.
- **Co-Simulation Evaluation:** Used multi-user simulation environments to study dynamic interactions between drivers, and VRUs and assess cooperative system performance.
- **Objective & Subjective Measures:** Combined data such as reaction times, driving metrics, and physiological responses with surveys and interviews to capture a holistic picture of user experience.
- **Ethical Framework & Guidelines:** Ensured that all evaluations adhered to ethical standards, with special attention to privacy, informed consent, and inclusion of vulnerable populations.

Strengths:

- **Multi-method validation:** By combining qualitative (interviews, questionnaires) and quantitative (reaction time, gaze, error rate) methods, HEIDI achieved a comprehensive understanding of HMI impact.
- **Real vehicle and VRU-inclusive testing:** Evaluation extended beyond the lab to include real cars and interactions with pedestrians, improving ecological validity and applicability to real traffic.

Weaknesses:

- **Underrepresented user categories:** Some user categories, especially older or vulnerable participants, were underrepresented in empirical studies, limiting statistical power and generalizability.

Key Deliverables: D5.1, D5.2, D5.3, D7.1, D7.2

3.3 Alignment with the European framework

In line with the EU-CEM, as promoted in the FAME project handbook, HEIDI's methodologies emphasize:

- Inclusive user-centred design through expert workshops and literature-driven user needs analysis.
- Explicit traceability from user needs → use cases → system requirements → HMI prototypes.
- Iterative design and validation, leveraging both simulator-based exploratory studies and real-world field tests.
- Co-simulation methodologies enabling complex interactions between drivers, VRUs, and automated vehicles.
- Combined use of objective and subjective KPIs, facilitating holistic evaluation.

This work provides a practical implementation model of the FAME process and contributes key insights for future European HMI design and validation practices.

To further illustrate the degree of alignment between the HEIDI project's methodological framework and the European Common Evaluation Methodology for CCAM, as defined by the FAME project, the following table provides a detailed cross-reference (Table 3-2). It maps the main steps of the FAME process to the corresponding activities, methodologies, and deliverables developed within HEIDI. This cross-reference highlights the systematic coverage achieved by HEIDI across all key phases of the FAME methodology, from scenario definition to final field testing and impact assessment. Here, it must be reminded that the HEIDI and FAME projects were developed independently. Therefore, the alignment between the respective methodological results is an important contribution in support of user-centred approaches.

Table 3-2: Cross-reference between EU-CEM and HEIDI

FAME Evaluation Step	HEIDI Activity / Methodology	Supporting HEIDI Deliverable(s)
Scenario Definition & User Needs Mapping	Literature review, expert workshops, user taxonomy	D1.1 Description of User Needs
Scenario Specification	Structured Use Case development with traceability to user needs	D1.2 Use Case Definition
Test Requirements & Functional Descriptions	Derivation of system requirements from user needs and use cases	D1.2, D2.4 Revised iHMI Concept, D4.2 Cooperative HMI Concept
Prototype Implementation & Pre-validation	Iterative prototyping of fluid iHMI and eHMI concepts	D2.4, D4.2 Cooperative HMI Concept

Verification & Early Performance Tests	Exploratory simulator studies of iHMI and eHMI	D2.4, D5.3 Results of Validation Tests
Pilot Testing & KPI Collection	Small-scale validation with co-simulation and structured KPI sets	D5.3 Results of Validation Tests
Field Testing, Final Evaluation, Impact Assessment	Large-scale tests in real vehicles and structured HMI rating	D7.1 Report on Evaluation Tests, D7.2 HMI Rating
Ethical, Legal & Privacy Compliance (cross-cutting step)	Definition of ethical guidelines and procedures	D5.1 Ethical Guidelines and Procedures
Validation Methodology Review & State-of-the-Art Alignment	State-of-the-art analysis of validation methodologies	D5.2 State-of-the-Art on Validation Methods

This mapping demonstrates that the HEIDI project not only adheres to the principles of the FAME Common Evaluation Methodology, but also provides concrete examples of its practical implementation in the context of fluid, adaptive, and cooperative HMI development. As such, HEIDI can serve as a valuable reference model for future CCAM projects aiming to align with European standards for validation and evaluation.

4. Impact on future HMI development

The work carried out in the HEIDI project in relation to the development of methodologies for the design and assessment of HMI is expected to provide a substantial impact on future HMI development. Indeed, HEIDI developed methodologies facilitate holistic requirement sets balancing safety, usability, and performance. This effort has the potential to enable automated requirements validation tools in future.

Using a structure consistent with Section 3.2, Table 4-1 outlines the methodologies applied in the iterative design, development, and evaluation of future HMIs, specifying which of these can benefit from the HEIDI methodologies and in what way.

Table 4-1: HMI phases and expected methodological impact

Phase	Activity	Description
Design	Rapid Prototyping	Creation of mock-ups, wireframes, and digital twins for concept visualization.
	Co-Design Workshops	Collaborative design sessions with stakeholders to align goals and gather insights.
Development	Agile Development Sprints	Iterative implementation and refinement of HMI features.
	Simulation-Based Prototyping	Use of driving simulators to test and develop HMI functionality in realistic conditions.
Assessment	Wizard-of-Oz Testing	Simulated system behaviour with hidden operator control to assess user interaction.
	User Testing in Simulators	Evaluation in static and dynamic driving simulators.
	Real-Vehicle Validation Trials	Testing on closed tracks and controlled public roads.
	Behavioural, Physiological, and Subjective Evaluation	Includes NASA-TLX, SUS, eye-tracking, and workload measures.

Overall, the strengths of the HEIDI methodologies rely on:

- the iterative loops that foster continuous improvement;
- multimodal evaluation (objective + subjective) to increase confidence in the results;
- early detection of usability and comprehension issues

On the other hand, the major weaknesses consist of:

- Transferability gap between simulator and real-world behaviour;
- Wizard-of-Oz testing, which may limit realism in automated interactions;
- Real-vehicle testing, which is constrained by safety and legal boundaries

In the analysis of strengths and weaknesses a few methodological aspects that were considered in the HEIDI methodologies reveal high potential impact for future HMI development, as briefly reported below.

User Needs: Capturing how users actually interact with systems is crucial for HMI. Real-world relevance ensures interfaces are intuitive and user-centred. However, gathering this information can be time-consuming and resource-heavy (e.g., requiring field studies, surveys, user testing). Future improvements could include more personalized and inclusive HMI designs, potentially supported by adaptive systems and diverse user modelling.

Use Cases: Designing around real-world scenarios makes HMIs more applicable. But it's challenging to cover edge cases or rare situations (e.g., sudden driver handover due to a medical event). Future systems may use dynamic scenario generation or AI-based simulation tools to expand the range and realism of test cases.

System Requirements: Defining requirements ensures technical feasibility and regulatory compliance across engineering domains. However, there can be conflicts between disciplines (e.g., usability vs. safety, or design vs. legal requirements). In the future, automated tools for requirement traceability and validation could help align these interests more efficiently.

Iterative Design: A core principle in HMI development, where feedback loops are used to refine the interface continuously. A major issue is the simulator-reality gap — designs that work well in simulation might not perform the same in real vehicles. Future iterations could leverage AI, virtual reality (VR), and digital twins to create more realistic and responsive test environments.

Table 4-2 summarizes strengths, weaknesses and potential impact of the above-mentioned methodological aspects.

Table 4-2: General Observations & Implications for Future HMIs

Aspect	Strength	Weakness	Future Potential Impact
User Needs	Real-world relevance	Time/resource intensive	More personalization, inclusivity
Use Cases	Scenario relevance	Hard to cover edge cases	Dynamic scenario adaptation
System Requirements	Standard-compliance, multi-discipline	Conflicting priorities	Automated traceability, validation
Iterative Design	Continuous improvement	Simulator-reality gap	AI/VR-enhanced iterative design

The HEIDI project has demonstrated that evolving HMI development methods offer a solid foundation for advancing human-in-the-loop design. By integrating technologies like virtual reality (VR) and AI-based user simulation, future HMI systems can better model user interactions with greater accuracy and lower development costs. These tools make testing environments more realistic, immersive, and cost-effective, helping accelerate the iterative design of user-centred interfaces.

Overall, the HEIDI approach—combining user-centred design, scenario-based thinking, requirements engineering, and iterative prototyping—proved to be a robust process for HMI development. Still, challenges remain in terms of scalability, realism, and managing complexity. This points to future opportunities for using AI-driven simulations, digital twins, and VR-based evaluation to further enhance next-generation HMI systems.

5. Best Practices for Future HMI Developments

The HEIDI project has generated a wealth of insights and practical guidance for UX/UI (User eXperience / User Interface) designers working on Human-Machine Interfaces in the context of automated and cooperative mobility systems. The following best practices are derived from the project's iterative design, development, and validation work, and are intended to support professionals in applying these insights to their work (Table 5-1). To effectively implement these practices, UX/UI designers should maintain close collaboration with human factors experts, behavioural scientists, and validation engineers throughout the design lifecycle.

Table 5-1: Best Practices

Best Practice	Rationale / Guidance for Application
Start with broad, inclusive user taxonomy	Conduct a comprehensive user needs analysis, including vulnerable users (e.g., elderly, children, impaired). Involve domain experts and use workshops to capture real-world needs.
Link user needs explicitly to use cases	Develop detailed use cases that clearly map back to user needs. Use traceability matrices to ensure that design decisions can be validated against initial requirements.
Use progressive scenario complexity	Start testing HMIs in simple, controlled scenarios and progressively introduce complexity to better simulate real-world interactions. This allows incremental refinement and ensures robustness across contexts.
Design fluid, adaptive HMIs	Implement context-aware and state-adaptive UI components that adjust modality, priority, and level of detail according to driver state and situational demands. Minimize unnecessary cognitive load.
Combine objective & subjective metrics	Integrate behavioural data (e.g., reaction times, driving performance) with subjective feedback (e.g., perceived usability, trust) to capture a complete picture of user interaction quality.
Integrate co-simulation in validation	Use co-simulation environments where drivers and VRUs can interact in shared virtual spaces. This enables testing cooperative behaviours and optimizing message synchronization across internal and external HMIs.
Perform real-world validation	Conduct validation in actual vehicles and urban environments to ensure that simulator-based findings transfer effectively to real-world use. Include diverse user groups in field studies.
Iterate based on exploratory study feedback	Treat exploratory studies as key sources of design insights. Regularly review and incorporate user feedback, observed interaction patterns, and behavioural anomalies into design iterations.
Adopt a multi-modal design approach	Design HMIs that combine visual, auditory, and (where appropriate) tactile feedback. This improves accessibility and supports redundancy for critical information in high-demand situations.
Use FAME-compatible modular validation architecture	Structure validation processes to align with the FAME methodology. This ensures that results are comparable across projects and supports the building of shared European validation frameworks.

By applying these best practices, UX/UI professionals can contribute to the development of HMIs that are safe, intuitive, and trusted by all road users; supporting the broader goals of Cooperative, Connected, and Automated Mobility.

6. Conclusion and Recommendations

The HEIDI project demonstrates that a modular, iterative, and adaptive approach to HMI development is both feasible and effective for advancing CCAM systems. Its methodologies align strongly with the FAME Common Evaluation Methodology and offer a practical blueprint for future European HMI validation frameworks. Going forward, greater emphasis should be placed on multi-actor co-simulation, cross-project KPI harmonization, and longitudinal field testing to further strengthen the robustness and generalizability of HMI evaluation. The HEIDI experience highlights the critical role of user-centred, scenario-based validation in ensuring that next-generation HMIs foster trust, safety, and smooth interaction in increasingly automated mobility ecosystems.

Based on the HEIDI project findings, the following best practices and recommendations are proposed to guide future HMI developments and validation approaches in CCAM systems:

1. Adopt an inclusive, systematic definition of user needs to ensure HMIs address the full diversity of road users.
2. Establish explicit traceability between user needs, use cases, and system requirements to enable structured validation.
3. Leverage iterative, fluid, and adaptive HMI design principles to optimize user interaction, trust, and acceptance.
4. Combine subjective and objective metrics in all stages of validation to provide comprehensive insights.
5. Incorporate co-simulation methodologies to enable realistic testing of complex, multi-actor traffic scenarios.
6. Ensure real-world testing complements simulation-based studies, validating transferability of results.
7. Align validation architectures with the modular approach proposed in the FAME methodology, facilitating harmonization and comparability across projects.
8. Promote cross-disciplinary collaboration between HMI designers, behavioural scientists, and validation experts to foster holistic design and assessment.

Note: This report made use of generative AI support (ChatGPT, OpenAI, July 2025) for drafting and summarization assistance [2]. All final interpretations and conclusions are the responsibility of the authors.

7. Abbreviations

Term	Definition
CCAM	Cooperative, Connected and Automated Mobility
cHMI	Cooperative Human-Machine Interface
eHMI	External Human-Machine Interface
EU-CEM	European Common Evaluation Methodologies
FAME	Framework for coordination of Automated Mobility in Europe
HEIDI	Holistic and adaptivE Interface Design for human-technology Interactions
HMI	Human-Machine Interface
iHMI	Internal Human-Machine Interface
KPI	Key Performance Indicator
R	Document, Report
SAE	Society of Automobile Engineers
SEN	Sensitive
UX/UI	User Experience / User Interface
VRU	Vulnerable Road Users
WP	Work Package

8. References

[1] FAME Project Consortium. (2024). *Common Evaluation Methodology for CCAM: Evaluation Framework Handbook, Version 1.0.* European Commission, Horizon Europe FAME project, Grant Agreement No. 101069559.

[2] OpenAI. (2025). ChatGPT (July 2025 version) [Large language model]. Retrieved from https://openai.com/chatgpt

A. Annex

Cross-Reference Table

FAME Step	HEIDI Deliverables
Step 1: User Needs & Scenarios	D1.1, D1.2
Step 2: Design & Development	D2.1, D2.3, D2.4, D3.1, D3.4, D4.2
Step 3: Evaluation & Impact Assessment	D5.1, D5.2, D5.3, D7.1, D7.2
Continuous Iterative Process	D2.3, D5.3, D7.1