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## Navigating the road ahead: Advancing transportation infrastructure maintenance for sustainable mobility.

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This work addresses the following topic(s) from the Call for Contributions:  
(Please check at least one box)

- Placemaking to integrate urban spaces and mobility
- Promoting sustainable mobility choices in metropolitan regions
- Governing responsible mobility innovations
- Shaping the transition towards mobility justice
- System analysis, design, and evaluation
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### Extended Abstract

#### Problem statement

Giving priority to the maintenance of existing transport infrastructure over the construction of oftentimes very energy- and material-intensive new infrastructure presents a key sustainability challenge in the field of mobility today. This is particularly relevant in highly developed countries of the Global North that have developed large-scale infrastructure systems to facilitate automobility during the second half of the twentieth century and that are looking for novel ways to enhance the circularity of these existing material stocks. For example, Germany is currently facing a rapidly deteriorating transport infrastructure system, including bridges and tunnels that are now in need of urgent maintenance (e.g. Deutscher Städtetag 2022). However, much policy regarding infrastructure maintenance remains patchy and disjointed, leading to serious maintenance gaps. Cumbersome planning processes, labour and material supply issues and regulatory hurdles lead to further delays in urgently needed maintenance work and increase costs. As a result, the public image of maintenance projects is often poor, limiting their appeal as a target of political and practical activity.

#### Research objectives

This article offers an interdisciplinary perspective on transport infrastructure maintenance as a tool for advancing sustainability in the mobility sector. Fusing insights from social science, human geography, urban planning, transport economics and transport infrastructure engineering, we argue for a novel approach to transport infrastructure maintenance based on integrated sustainability and circularity assessments. First, our conceptual and empirical work serves to highlight barriers to maintenance. Building on these insights, the paper explores how different decision support systems that seek to proactively address operational inefficiencies can promote effective and timely transport infrastructure maintenance work. Here, the study compares and contrasts different established decision support systems such as Cost-Benefit Analysis (CBA), Life Cycle Analysis (LCA) and

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multi-criteria decision making (MCDM), and their (un)suitability for evaluating maintenance projects (cf. Annema et al. 2015). It subsequently explores possible alternatives that prioritize sustainability and circularity criteria.

### **Methodological approach**

Cost-Benefit Analysis (CBA) has served as a pivotal tool for the evaluation and facilitation of decision-making processes pertaining to the financing of large-scale infrastructure initiatives. Notably, the European Commission has consistently relied upon CBA as the preferred methodology for the assessment and guidance of investments spanning various modes of transport infrastructure alongside other multifaceted projects (Lovrenčić Butković et al., 2023). At its fundamental core, CBA seeks to identify the most optimal viable alternatives, ascertain the requisite financial resources for project realization, examine the project's impacts within a predefined area, and evaluate the potential risks and their corresponding financial and economic implications.

Against the backdrop of a comprehensive analysis of transport infrastructure maintenance in Germany over the past decade, this study presents a cost-benefit analysis (CBA) of a selected case study – the Allach tunnel maintenance project in the Munich region in Southern Germany – to illustrate the benefits and drawbacks of this particular decision support tool for enhancing circularity in transport infrastructure. This analytical exercise entails an exhaustive exploration of the financial and environmental factors, particularly emphasizing the social dimension of CBA that aims to capture all welfare effects. At the same, it seeks to identify gaps in current CBA approaches that prevent a more comprehensive assessment of the long-term sustainability benefits of maintenance projects.

### **(Expected) results**

Regarding the case study, the CBA evaluation method presents three distinct scenarios for consideration: a “business as usual” scenario, a scenario involving tunnel maintenance provision, and a scenario that entails the construction of a new tunnel. The ultimate objective is to assess which of these alternatives best serves the broader community's interests. This evaluation is carried out from an aggregate perspective level, and it aims to determine whether the project yields benefits for society at large or the overall economy (Mackie et al., 2014). In addition, the study identifies gaps in the CBA method that prevent a more comprehensive appreciation of the circularity potential of maintenance work and, by extension, the wider sustainability impacts of such projects. Here, our findings underscore the significance and benefits of maintaining existing infrastructure compared to constructing new tunnels or leaving the infrastructure unattended. However, addressing the procedural concerns requires institutional interventions rather than analytical resolutions. It is imperative to recognize that the solution to the process issues is not rooted in analytical findings but in the development and implementation of new institutional policies.

### **References**

Annema, J. A., Mouter, N., & Razaei, J. (2015). Cost-benefit analysis (CBA), or multi-criteria decision-making (MCDM) or both: politicians' perspective in transport policy appraisal. *Transportation research procedia*, 10, 788-797.

Deutscher Städtetag (2022) Investitionsstau für kommunale Infrastruktur bei 150 Milliarden Euro. <https://www.rnd.de/politik/staedtetag-150-milliarden-euro-investitionsstau-fuer-kommunale-infrastruktur-4PAGR7FI7VCVPDBN62KMWGUAWY.html>

Mackie, P., Worsley, T., & Eliasson, J. (2014). Transport appraisal revisited. *Research in Transportation Economics*, 47, 3-18.

Lovrenčić Butković, L., Mihić, M., & Sigmund, Z. (2023). Assessment methods for evaluating circular economy projects in construction: A review of available tools. *International Journal of Construction Management*, 23(5), 877-886.