

Intelligent Mass Management for Infrastructure Optimisation

Reducing Cost and Carbon Through Digital Earthworks Planning

Target: Project Owners, Transport Authorities and Engineering Firms

Executive Summary

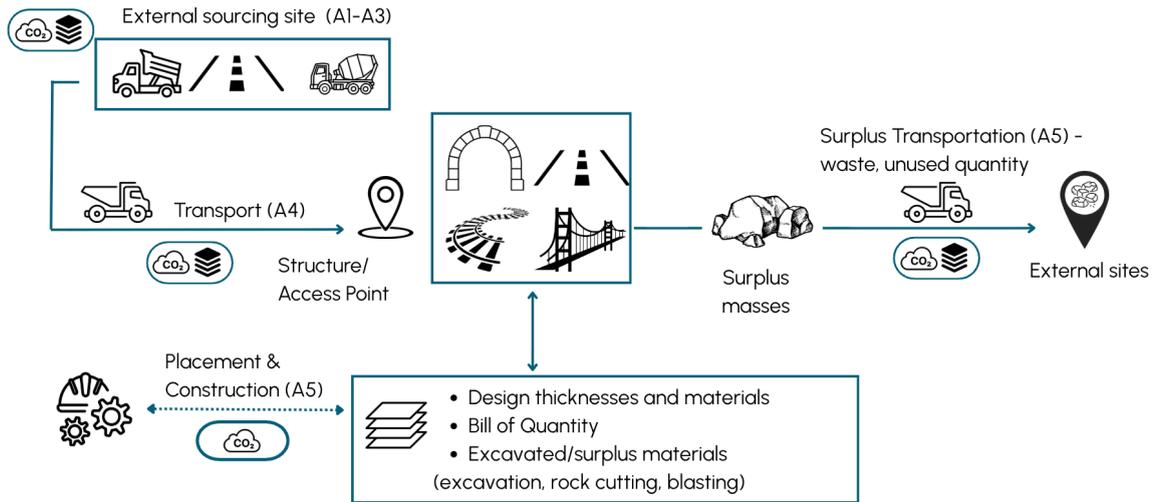
Earthworks account for 20-30% of infrastructure project costs and 21% of construction-phase emissions; yet most projects lack systematic mass-management optimisation. Traditional approaches rely on manual calculations, generic cut-and-fill assumptions, and rule-of-thumb heuristics that miss opportunities for material reuse, balanced earthworks, and integration with the circular economy. The result: Millions in avoidable transport costs, thousands of tonnes of unnecessary emissions, and missed opportunities to leverage excavated materials as resources rather than waste.

ORIS proposes a digital mass management framework that optimises earthworks across the entire project lifecycle, from route selection through detailed design to construction planning. By creating a "living digital model" that evolves with the project, the approach enables continuous optimisation: Comparing alignment alternatives during feasibility, refining cut/fill balance during design, and optimising haulage logistics during construction. The result: Infrastructure that is materially efficient by design, not by accident.

**Source: Multiple peer-reviewed studies on earthwork optimisation, including "Sustainable earthworks: Optimisation with the ICOM method" (2020), showing 5-14% cost and carbon reductions*

The Challenge

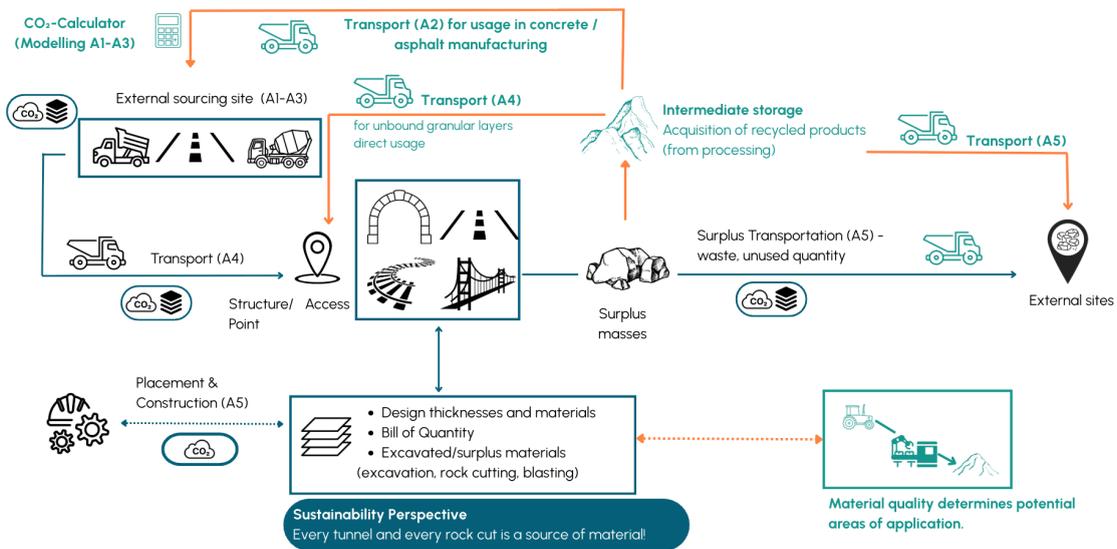
- ✦ Earthworks decisions are made without quantifying mass balance, haul distance, and material reuse opportunities across project phases.
- ✦ Route alternatives are selected based on geometric criteria, without considering earthwork efficiency or potential for circular economy.
- ✦ Manual mass haul calculations cannot evaluate multiple scenarios quickly enough to inform design iterations.
- ✦ Excavated materials are treated as waste rather than evaluated for on-site reuse or circular economy applications.
- ✦ Lack of continuity between project phases prevents optimisation insights from informing subsequent design decisions.



Project Scenario Modelling - Base Case (Traditional Way)

The ORIS Solution: A Living Digital Model Across Project Phases

<p>01 Route Selection Phase → Compare alignment alternatives with quantified earthwork volumes, mass balance efficiency, and transport logistics</p>	<p>02 Design Optimisation Phase → Simulate cut/fill scenarios, stockpile locations, and local material sourcing to minimise haul distances and maximise reuse</p>
<p>03 Circular Economy Integration → Identify opportunities for excavated material reuse, recycled aggregate substitution, and material flow optimisation</p>	<p>04 Living System Continuity → Digital model evolves as a SaaS platform, enabling ongoing optimisation as designs mature and construction planning progresses</p>



Project Scenario Modelling - Enhancing the Project's Circularity



Key Benefits & Quantifiable Impact



Cost Efficiency

→ 5–14% cost reduction through optimised mass management.



Emission Reduction

→ 5–14% reduction in construction-phase CO₂.



Circular Economy Enablement

→ Systematic evaluation of excavated materials reduces virgin aggregate demand.



Design Continuity

→ Living digital model preserves optimisation insights across all project phases.

Success Story: Länsirata (West Railway) Project, Finland

Working for Länsirata on Finland's 100km One-Hour Train high-speed rail project (113 bridges, 22 tunnels), ORIS optimised over 400 sections through systematic mass management analysis. The digital framework enabled comparisons of earthwork alternatives, identification of circular-economy opportunities, and integration of proactive adaptation measures. By treating the ORIS platform as a living system throughout the design process, the project team continuously refined mass balance optimisation as designs matured, demonstrating how digital mass management transforms from a one-time study into an ongoing design tool.

Conclusion

This approach addresses the infrastructure sector's most overlooked cost and carbon driver: the movement and management of earth. By treating mass management as a lifecycle optimisation challenge rather than a one-time calculation, the framework enables continuous improvement from route selection through construction. The living digital model ensures that optimisation insights inform decisions at every stage, transforming earthworks from a cost centre into a source of efficiency and circular-economy value.

About ORIS

ORIS Materials Intelligence brings together digital and sustainable transformations in the infrastructure sector through a faster, cheaper, and more accurate consulting approach that leverages data and AI. It helps infrastructure players quantify their carbon emissions, optimise their material choices, and transition from traditional reporting to data-driven decision-making, thanks to AI- and LCA-based insights. This enables them to secure financing, reduce costs, ensure climate resilience and progress towards net-zero targets for their projects.

