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# CLIMATE-SMART CONSTRUCTION

From commitment to  
verifiable practice  
in Teivo-Mäkkylä

2026



\*This policy brief is a student work related to the course *Urban Lab 2: Planning Policy and Infrastructure*, organised by Tampere University's Bachelor's degree programme in Sustainable Urban Development.

# EXECUTIVE SUMMARY

The Teivo-Mäkkylä development is at a critical decision point where foundational infrastructure choices will become effectively irreversible. At the same time, the municipality's commitment to 'climate-smart construction' has not been translated into operational criteria, monitoring practices, or clearly assigned responsibilities. As a result, the municipality risks advancing through critical planning phases without a way to demonstrate, verify, or steer sustainability performance as decisions are taken.

In the absence of shared verification standards, sustainability commitments may be applied inconsistently across project stages, weakening the municipality's steering capacity and its ability to defend decisions retrospectively. Once the early planning choices are embedded in infrastructure and zoning, they are likely to persist, exposing the municipality to governance and reputational concerns.

## Key findings:

- Sustainability commitments cannot be enforced or defended without clear ways to measure progress.
- Early planning decisions tend to persist even when improved or updated information becomes available.
- Multi-actor development processes increase the need for shared evidence and agreed checkpoints to ensure consistent outcomes.
- Comparable municipal development projects demonstrate that iterative, evidence-based verification is operationally feasible and improves outcomes.

## Recommendation:

Introduce a phase-gate sustainability verification system, under which progression from one planning or implementation phase to the next requires an updated, evidence-based sustainability assessment. This process operates through defined checkpoints, assigns responsibility, and specifies the evidence required to support each stage. It can be gradually built into existing planning practice, beginning with the upcoming detailed plan stages.

Without such a process, the municipality risks proceeding through a critical stage of development without the ability to monitor and, where necessary, correct its own sustainability commitments.

## Why Teivo-Mäkkylä needs a credible path to climate-smart construction

The new district of Teivo-Mäkkylä in Ylöjärvi strives to be a 'climate-smart' addition to the broader Tampere city region. Still, it has not translated this ambition into operational standards, verification measures, or clearly assigned responsibilities. Early decisions on land use and infrastructure are constraining future development options available, which will affect the area for decades as planning progresses.

Without defined criteria and shared verification practices, sustainability considerations risk being interpreted differently across actors and development phases, which in turn threatens the long-term success and cohesion. This brief addresses the lack of an implementation structure that allows 'climate-smart construction' to be evaluated, demonstrated, and adjusted as the project progresses.

### EVIDENCE FOR PHASED, ADAPTIVE SUSTAINABILITY VERIFICATION

#### STOCKHOLM, SWEDEN

HIGHWAY 73 EMBANKMENT PROJECT  
Technical proof-of-concept

- Continuous data-driven updating under uncertainty
- Probabilistic digital twin (PDT) in use during construction
- Settlement predictions updated with monitoring data
- Evidence reviewed at staged points

#### FREIBURG, GERMANY

VAUBAN DISTRICT  
Sustainability governance model

- Long-term transition built through phased governance
- Standards were tightened gradually
- Feedback loops enabled learning over time
- Sustainability treated as revisable

#### TAMPERE, FINLAND

HIEDANRANTA DISTRICT  
Domestic planning precedent

- District-scale sustainability ambitions
- Multi-actor coordination required for delivery
- Shared criteria and continuity processes central
- Gaps emerge without phase-based verification

## Research approach

This brief is based on a qualitative review of publicly available municipal development materials, including environmental and traffic assessments, and discussions with project stakeholders. These sources were examined to analyse the presence of measurable sustainability criteria, verification practices and assigned responsibilities. It builds on relevant academic and policy literature and assesses approaches by comparatively benchmarking developments in Finland, Sweden, and Germany.

## Why current policies cannot deliver a climate-smart construction

Sustainability claims are often used to frame the ambitions of new urban districts, but when such claims are articulated as fixed headlines rather than tested across planning phases, they offer little guidance for decisions taken over time (Wallin, 2025). In multi-stage planning processes, the absence of criteria that can be revisited and updated means that sustainability cannot be tested or corrected as conditions change, allowing early assumptions to persist unchallenged.

Teivo-Mäkkylä illustrates this gap at a critical moment. Although the development is presented as 'climate-smart', its planning documents do not specify how to interpret or demonstrate it in practice. As the project is nearing phases in which land-use and infrastructure choices are increasingly fixed, early assumptions risk being embedded in difficult-to-revise designs. In this context, in the absence of operational sustainability criteria, matters both in principle and timing. It coincides with moments when planning decisions begin to lock in long-term outcomes.

The gap has compounding effects. Without shared indicators or verification practices, different actors are likely to interpret 'climate-smart' by their own priorities (Valta et al., 2025). The small inconsistencies accumulate across phases, making it harder to ensure that decisions are still aligned with the development's stated ambitions. At the same time, the city lacks the means to show that sustainability considerations are applied consistently or that decisions remain justified. The issue is thus not a lack of vision, but rather the absence of a workable channel through which that vision can be made credible and actionable across the development lifecycle.

From the municipality's perspective, the change is a series of explicit checkpoints that require updated evidence for progression.

## Evidence supporting phase-gate sustainability verification

The verification gap in Teivo-Mäkkylä does not stem from weak sustainability ambitions. Instead, it persists due to planning processes that systematically replicate this gap at each project phase.

## THE VERIFICATION GAP

### PROBLEM IN FOCUS

Climate-smart construction is an ambition rather than an operational requirement.

### UNDERLYING CAUSES

- Path-dependent planning practices
- Absence of measurable indicators
- Fragmented multi-actor governance
- Lack of data-driven updating systems

### POLICY RELEVANCE

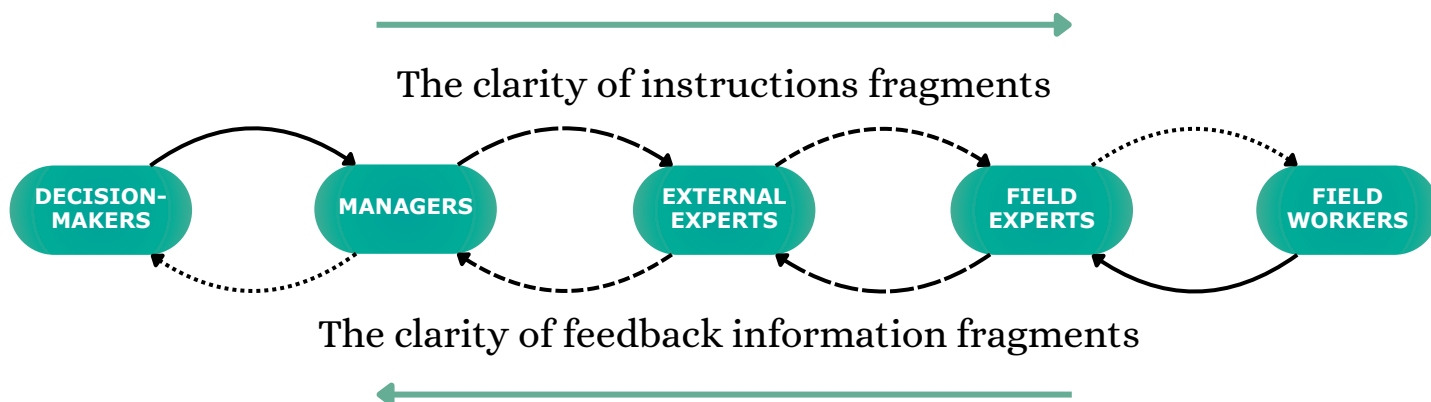
Findings show that Teivo-Mäkkylä requires a structure that ensures sustainability is evaluated and updated throughout the project lifecycle. Sustainability must be treated as a continuous, cross-phase process, not a one-time planning declaration.

*First*, path dependence materialises when early spatial and infrastructure assumptions, including the planned tramway extension, begin to structure street layouts, density decisions, and investment logic before final investment and implementation decisions are taken. *Second*, accountability ends up fragmented across the multi-actor development process. Planning documents show that the responsibilities of ‘climate-smart construction’ are distributed among municipal units, developers, and service providers. Yet, no single point at which the evidence for sustainability must be jointly reviewed exists. *Third*, evidence updating is inconsistent at decision moments. Assessments of traffic, groundwater behaviour, and settlement impacts are conducted at different phases without systematic re-examination in response to evolving conditions (Wallin, 2025; Ylöjärven kaupunki & INARO).

The following examples illustrate the technical, governance, and regional dimensions of why the gap persists, as well as what addressing it requires in practice.

## Evidence for multi-actor coordination under municipal control

The development provides evidence that coordinated governance and shared criteria are essential for achieving sustainability at the district level. Interviews with utility companies, developers, municipal actors and service providers revealed that stakeholders operate from different incentives and responsibilities, indicating that effective path creation occurs when responsibilities, data and criteria are organised at the district scale rather than relying on informal alignment. In response, the city established a dedicated intermediary to coordinate, manage, and ensure that decisions could be updated as the project progressed. The case also shows that project-wide learning—facilitated by early workshops, cross-sector engagement and shared platforms—emerges when continuity is deliberately managed over long development timelines. For Teivo-Mäkkylä, this highlights the governance principle it demonstrates. Continuity does not materialise through informal alignment alone in a multi-actor district development; it demands an explicitly assigned coordinating role. Hiedanranta’s application is evidence that lasting sustainability outcomes rely on institutionalised coordination, even when achieved incrementally and through context-specific arrangements rather than via a new standalone organisation (Valta et al., 2025).



## Evidence for governance continuity and coordination

Over three decades, the city advanced from low-energy buildings to passive-house and plus-energy neighbourhoods through a sequence of incremental policy steps, with each stage informed by documented learning from earlier phases. Research on Vauban’s building sector highlights that learning-by-doing, phased experimentation, and regular tightening of criteria were central to this process, with compliance treated as temporary, rather than fixed at each approval stage. This provides regional evidence that sustainability standards can be hardened over time only when decisions allow additional revisions across phases (Fastenrath & Braun, 2018).

## Evidence for revisability across planning phases

For Teivo-Mäkkylä, a probabilistic digital twin (PDT) illustrates how relevant conditions can be systematically reassessed as new information emerges. By integrating all available data and their associated uncertainties, a PDT produces a continuously updated picture of physical site conditions. This includes both ‘property data’ (i.e., direct measurements done on the field) and ‘behaviour data’, such as monitoring of groundwater levels and settlements throughout the project’s lifespan. Designed to accommodate sparse, incomplete, and multisource data, the PDT supports structured evidence updating by identifying when and where the collection of new information would most effectively reduce uncertainty (Cotoarbă et al., 2025).

# What happens when sustainability cannot be verified

The three cases in our analysis show that when assumptions are not checked during delivery, they turn into commitments that are difficult to revise. In Teivo-Mäkkylä, this is already visible as planning advances. Several early choices already depend on conditions that have not been verified, such as the tramline to Ylöjärvi. Although its construction is still uncertain, parts of the street layout and density logic assume it will be built. If the tram does not materialise, the municipality would need to explain why it approved a layout based on infrastructure it could not guarantee. This risk of locking in designs around uncertain infrastructure implies that approval must become provisional rather than fixed.

The same issue appears in the environmental and mobility assessments. Groundwater behaviour, settlement patterns and traffic flows change as construction progresses. Without defined checkpoints, these changes are not incorporated into decisions. If a design later underperforms, planners will have limited grounds to justify the deviation because no structured process existed to update the assumptions. This risk of being unable to justify deviations implies that assumptions must be revisited at defined points rather than carried forward by default.

These gaps create risks for accountability and legal defensibility. When decisions are questioned by the council, residents or external reviewers, the municipality must show that it acted on the best available evidence at the time. A static approval model makes this difficult because it relies on a single justification at the master plan stage. The risk of weak evidentiary grounding implies that decision-making requires a traceable record of how evidence was reviewed across phases.

ASSUMPTIONS → DECISIONS → DEFENSIBILITY

## What this means for Teivo-Mäkkylä

The implication for policy logic is substantial. Treating sustainability as a one-time approval allows inconsistencies to accumulate across phases. Treating it as a process creates a structure where assumptions can be corrected before they become commitments. For Teivo-Mäkkylä, this shift would reduce the risk of locking in designs that depend on uncertain infrastructure, improve the city's ability to justify decisions and provide a clearer basis for defending choices if they are contested.

If these implications are taken seriously, the effects would be institutional rather than operational. Clear rules for when evidence must be reviewed would create predictable moments for revisiting assumptions. Responsibility for assessing that evidence, when placed with a defined actor, would provide a stable point of accountability across phases. A structured way of updating information would ensure that decisions are based on conditions as they evolve across phases. Together, these shifts would make sustainability something that can be demonstrated throughout the development process.

### SHORT-TERM

Relevant when early assumptions begin shaping spatial choices, investment logic, or design direction.

Matters at moments when new information emerges that could alter those assumptions.

### LONG-TERM

Relevant as conditions evolve across planning and construction phases, and when decisions require defensibility over time.

Matters whenever sustainability performance must be demonstrated or revisited.

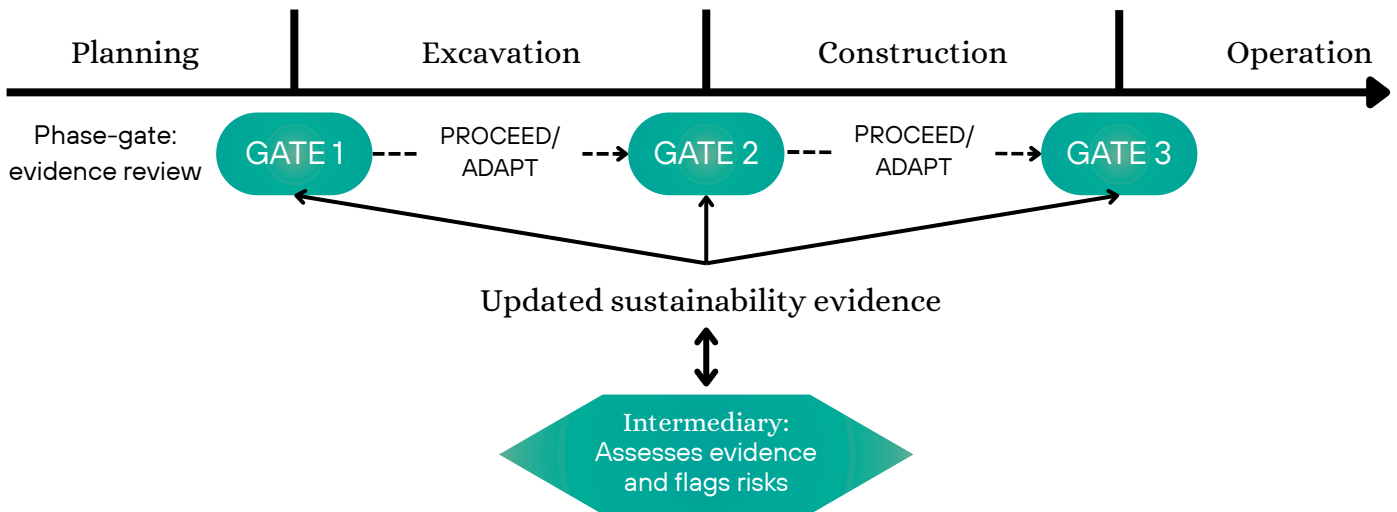
# Recommended actions

These recommendations specify how sustainability-related decisions must be reviewed, justified and allowed to proceed across development phases, while leaving political authority unchanged.

## Condition project progression on phase-gate sustainability verification

Advancement of the project should depend on the review and availability of up-to-date sustainability evidence at clearly defined decision points. Progression from one planning or construction phase to the next, such as moving from excavation to building, should be contingent upon the submission of current sustainability evidence that reflects present site conditions and the decisions pending at each stage.

This approach makes sustainability verification a formal procedural requirement, with each phase-gate serving as an evidentiary checkpoint. Which, in turn, promotes that anticipated sustainability risks and outcomes remain aligned with established goals at the time each decision is made.



## Assign responsibility for phase-gate evidence assessment

Responsibility for assessing the sufficiency of sustainability evidence at each phase-gate should be clearly assigned. Building on experience from comparable district developments such as Hiedanranta, the City of Ylöjärvi should designate an intermediary to coordinate sustainability-related information across actors and phases.

This intermediary would evaluate whether available evidence satisfies the criteria for progression at each phase-gate and report its findings to municipal decision-makers, emphasising projected sustainability outcomes and associated risks.

## Phase-gate evidence updating for sustainability verification

To ensure phase-gate verification is effective, sustainability assessments must rely on evidence that has been updated since the previous decision point and accurately reflects current site conditions and outstanding planning decisions. As environmental dynamics, infrastructure needs, and construction outcomes evolve throughout the project, sustainability evidence should be re-evaluated at each phase-gate, rather than relying on unaltered evidence from earlier stages.

To meet this information requirement, the municipality may use an information tool capable of integrating evidence and changes, as well as enabling the comparison of projected outcomes across phases. A probabilistic digital twin (PDT) is one illustrative option. Its role is purely evidentiary, to support phase-gate decisions by providing current, comparable, and uncertainty-aware information. The choice of tool remains flexible in principle and should serve the phase-gate requirement and not constitute a standalone policy objective.

*To conclude*, the recommendations redefine sustainability as an ongoing, evidence-monitored status rather than a single approval event.

They preserve existing political decision-making authority while providing clear guidance on when sustainability evidence should be revisited, evaluated, and substantiated as Teivo-Mäkkylä advances.

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