

Structural Admissibility Surface

The structural admissibility surface disclosed in provisional application 64/050,895 is a property surface of a credentialed admissibility profile that declares the structural mechanical properties of a credentialed structural element. It is signed by a structural-engineering authority with declared scope, bound to the element's identity through the authority signatures block, and composed with the other property surfaces of the profile, including the energy storage surface, through declared and signed composition rules. Because the surface is a credentialed, versioned, revocable element of the profile rather than a static report, a building-code authority and a building energy management system can evaluate the material's structural admissibility as one surface among independently credentialed peers.

Mechanism: A Property Surface For Structural Mechanical Properties

The structural admissibility surface is a property surface of a credentialed admissibility profile that declares the structural mechanical properties of a credentialed structural element. In the disclosed architecture, energy storage and other functions are treated not as properties of dedicated devices but as credentialed properties of structural building materials, and each declared property is carried on its own admissibility surface. The structural surface is one such surface, declaring the element's structural

mechanical performance, including the realized composite-scale tensile capacity on which load-class admission depends, alongside the thermal, energy storage, electrical distribution, data network, water-coupled, fire-performance, and carbon-sequestration surfaces that the same element may carry.

Each admissibility surface declares property-specific parameters and admission conditions for one declared building-code-recognized or operationally-recognized property category. The structural surface therefore states the parameters by which a building-code authority and the building energy management system can evaluate whether the element is admissible for a declared structural use, and admits independently for its corresponding requirement. The plurality of surfaces composes through declared composition rules to produce a composite admissibility profile that is evaluable by a building-code authority and by the building energy management system.

The structural surface is bound into the credentialed admissibility profile through the authority signatures block, which binds the entire profile to the credentialed structural element's identity through one or more cryptographic signatures of credentialing authorities admitted to the architecture. The cryptographic-signature scheme follows the keyless-identity-through-continuity primitive of the Identity Application, providing classical public-key signature compatibility while admitting continuity-based identity verification. The structural surface is thus not a free-standing report but a signed constituent of the profile whose binding to the element's identity is verifiable in band.

Profile versioning is maintained through monotonically increasing version vectors with conflict-resolution policies declared by the composition-rule architecture, so that updates to the structural surface are ordered deterministically rather than overwritten. Authority revocation is handled through the credentialed-revocation primitive of the Identity Application; revocation events propagate through the lineage chain and are honored prospectively at admissibility-evaluation time. A revocation that affects the structural surface is therefore evaluated as of the time admissibility is checked, while the lineage chain preserves the prior credentialed states.

Authority And Scope

The structural surface is signed by a structural-engineering authority with declared scope. In the disclosed multi-authority credentialing arrangement, each surface is independently credentialed by an authority with declared scope: a structural-engineering authority signs the structural surface; a thermal-rating authority signs the thermal surface; a fire-marshal authority signs the fire-performance surface; a utility or building-code authority signs the storage surface; and an environmental-credit authority signs the carbon-sequestration surface. The structural authority's signature is therefore interpreted within the structural scope, and the non-structural surfaces are signed by their respective authorities under the authority signatures block.

Multi-authority credentialing of a credentialed structural-storage element is performed by a manufacturer authority, a building-code authority, a utility authority, a carbon-credit authority, and an independent testing authority, producing a composed admissibility profile by which the element is admitted into building-scale operations, building-code review, grid-services participation, carbon-credit issuance, and independent verification. The independent testing authority is the disclosed mechanism by which test results enter the profile; the structural-engineering authority and the building-code authority evaluate the element for structural admissibility within their declared scopes.

The structural surface persists across the element's lifecycle. At end-of-storage-life, a credentialed transition in which the realized energy storage capacity has degraded below a declared threshold, the credentialed admissibility profile is updated to reflect zero or reduced storage capacity while the structural admissibility surface continues to support the element's structural function. The structural surface is thus decoupled from the storage surface's degradation, and the element remains in service as a structural body after its storage function has ended.

Where the deployment requires it, the disclosed architecture admits continuous re-credentialing across operational material flows during the element's in-service lifetime, each material flow being a credentialed event signed by an installer authority and recorded in the lineage chain, and the composite admissibility profile is re-evaluated against the cumulative material flow rather than only at original installation. Authority revocation propagates through the lineage chain and is honored prospectively at admissibility-evaluation time, and the lineage chain preserves prior credentialed states rather than overwriting them.

Alternative Embodiments

In a first alternative embodiment the credentialed structural element carries a per-element identity that the structural surface references. The identity is assigned through one or more classes declared in the element's admissibility profile: a tag-bonded identity class, in which an RFID, NFC, optical, or comparable identity tag is permanently bonded to the element during manufacturing; a physical-fingerprint identity class, in which an identity is derived from a hash of physical characteristics observable post-manufacturing, including the element's unique impedance signature, surface texture pattern, fiber-distribution pattern, or random nano-scale features, the hash being signed by the manufacturer authority; and a per-batch-with-subdivision identity class, in which elements share a batch identity at manufacturing and subsequent credentialed events subdivide it into per-element identities through credentialed attestation by the installer authority.

In a further embodiment the structural surface participates in the cradle-to-cradle credentialed substrate lifecycle, in which the element's lifecycle is recorded in a lineage chain comprising pre-installation credentialing, in-service credentialed operation, end-of-storage-life substate, end-of-structural-life decommissioning, recycling-grade re-credentialing, and re-installation in a subsequent structural application. End-of-structural-life decommissioning is a credentialed event signed by a licensed demolition or deconstruction contractor admitted under credentialed scope, producing a

demolition-recovery attestation that declares the recovered material's grade, mass, and physical state; recycling-grade re-credentialing is performed by a recycler authority and produces a new admissibility profile at recycled grade.

In a still further embodiment the structural surface is read as a distributed physical-state observation. The credentialed structural-storage substrate operates as a distributed physical-state observatory in which the building energy management system observes the substrate's electrical state to detect events of interest, and the state-of-health attestation primitive records the realized capacity, power capacity, cycle count, calendar age, round-trip efficiency, fault history, and degradation indicators of a credentialed structural element. The structural surface composes with this observed state through the disclosed composition rules rather than through any free-standing report.

Composition With The Energy-Storage Surface

For materials that simultaneously carry a structural surface and an energy storage surface, most prominently the cementitious-graphene composite class, the structural surface composes with the energy storage surface through declared composition rules. Two disclosed rules bind these surfaces. A structural-load-vs-storage-cycle rule reduces storage admissibility when the structural admissibility surface reports structural fatigue accumulation above a declared threshold. A mechanical-fatigue-derated capacity rule operates on the storage admissibility surface as a function of the structural admissibility surface, alongside the freeze-thaw-derated capacity rule and the carbonation-tracked-state-of-health rule that operate as functions of the structural and environmental surfaces. The structural authority signs the structural surface and the storage authority signs the storage surface; the composition rule binds the two without merging them.

Each composition rule is a credentialed and signed data artifact held in a composition-rule registry, declaring a scope of property surfaces and conditions to which the rule applies, a composition logic specifying how the relevant admissibility surfaces interact under the enumerated conditions, a version vector for deterministic conflict resolution, a conflict-resolution policy selected from latest-signed-rule, declared-precedence-table, and authority-rank-resolution, and an authority signature. The registry is consumed by the building energy management system at admissibility-evaluation time, so that the composition decision is reproducible from the signed and versioned rule rather than from a narrative trade-off statement.

Prior-Art Distinction

Existing building codes recognize multiple material properties of building components, including structural load ratings, fire-resistance ratings, thermal insulation R-values, sound transmission ratings, and vapor permeability, but none of them recognize energy storage, electrical distribution, data networking, or carbon sequestration as material properties of structural building components, and existing architectures do not treat the built environment as a single credentialed substrate whose structural, thermal, energy storage, distribution, network, fire-performance, and carbon-sequestration properties are independently credentialed but compositional surfaces. What the disclosed structural surface adds is that the structural mechanical properties are declared on a credentialed, signed surface that composes with the other surfaces of the same element under signed and versioned composition rules and that is bound to the element's identity through the authority signatures block. Prior structural-battery and embedded-battery research treats the storage device as the architectural primary and does not contemplate composition with thermal, fire-performance, carbon-sequestration, or distribution surfaces as independently credentialed peers; the disclosed architecture treats the structural surface as one such peer, signed within its declared scope and composable with the others.

Disclosure Scope

This article describes subject matter disclosed in U.S. Provisional Application No. 64/050,895. The scope encompasses the structural admissibility surface as a property surface declaring the structural mechanical properties of a credentialed structural element, the structural-engineering authority that signs it within its declared scope and the multi-authority signature block that binds the profile to the element's identity, the composition of the structural surface with the energy storage surface and other surfaces under the disclosed composition rules, the per-element identity classes and profile versioning, and the cradle-to-cradle lifecycle, decommissioning, and re-credentialing transitions recorded in the lineage chain. The disclosed architecture is not limited to a particular material class and contemplates structural elements across the cementitious composite systems described in the specification.

The scope further encompasses the composition rules that bind the structural surface to surfaces other than the energy storage surface, where each such composition rule is itself a signed and versioned artifact held in the composition-rule registry, and the building energy management system that consumes the registry and the structural surface at admissibility-evaluation time. This article does not describe energy-storage-cell internals, which are the subject of a separate filing; the structural admissibility surface authorizes the element's structural participation in the credentialed architecture rather than describing any storage mechanism.

Credentialed Surfaces ([/credentialed-materials](#))

[All 40 steps](#) → ([/inventive-steps](#))

Building surfaces as credentialed agents that participate in the structure's networking and electrical systems.

Provisional application

PRIMARY TECHNICAL DISCLOSURE

- [credentialed-building-materials-cryptographic-admissibility-for-structural-surfaces \(/articles/credentialed-building-materials-cryptographic-admissibility-for-structural-surfaces\)](/articles/credentialed-building-materials-cryptographic-admissibility-for-structural-surfaces)

SECONDARY TECHNICAL

- [credentialed-materials/carbon-sequestration-property-surface \(/articles/credentialed-materials/carbon-sequestration-property-surface\)](/articles/credentialed-materials/carbon-sequestration-property-surface)
- [Composition Rules Governing Surface Interactions \(/articles/credentialed-materials/composition-rules\)](/articles/credentialed-materials/composition-rules)
- [Decommissioning And Re-Credentialing Attestation \(/articles/credentialed-materials/decommissioning-and-recredentialing\)](/articles/credentialed-materials/decommissioning-and-recredentialing)
- [Electrical-Distribution Admissibility Surface \(/articles/credentialed-materials/distribution-property-surface\)](/articles/credentialed-materials/distribution-property-surface)
- [credentialed-materials/end-of-storage-life-attestation \(/articles/credentialed-materials/end-of-storage-life-attestation\)](/articles/credentialed-materials/end-of-storage-life-attestation)
- [credentialed-materials/energy-storage-property-surface \(/articles/credentialed-materials/energy-storage-property-surface\)](/articles/credentialed-materials/energy-storage-property-surface)
- [Lineage Chain Across Material Lifecycle \(/articles/credentialed-materials/lineage-chain-across-lifecycle\)](/articles/credentialed-materials/lineage-chain-across-lifecycle)
- [Master Credential Signature Binding All Property Surfaces \(/articles/credentialed-materials/master-credential-binding\)](/articles/credentialed-materials/master-credential-binding)
- [Multi-Authority Signature Block \(/articles/credentialed-materials/multi-authority-signature-block\)](/articles/credentialed-materials/multi-authority-signature-block)
- [Data-Networking Admissibility Surface \(/articles/credentialed-materials/network-property-surface\)](/articles/credentialed-materials/network-property-surface)
- [Profile Versioning Continuity \(/articles/credentialed-materials/profile-versioning-continuity\)](/articles/credentialed-materials/profile-versioning-continuity)
- **[credentialed-materials/structural-property-surface \(/articles/credentialed-materials/structural-property-surface\)](/articles/credentialed-materials/structural-property-surface)**
- [credentialed-materials/thermal-property-surface \(/articles/credentialed-materials/thermal-property-surface\)](/articles/credentialed-materials/thermal-property-surface)
- [Versioned Admissibility Profiles With Lineage Chain \(/articles/credentialed-materials/versioned-profiles-with-lineage\)](/articles/credentialed-materials/versioned-profiles-with-lineage)
- [credentialed-materials/water-coupled-property-surface \(/articles/credentialed-materials/water-coupled-property-surface\)](/articles/credentialed-materials/water-coupled-property-surface)

[Credentialed Surfaces overview → \(/credentialed-materials\)](/credentialed-materials)

