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Electrical-Distribution Admissibility Surface

The distribution admissibility surface, disclosed in Provisional Application 64/050,895 as one of the credentialed property surfaces of a credentialed structural panel, declares an electrical-distribution capability of the panel through a conductive layer topology specification, a surface attachment specification, a surface conductivity specification, an inter-panel continuity specification, a per-zone current limit specification, a voltage class declaration, a fault response specification, an optional data signaling capability declaration, and an electrical-code-compliance attestation. The surface admits the panel to carry distribution function under credentialed control, recording the distribution capability as a signed property of the structural panel rather than relying on separately installed branch-circuit conductors.

Mechanism of the Distribution Surface

A credentialed structural panel comprises a structural matrix carrying the storage admissibility surface of the credentialed-materials primitive and further carrying a distribution admissibility surface, a credentialed admissibility surface that declares an electrical-distribution capability of the panel. The distribution admissibility surface is one surface among a plurality of independently credentialed property surfaces that compose through declared composition rules, and it is bound to the identity of the

credentialed structural element through a credentialing signature block carrying one or more cryptographic signatures of credentialing authorities admitted to the disclosed architecture.

The distribution admissibility surface comprises a conductive layer topology specification, a surface attachment specification, a surface conductivity specification, an inter-panel continuity specification, a per-zone current limit specification, a voltage class declaration, a fault response specification, an optional data signaling capability declaration, and an electrical-code-compliance attestation. The credentialed surface attachment of devices to the panel produces a credentialed attachment event signed by both the panel's credentialed identity and the attached device's credentialed identity and recorded in the lineage chain, so the declared distribution capability participates in the building's electrical system under credentialed control rather than through separately installed branch-circuit conductors.

Specification Components of the Surface

The distribution admissibility surface declares its capability through several specification components. The **conductive layer topology specification** comprises one or more of a continuous conductive surface plane operable across the panel's surface area, a patterned conductive grid operable through energized and grounded zones at controlled geometry, layered conductive arrangements comprising distinct planes for power distribution and for return path, and embedded busbars operating at higher current density than the surrounding distribution surface. The **surface attachment specification** declares the attachment classes by which devices couple to the panel's surface, including magnetic snap-on, pin-array, adhesive-conductive, capacitive coupling, inductive coupling, and hybrid combinations, each admitting an attachment-credential exchange between the panel's credentialed identity and the attached device's credentialed identity.

The surface further carries a **surface conductivity specification**, an **inter-panel continuity specification**, a **per-zone current limit specification**, a **voltage class declaration**, and a **fault response specification**. The panel admits bidirectional surface attachment, in which a surface-attached device may operate as a load drawing power from the panel and may also operate as a source supplying power to the panel, each operation being a credentialed event recorded in the lineage chain. The surface also carries an **optional data signaling capability declaration**.

The surface concludes with an **electrical-code-compliance attestation**. The structural-to-electrical interface satisfies applicable electrical-code requirements through grounding and bonding of conductive elements integrated into the structural matrix, arc-flash and shock protection consistent with operating voltages and fault-current capabilities, isolation under fault conditions operating independently of the building energy management system, integration with fire-protection systems for coordinated isolation and de-energization during fire events, and inspection and accessibility provisions consistent with code requirements. Operating voltages typically below 60 volts DC qualify substrate operations as Class 2 or Class 3 wiring under NFPA 70 Article 725 and as compatible with NFPA 70 Article 680.

Alternative Embodiments

The means by which energy moves between the structural matrix and the building's electrical system is declared as part of the credentialed admissibility profile through a structural-to-electrical interface specification, which operates through one or more topology classes. An embedded electrode network topology comprises distributed conductive current collectors selected from carbon mesh, conductive polymer strands, copper rods, carbon-fiber tow, and combinations thereof, embedded throughout the structural matrix at controlled spacing in the range of approximately 0.3 to 1.0 meters and aggregating to terminal collectors at the element's electrical-access perimeter. A

surface electrode termination topology comprises conductive boundary strips integrated with electrical-box flanges, conductive trim profiles, baseboards, ceiling-line trim, or dedicated termination channels.

A per-zone power electronics topology comprises a plurality of zones each comprising a zone converter, a per-zone state-of-health monitor, a per-zone fault-detection-and-isolation circuit, and a connection to a building low-voltage DC bus aggregating the zone converters into a master inverter at the point-of-common-coupling. Hybrid topologies combine the foregoing within a single element or assembly. In each case the surface's declared capability is bounded by the substrate's engineered properties, and the surface is verifiable by any party that can read the cryptographic signature.

The panel-as-distribution-substrate primitive composes with the storage admissibility surface to support local source-load coupling, building-bus arbitration, distributed generation integration, per-room aggregation, and per-building aggregation. The aggregate copper reduction relative to conventional AC branch-circuit topology is typically in the range of approximately 50 to 80 percent, operating through elimination of per-receptacle homeruns, lower conductor sizing through DC operation at smart-load-managed loads, integrated thermal management through the panel's structural mass, and load coordination by the building energy management system.

Composition and Authority

A representative distribution-surface composition comprises (a) the specification components described above declared within the credentialed admissibility profile; (b) a credentialing signature block binding the profile to the identity of the credentialed structural element through one or more cryptographic signatures of credentialing authorities admitted to the disclosed architecture; (c) a binding between the credentialed identity and the physical substrate, implemented through an RFID, NFC,

optical, or comparable identity tag permanently bonded to the element during manufacture; and (d) the lineage chain in which credentialed events, including credentialed attachment events and bidirectional source-load events, are recorded.

The disclosed architecture admits multi-authority credentialing of a structural-storage element, in which the plurality of admissibility surfaces composing a credentialed structural element may be signed by different credentialing authorities, each attesting to the property category within its competence. The signature block binds the credentialing authorities to the declared capability, and the composite admissibility profile is evaluable by a building-code authority and by the building energy management system.

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. None of the existing building codes recognize electrical distribution as a material property of structural building components. Existing electrical codes treat energy storage and distribution as installed equipment; there is no provision in the existing electrical code for distribution as a property of structural building elements aggregated by the building's electrical system.

What is not taught in this prior-art body, and what the disclosure of Provisional Application 64/050,895 establishes, is the recording of an electrical-distribution capability as a credentialed admissibility surface bound to a structural panel, composing with the storage and other property surfaces through declared composition rules, and evaluable by a building-code authority and by the building energy management system. The structural-to-electrical interface satisfies applicable electrical-code requirements, with operating voltages typically below 60 volts DC

qualifying substrate operations as Class 2 or Class 3 wiring under NFPA 70 Article 725 and as compatible with NFPA 70 Article 680, and the electrical-code-compliance attestation is carried as a component of the surface itself.

Disclosure Scope

The disclosure of the distribution admissibility surface in U.S. Provisional Application No. 64/050,895 covers (a) the recording of an electrical-distribution capability of a credentialed structural panel through the specification components described above, bound to the credentialed structural element by a credentialing signature block; (b) the conductive layer topology classes, the credentialed surface attachment classes, and the bidirectional source-load operation by which the panel participates in the building's electrical system; (c) the structural-to-electrical interface topology classes, including embedded electrode network, surface electrode termination, per-zone power electronics, and hybrid topologies; (d) the electrical-code-compliance attestation and the qualification of substrate operations below 60 volts DC as Class 2 or Class 3 wiring under NFPA 70 Article 725 and as compatible with NFPA 70 Article 680; and (e) the multi-authority credentialing of the structural-storage element. The scope extends to credentialed structural elements in which a credentialed material participates in electrical distribution under signed-property control, and is not limited to the implementation embodiments of any single example.

PRIMARY TECHNICAL DISCLOSURE

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

Credentialed Surfaces overview → (/credentialed-materials)