

# Highway Infrastructure as Credentialed Marker Network

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## What This Application Specifies

Highway lane markers, edge markers, and intersection markers integrate the dual-use article. Vehicles passing the markers read credentialed payloads as positioning observations; human drivers see standard retroreflective markers. The deployment composes with conventional highway maintenance processes.

Marker authority composition structures map to highway reality: state DOT authority for installation, federal-highway authority for cross-state composition, coalition authority for cross-border highway corridors. The architecture supports the multi-authority reality of highway operations.

## Why It Matters Operationally

Current autonomous-vehicle positioning depends on HD-map preloading, GNSS, and on-vehicle perception. The HD-map maintenance burden is significant; GNSS denial defeats positioning; on-vehicle perception faces structural limitations in adverse conditions.

Credentialed marker networks produce structural support. Markers provide positioning that survives GNSS denial; the marker maintenance composes with existing highway maintenance; AV positioning gains structural redundancy.

## **How It Composes With the Domain**

Each marker installation enters the mesh as a credentialed event. AV passes generate credentialed positioning observations. Cross-jurisdiction highway operations admit through cross-state federation. Adversarial actions (marker tampering, marker substitution) surface as credentialed integrity events.

Highway-maintenance workflows compose with marker management. Marker installation, marker replacement, and marker decommissioning all enter as credentialed events; the maintenance authority signs the events; downstream consumers admit against the maintenance chain.

## **What This Enables**

Highway operators gain structurally-supported AV-positioning infrastructure that composes with existing maintenance. AV manufacturers gain positioning resilience that on-vehicle perception alone cannot provide. Highway commerce (tolling, V2I services) gains structurally-credentialed infrastructure.

The architecture also supports highway evolution. As emerging highway capabilities (V2X, dynamic lane management, dynamic-priority operations) mature, the architecture admits the new capabilities through declared credentialed marker payloads.