

# Multi-Class Operator Parameterization

by [Nick Clark](#) | Published April 25, 2026

## What Multi-Class Parameterization Specifies

The marker-track architecture treats operator class as a configuration parameter. A passenger AV configures the architecture for personal-comfort patterns and intra-city operation. Commercial freight configures for highway long-haul or intermodal handling. Emergency response configures for graduated-response operation under operator direction. Transit configures for fixed-route operation with passenger handling. Each class differs in specific parameters but operates the same architectural primitives.

The credentialed marker stream's payload accommodates class-specific information. A segment may authorize different operating envelopes for different classes (lower speed for transit, higher speed for emergency, weight restrictions for freight). The vehicle's class identity is itself credentialed, and the segment's authorization considers the vehicle's class.

## Why Per-Class Engineering Fragments AV Development

Each vehicle class has been treated as a separate engineering problem. Passenger AVs build their own architecture; commercial trucking builds its own; emergency

response builds its own. The cumulative engineering effort across classes is substantial; cross-class learning is limited.

Architectural parameterization changes the pattern. The same primitives operate across classes; investment in the architecture benefits all classes; learning from one class's deployment informs other classes' deployments.

## **How Class-Specific Authorization Operates**

When a vehicle approaches a segment, both the segment's authorization payload and the vehicle's class credential are evaluated. The segment may admit the vehicle's class at a specific operating envelope; the vehicle adjusts operation accordingly.

Cross-class operations gain structural support. Mixed traffic where multiple classes share roads operates through the same architectural framework. Cross-class coordination — emergency-response vehicles taking precedence over commercial freight, transit having priority lanes — operates through credentialed cross-class authorization.

## **What This Enables for the Transportation Ecosystem**

The transportation ecosystem gains a unified architectural foundation. L4/L5 commercial deployment progresses faster when investment in one class's primitives accelerates other classes' deployments.

Cross-class regulatory frameworks (state DOT regulation that applies consistently across passenger AVs, commercial freight, and emergency response) gain structural support. The patent positions the primitive at the architectural layer where vehicle-class engineering currently fragments.

