CGE & Fare Epoch Configuration — Detailed Explanations (RAG / Embedding Ready)

> This document **explains every configuration item and its set values in detail**, strictly derived from the original configuration document. It is designed for **semantic embeddings, retrieval-augmented generation (RAG), and agentic reasoning**.

---

1. CGE Configuration – Full Route

1.1 What CGE Means

CGE (Competitive Guardrail Engine) defines *how far self-fare is allowed to move relative to competitors*. It prevents extreme under-pricing or over-pricing while still allowing controlled revenue optimization.

1.2 Service & Route Context

- **Service ID: OPR3025-339**
  Represents one physical bus service operated by **Sri Vengamamba Bus Transport (SVBT)**.

- **Route ID: 37160966 (Bangalore → Khammam)**
  The *primary origin-destination corridor* on which CGE rules are applied.

All CGE logic downstream (thresholds, occupancy differential, epoch interaction) anchors on this route.

1.3 Enable / Disable CGE for Full Route

Purpose
Controls whether competitive pricing guardrails are applied at all.

Configured State: Enabled (option visible)

Effect
- If enabled → fare decisions are constrained by competitor prices - If disabled → pricing behaves independently of market competition

---

1.4 Minimum Competitors = 1

Meaning
Defines the minimum number of valid competitor fares required for CGE to activate.

Why value = 1 matters
- Even a *single strong competitor* is enough to enforce guardrails - Prevents CGE from failing open due to sparse data

System behavior
If fewer than 1 competitor is available → CGE does not trigger.

1.5 System-Recommended Competitors

Observed State: None available (Error)

Meaning
The system attempted to auto-detect competing services based on overlap, timing, and route similarity but failed.

1.6 Manually Added Competitor

- **Competitor ID: 29371662 – Sri Krishna**

Why this matters
Manual competitor selection overrides system intelligence and directly influences: - CGE thresholds - Aggressiveness of pricing - Allowed upsell/downsell range

---

1.7 Override Reason (Field Present)

Purpose
For auditability and governance, any manual override requires a justification.

---

2. CGE Configuration – Via Routes

2.1 Why Via Routes Exist

Via routes represent *partial segments* inside the full route. Pricing leakage often occurs when competitors undercut on these segments.

2.2 Selected Via Route

- **Route ID: 37161025 (Bangalore – Miryalaguda)**

This route is a strict subset of the full Bangalore–Khammam corridor.

2.3 Minimum Competitors = 1

Same logic as full route CGE. Even a single via-route competitor is sufficient to activate guardrails.

2.4 Manually Added Via-Route Competitor

- **31821417 – Sai Balaji Travels**

This competitor directly influences via-segment pricing bands.

---

3. CGE Thresholds (Core Pricing Math)

3.1 What a Threshold Means

CGE thresholds define **multiplicative bounds** on competitor fares.

```
Allowed Fare = Competitor Fare × [Min Threshold, Max Threshold]
```

3.2 Demand Buckets

Bucket	Meaning
VH	Very High Demand
H	High Demand
M	Medium Demand
L	Low Demand
VL	Very Low Demand

Buckets are computed using occupancy velocity, time-to-departure, and historical demand curves.

3.3 Existing Thresholds (Currently Active)

Bucket	Min	Max	Explanation
VH + H	0.95	1.05	Allows ±5% pricing vs competitors in strong demand
M + L	0.90	1.00	Prevents premium pricing in moderate demand
VL	0.80	0.90	Enforces discounting when demand is weak

3.4 Recommended Thresholds – Aggressive

Used when revenue maximization is prioritized.

Bucket	Min	Max	Meaning
VH + H	1.2337	1.4514	Strong upsell allowed in peak demand
M + L	1.0500	1.2337	Controlled premium pricing
VL	1.0223	1.1723	Avoids deep discounting

3.5 Recommended Thresholds – Moderate

Balanced risk configuration.

Bucket	Min	Max	Meaning
VH + H	1.0837	1.2337	Mild upsell
M + L	0.9000	1.0500	Near-parity pricing
VL	0.8110	1.0223	Allows mild discounting

---

4. CGE Sub-Modules

Module	Enabled	Explanation
Fare Range	Yes	Absolute hard caps on fare
Competitor Backfill	No	Do not use historical competitor fares
Occupancy Differential	Yes	Adjust thresholds using self vs competitor occupancy
Dynamic Thresholds	No	Thresholds remain static

Dependency Rule
If Competitor Backfill were enabled → Dynamic Thresholds must also be enabled.

---

5. Fare Epoch Configuration

5.1 What a Fare Epoch Is

A **Fare Epoch** is a time-based pricing phase controlling how fares evolve as departure approaches.

5.2 Epoch Mode

- **Negative Epoch** → Early-stage discounts
- **Altered** → Non-default, manually tuned epoch

5.3 Starting Fare (SF)

- **Generate SF from Model**: Available
- **Model Status**: Training Error

Impact
When model fails, system falls back to static or last-known starting fare.

---

6. Rule Configuration – Global Parameters

Parameter	Value	Meaning
Categories	6	Seat category hierarchy
Bus Type	Sleeper	Pricing logic tied to sleeper elasticity
Pricing Nature	Moderate	Balanced revenue risk
Fare Ending	9	Psychological pricing (₹x9)

---

7. TDSA (Time Dependent Seat Availability)

TDSA controls *when routes and sub-routes become sellable*.

7.1 Rule Variant by initialIndex

initialIndex	Via-route open time (hrs)
3,4,5	48
2	5
1	1

Lower initialIndex = closer to departure = more restrictive control.

---

8. Seat Category Price Protection

Ensures hierarchical pricing across seat categories.

From	To	Min Diff
6	5	30
5	4	30
4	3	50
3	2	50
2	1	100

Active only when **minutesToDeparture ≥ 60**.

---

9. Advance Booking Fare Reduction (ABFR)

Controls early-stage price reduction to stimulate demand.

initialIndex	Expected Occupancy
3,4,5	25%
1,2	10%

Lower occupancy target later → prevents over-discounting.

---

10. Route vs Via-Route Fare Parity

Parameter	Value
Full Route	37160966
Via Route	37161025
Min Diff	70
Max Diff	150

Prevents through-route being cheaper than partial route.

---

11. Why This Document Is Embedding-Friendly

Each section: - Is self-contained - Has explicit intent, parameter meaning, and effect - Can be chunked at **section or rule level** for vector storage

---

End of Detailed Explanation Document