

End-to-End Multimodal Transport Process

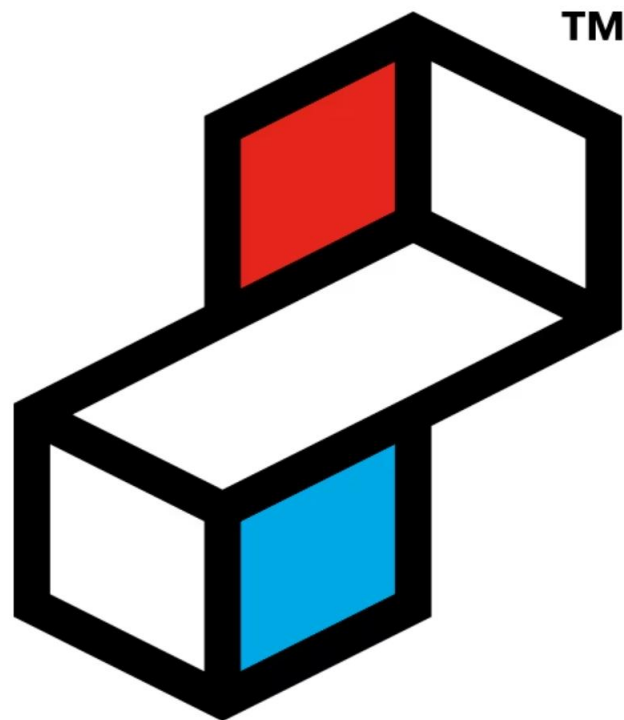
Truck → Rail → Truck

A maximum-detail operational, compliance, and control-tower process guide covering every micro-step, control point, document, and system from first-mile pickup to final-mile delivery.

LOGISTICS OPERATIONS

COMPLIANCE

CONTROL TOWER



CLUSTER FOR LOGISTICS

LUXEMBOURG

ADDING VALUE IS THE KEY.



1. Pre-Booking & Feasibility Assessment

1.1 RFQ Intake & Qualification

Every shipment begins with the structured capture of a Request for Quote (RFQ), received via email, EDI, API, shipper portal, or 4PL control tower. The intake team must record all critical cargo parameters before any feasibility or pricing work begins.

Cargo Profile

- Type: FTL, LTL, palletised, containerised, swap body, trailer
- Dimensions, weight, stackability, loadability
- HS code, ADR class, temperature regime, high-value flag

Service Requirements

- Pickup & delivery addresses (geocoded)
- Pickup/delivery windows & transit-time tier (standard, express, guaranteed)
- Equipment type: container, swap body, trailer, mega trailer
- Terminal pair (origin / destination rail terminals)

Special Requirements

- Customs: T1, EX1, NCTS
- Security: TAPA TSR1/2/3
- Reefer: setpoint, power continuity
- High-value: escorts, geofencing, panic button
- Rail restrictions: loading gauge, wagon type, tunnel codes

1.2 Routing & Operational Feasibility

With the RFQ qualified, the operational planner constructs the full multimodal routing: origin truck leg → rail terminal pair → rail service type → destination truck leg. Each corridor must be stress-tested against timetable slots, equipment compatibility, and regulatory constraints before a quote can be issued.

Route Construction Steps

- Determine origin truck route to rail terminal
- Select rail service: block train, single wagon, intermodal shuttle, or RoLa (rolling highway)
- Confirm rail transit time & timetable (departure/arrival slots)
- Check terminal cut-off times: gate-in, documentation, ADR
- Map destination truck route from terminal to consignee
- Check border crossing requirements (NCTS, CIM/SMGS)

Feasibility Controls

- Rail loading gauge compliance (G1/G2/GA/GB/GC profiles)
- Wagon type suitability (Sgns, Sgmmns, Sggmrss, pocket wagons)
- Terminal crane capacity (reach stacker, gantry crane)
- ADR tunnel code compliance (RID)
- Reefer power continuity: diesel genset vs. terminal plug-in
- High-value secure routing — avoid known hotspots
- Driver hours compliance: pre- and post-rail legs

1.3 Quotation & Booking

A multimodal quotation aggregates costs across all legs and service components. Once accepted, bookings are confirmed simultaneously with all parties – trucking carrier, rail operator, terminals, and customs broker – to lock capacity and document allocations.

1

Calculate All Cost Components

Pre-carriage trucking · Terminal handling (origin & destination) · Rail linehaul · Fuel & energy surcharges · Waiting time · Customs fees · Reefer genset rental · Security escort

2

Issue & Accept Quotation

Send formal quotation to shipper or 4PL. Record acceptance with timestamp, rate validity window, and applicable tariff version.

3

Confirm Booking with All Parties

Trucking carrier · Rail operator (wagon allocation) · Origin & destination terminals (capacity confirmation) · Customs broker if required

4

Booking Controls

Rail slot availability · Wagon allocation confirmation · Terminal capacity confirmation · Sanctions screening · ADR feasibility (road + rail) · Reefer power availability on rail

2. Cargo Preparation at Shipper

2.1 Packaging & Palletisation

Proper packaging is the first physical defence against damage, contamination, and compliance failure. All cargo must be verified and labelled before the pre-carriage truck arrives. Multimodal shipments face higher vibration, shock, and handling cycles than road-only moves.

Verification Checklist

- Pallet quality: EUR/EPAL, CHEP, block pallet
- Shrink-wrap tension & load stability
- Moisture protection: desiccants, VCI film
- ADR packaging: UN-approved materials & closures
- Temperature packaging: insulated, active or passive
- High-value: tamper-evident packaging & seals

Label Application

- Handling labels & orientation arrows
- ADR hazard labels (correct class & subsidiary risk)
- Temperature labels (setpoint, range)
- High-value security seals with serial numbers recorded
- Shock/tilt indicators where required



2.2 Documentation Preparation

Documentation errors are the single most common cause of customs holds, rail delays, and ADR penalties in multimodal transport. Every document must be prepared, cross-checked for consistency, and pre-validated before the truck is loaded.



Commercial & Transport Docs

- Commercial invoice & packing list
- CMR instructions (pre-carriage & final-mile)
- CIM/SMGS draft (rail consignment note)



ADR / Dangerous Goods

- Dangerous Goods Declaration (DGD)
- Tremcard (emergency action card)
- ADR documentation completeness check



Customs & Compliance

- Export documents: EX1, EUR1, Certificate of Origin
- T1 transit document (if applicable)
- HS code validation & licence/permit check



Special Cargo Docs

- Temperature instructions & setpoint confirmation
- High-value security protocol document
- MSDS for ADR cargo

3. First-Mile Truck Transport (Pre-Carriage)

3.1 Vehicle Assignment

The pre-carriage leg delivers the cargo from the shipper's premises to the origin rail terminal. Vehicle selection and pre-departure inspection are critical: a failed PTI or missing ADR kit will cause terminal rejection and rail slot loss.



Vehicle & Equipment

- Vehicle type: tautliner, box, reefer, mega, flatbed
- Straps, load bars, blankets, load locks
- Reefer pre-cooling to setpoint
- Security: locks, seals, GPS tracker, panic button



Pre-Departure Inspection

- Vehicle maintenance records current
- Tachograph calibration valid
- ADR equipment: fire extinguishers, PPE, ADR kit
- Reefer PTI (pre-trip inspection) completed



Driver Controls

- Driver certification (ADR if required)
- TAPA compliance verification
- Reefer temperature validation at departure



3.2 Pickup at Shipper

The physical handover at the shipper is the first point where cargo condition, count, and security are formally recorded. Any discrepancy noted here prevents future disputes about origin-of-damage and establishes chain-of-custody for high-value and ADR shipments.

Gate-In & Briefing

- Driver checks in at gate; security verifies ID, vehicle registration, booking reference
- Driver receives safety instructions, PPE requirements, dock assignment

Loading Process

- Count check & condition check
- Pallet integrity check & weight distribution
- ADR segregation compliance
- Temperature probe insertion (reefer)
- Straps, load bars, dunnage, anti-slip mats applied
- Seals applied: standard or high-security

Departure Controls

- Load securing audit (EUMOS 40509 or equivalent)
- Seal numbers recorded in TMS and CMR
- Temperature probe calibration confirmed
- ADR segregation compliance signed off
- CMR countersigned by shipper and driver

📄 **Key Risk:** Failure to record seal numbers and pallet counts at origin is the primary cause of contested damage claims at destination.

3.3 Transport to Origin Rail Terminal

During the pre-carriage drive, the shipment is under active GPS monitoring. ADR routing rules, driver hours regulations, and high-value security protocols all apply simultaneously. Arrival at the terminal gate must happen before the published cut-off time or the rail slot is forfeited.

1

Depart Shipper

GPS tracking active · Temperature monitoring live · ADR route compliance confirmed

2

En-Route Monitoring

High-value secure routing enforced · Driver hours tracked · Control tower visibility maintained

3

Arrive at Terminal Gate

Driver ID · Vehicle registration · Booking reference · Seal integrity · ADR documentation checked

4

Gate Controls

Access control · Terminal safety rules · ADR gate compliance · Weight bridge check

4. Origin Rail Terminal Handling

4.1 Terminal Check-In

The origin terminal is the critical interface between road and rail. Every unit entering the terminal must be validated for weight, documentation, ADR compliance, and equipment condition. Errors caught here prevent unsafe or non-compliant loads from being placed on the train.

Gate-In Procedures

- Truck enters terminal; gate OCR reads plate and unit number
- Seal check: visual integrity of all security seals
- Weight check on terminal weighbridge – tolerance applied

Documentation & ADR Check

- Documentation check: CMR, DGD, T1, CIM draft
- ADR compliance check against RID requirements
- Reefer: power connection established; temperature log reviewed

Terminal Controls

- Gate OCR for unit/wagon tracking accuracy
- Weight discrepancy tolerance enforced (<2% variation)
- Reefer power continuity confirmed on terminal grid

4.2 Unloading & Pre-Rail Handling

After gate-in, units are positioned in the terminal staging area. A pre-rail condition check creates a formal record of unit status before it is placed on the wagon – essential for damage liability allocation between the trucking carrier and the rail operator.

Handling Steps

- Unload cargo or container from truck
- Move to designated staging area
- Perform damage check – photograph and record any defects
- Temperature check for reefer units – log reading
- Dangerous goods check: labels, packaging integrity, DGD match
- Assign wagon number or loading slot in terminal OS

Pre-Rail Controls

- Damage reporting logged in terminal OS and TMS
- Temperature log validation – excursion alert if triggered
- DG compliance: classification, labels, and segregation plan
- Staging area assignment communicated to loadmaster

📄 **Liability boundary:** The damage check at this point establishes the handover condition from road carrier to rail operator.

4.3 Rail Loading

Loading onto the wagon is a safety-critical operation governed by UIC load-securing standards, ADR/RID segregation rules, and the train's agreed load plan. The loadmaster bears formal responsibility for approving the loaded wagon before it is released for train assembly.

01

Select Wagon Type

Intermodal wagon · Flatcar · Swap body platform · Trailer on flatcar (RoLa) — matched to unit type and loading gauge

03

Loadmaster Validation

Validates load plan compliance: wagon compatibility · ADR segregation · rail loading gauge · weight distribution (centre of gravity)

02

Load & Secure Unit

Apply twistlocks, lashing chains, and securing devices per UIC 591/596. Anti-creep devices for trailers on RoLa wagons.

04

Release for Train Assembly

Wagon number confirmed in rail TMS. ADR wagon list updated. Wagon tagged for train consist.

4.4 Rail Documentation

Rail documentation is legally distinct from road documentation. The CIM consignment note (or SMGS for CIS-country crossings) is the legal transport contract for the rail leg. Accuracy at this stage prevents customs holds at border crossings and destination terminals.

Documents Issued

- CIM consignment note (per COTIF/CIM rules)
- SMGS consignment note (if CIS countries involved)
- Wagon list (full consist)
- Train manifest (departure document)

Systems Updated

- Rail TMS: wagon allocation, departure slot, ETA
- Terminal OS: unit status updated to "loaded on rail"
- 4PL control tower: visibility event pushed

Document Controls

- Document accuracy vs. booking data
- Wagon number validation (physical vs. system)
- DG documentation: class, UN number, quantity, segregation

5. Rail Linehaul

5.1 Train Departure

Before a freight train can depart, a formal sequence of safety validations must be completed. These are non-negotiable under ERA (European Union Agency for Railways) rules and the Infrastructure Manager's network statement. Any failure at this stage delays the entire consist.

1

Train Assembly

All wagons marshalled into final consist order per train plan

2

Brake Test

Full brake test performed and certified; continuous brake percentage confirmed

3

Locomotive Assignment

Traction unit assigned; crew briefed on DG wagon positions and emergency procedures

4

Departure Authorisation

Infrastructure Manager grants path; train departs on allocated slot



5.2 En-Route Rail Operations

Rail linehaul is actively monitored by both the rail operator and the 4PL control tower. Multiple technical interventions — crew changes, locomotive swaps, technical inspections — occur en route and must be tracked to maintain ETA accuracy and temperature/security compliance.

Monitoring & Tracking

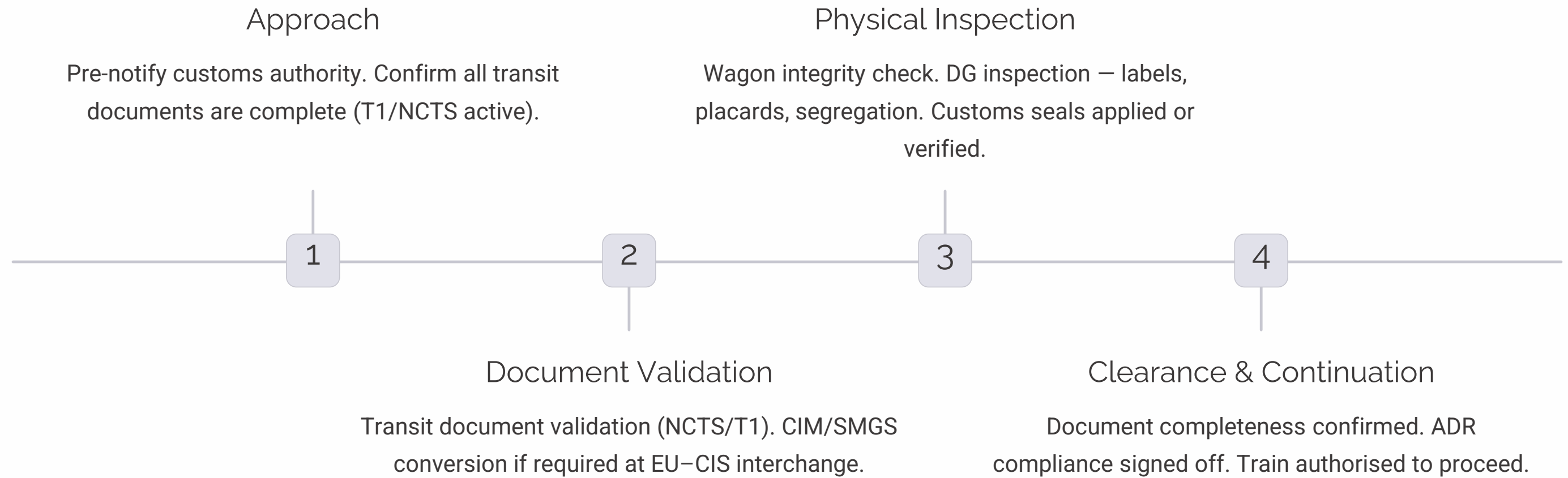
- GPS positioning of consist
- Rail operator ETA updates to control tower
- Border crossing progress tracking
- Wagon temperature monitoring (reefer genset or plug-in power)
- Shock sensors on high-value wagons
- High-value geofencing alerts

Rail Operator Interventions

- Crew changes at designated relief points
- Locomotive changes (traction handover between operators)
- Technical inspections at intermediate yards
- Wheelset checks (flat wheel detection)
- Brake system checks at re-marshalling points
- ADR RID compliance maintained throughout
- Reefer power continuity confirmed at each stop

5.3 Border Crossings

International multimodal corridors typically involve one or more border crossings, each carrying customs, regulatory, and physical inspection risk. CIM-to-SMGS document conversion is required at EU–CIS interchange points. Any wagon found non-compliant at a border may be detached and held.





6. Destination Rail Terminal Handling

6.1 Train Arrival

The destination terminal receives the train against the pre-advised manifest. Safety procedures govern train positioning, and DG wagons must be handled according to the terminal's ADR/RID emergency plan. Arrival event triggers automated ETA updates to consignee and customs systems.

Pre-Arrival Preparation

- Terminal receives wagon list, manifest, and DG list in advance
- Crane/equipment pre-positioned for the consist
- DG handling teams briefed and PPE issued

Train Arrival & Positioning

- Train arrives on scheduled path
- Consist positioned on unloading track per terminal plan
- Rail safety procedures: track isolation, debrake confirmation
- DG wagon positions confirmed against manifest

6.2 Unloading at Destination Terminal

Unloading reverses the origin loading sequence. A thorough condition check at this stage — before units leave the terminal — establishes the end-of-rail-leg condition and is essential for attributing any damage or temperature excursion to the correct carrier.



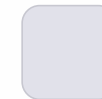
Unload Containers, Swap Bodies, or Trailers

Reach stacker or gantry crane lifts units off wagons. Units moved to terminal staging area. RoLa trailers driven off under own power.



Post-Rail Condition Checks

Damage check: photograph and record.
Temperature check: reefer log downloaded and reviewed for excursions. Seal check: all seals intact and numbers match CIM. DG check: labels and packaging intact.



Reporting Controls

Damage reports raised immediately in terminal OS and TMS. Temperature log validated — excursion escalation procedure triggered if required. DG compliance confirmed before handover to trucking carrier.

6.3 Customs Clearance

Where cargo crosses a customs frontier, import declaration and clearance must be completed before the unit can leave the terminal. Customs authorities retain the right to inspect, X-ray, sample, or seal wagons/units at their discretion. Pre-lodgement of declarations minimises dwell time.

Declarations Submitted

- Import declaration (SAD / ENS where applicable)
- Commercial invoice & packing list
- Certificates: EUR1, COO, phytosanitary, health
- HS code validation against declaration
- Permit / licence compliance check

Customs Examination Options

- Documentary check (Level 1)
- X-ray scan (Level 2)
- Physical inspection and sampling (Level 3)
- Customs seal applied to unit pending payment or bond
- Customs seal integrity maintained until delivery

7. Final-Mile Truck Delivery

7.1 Truck Assignment & Route Planning

The final-mile leg carries the highest risk of theft, temperature deviation, and delivery-window failure. Vehicle and driver selection must mirror the standards applied at the pre-carriage stage, with additional attention to secure routing for high-value cargo and urban access restrictions for ADR.



Vehicle & Driver

- Assign truck type appropriate to cargo
- Driver certification verified (ADR if required)
- Vehicle condition pre-trip inspection
- ADR equipment loaded and checked



Route & Security

- Plan secure route for high-value cargo
- ADR route compliance (tunnel codes, urban restrictions)
- GPS and real-time monitoring active



Temperature Continuity

- Reefer pre-cooled to setpoint before loading
- Temperature probe calibrated
- Continuous monitoring during delivery leg



7.2 Delivery to Consignee

Physical delivery is the final handover point in the multimodal chain. Count, condition, temperature, and ADR unloading compliance must all be confirmed before the driver obtains a clean Proof of Delivery. A signed POD closes the transport contract and initiates the billing cycle.

01

Transport to Consignee

Real-time GPS monitoring · Temperature log continuous · ETA update pushed to consignee · ADR restrictions observed en route

03

Delivery Checks

Count check — every unit accounted for. Condition check — photograph any damage before signing. Temperature check — log downloaded and reviewed. Seal numbers confirmed against CMR.

02

Arrival & Unloading

Check in at consignee gate. Dock assignment. Unloading with ADR compliance: correct PPE, no prohibited mixing with incompatible goods at dock.

04

POD & Close-Out

Consignee signs POD (paper or ePOD). Temperature log handed over to consignee (GDP requirement). Damage report raised immediately if any discrepancy. POD uploaded to TMS and invoicing triggered.

8. Post-Shipment Activities

8.1 Billing & Invoice Reconciliation

Post-delivery billing requires consolidating charges from multiple parties — trucking carriers, terminal operators, rail operator, customs broker — against the original quotation. Surcharges and accessorials must be validated against agreed tariffs before invoices are issued to the client.

Pre-Carriage

First-mile trucking charge per agreed rate card. Waiting time and extra stops if applicable.

Terminal Handling

Origin and destination terminal handling charges (THC). Reefer power connection fees. Storage/dwell beyond free time.

Rail Linehaul

Rail operator invoice: linehaul + energy surcharge + wagon rental. Validate against slot booking confirmation.

Final-Mile & Other

Final-mile trucking · Customs brokerage fees · Security escort · Genset rental · Fuel surcharge · ADR supplement

8.2 KPI Reporting

Performance measurement closes the operational loop. KPIs are reported to the shipper and reviewed internally to identify systemic issues across trucking carriers, rail operators, and terminals. Multimodal sustainability reporting (CO₂) is increasingly a contractual requirement.

OTP

On-Time Performance

On-time pickup · On-time rail
departure · On-time rail arrival · On-
time delivery

DMG

Cargo Integrity

Damage rate (% shipments) ·
Temperature excursions (°C
events) · ADR incidents

OPS

Operational Efficiency

Rail delays (minutes) · Terminal
dwell time · Wagon utilisation (%)

CO₂

Sustainability

CO₂ emissions per tonne-km ·
Modal shift ratio (% rail vs. road) ·
Genset hours (reefer)

8.3 Claims Handling

Multimodal claims are complex because liability shifts between carriers at each handover point (CMR → CIM → CMR). Claims must be raised within strict statutory deadlines — 7 days for visible damage under CMR, 14 days for concealed damage — with documentary evidence gathered at each leg's handover point.



Damage Claims

Supported by: condition photos at each handover · damage reports from terminal OS · signed CMR/CIM exceptions. Liability attributed to leg where damage originated.



Loss Claims

Full cargo or partial loss. Cross-reference count records at each handover: shipper → truck → terminal → wagon → terminal → truck → consignee.



Delay & Temperature Claims

Rail delay claims under CIM Article 43. Temperature deviation claims require continuous log evidence. Reefer power failure records from terminal OS.

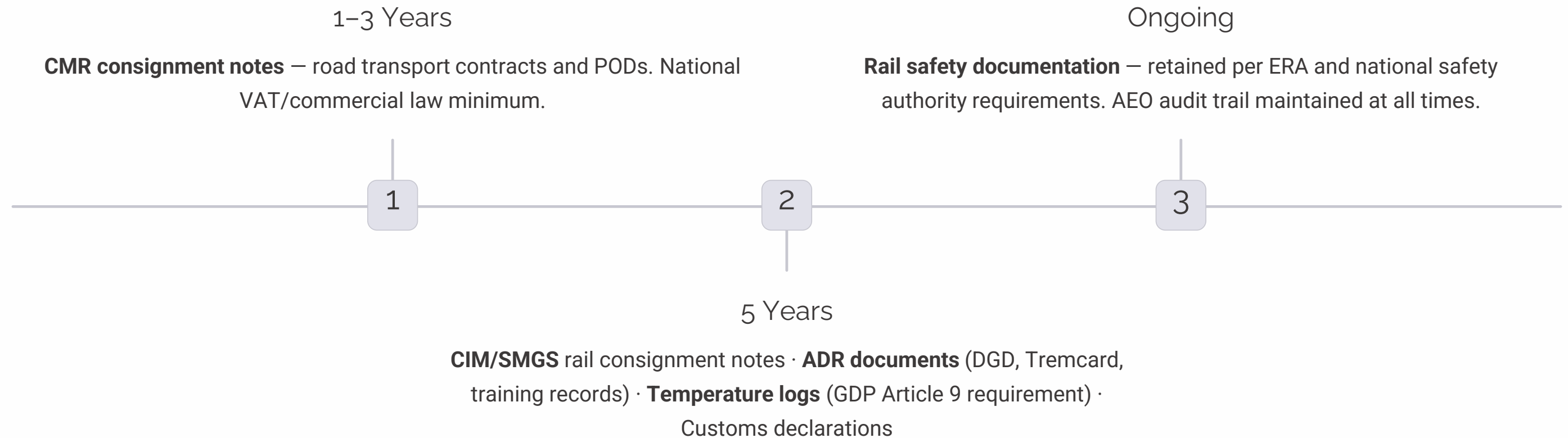


ADR & Rail Incidents

ADR road incident: 1-hour report to competent authority. RID rail incident: immediate report to infrastructure manager. Full root-cause analysis required.

8.4 Data Archiving & Retention

Document retention in multimodal transport is governed by multiple regulatory frameworks simultaneously. Non-compliance with retention requirements can result in customs penalties, loss of AEO status, or inability to defend legal claims. All records must be stored in a tamper-evident, retrievable format.



📄 **Best Practice:** Store all documents in a single digital repository linked to the shipment reference number, enabling instant retrieval for customs audits, claims, and KPI reviews.