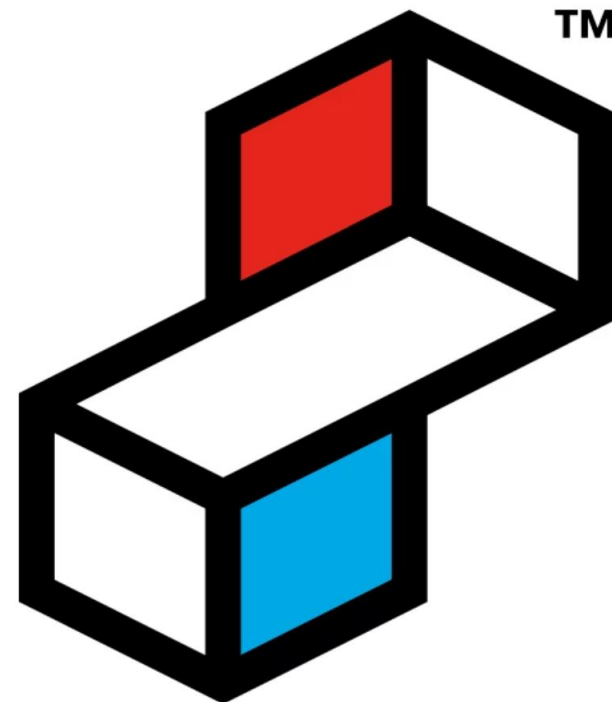




# End-to-End Inland Waterway Barge Shipment Process

A maximum-detail operational guide covering every stage from truck to port to barge to locks to waterway to port to truck – integrating hydrology, RIS, ADN, stowage, nautical operations, and multimodal logistics.

TRUCK → PORT → BARGE → LOCKS → WATERWAY → PORT → TRUCK



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LOGISTICS**

LUXEMBOURG

**ADDING VALUE IS THE KEY.**



# 1.1 RFQ Intake & Qualification

## Cargo Capture Requirements

- Cargo type: dry/liquid bulk, containers, breakbulk, OOG, project cargo
- HS code, ADN class, IMO class (multimodal interface)
- Density, stowage factor, moisture & temperature sensitivity
- Handling method: grab crane, conveyor, pumping, reach stacker
- Origin/destination: port, terminal, quay, mooring location
- Draft & air draft restrictions; lock availability & convoy requirements

## Controls & Compliance Checks

- Sanctions screening: shipper, consignee, vessel, operator
- ADN inland waterway dangerous goods compliance
- Water level forecast: WSV, VNF, Rijkswaterstaat hydrological data
- Draft feasibility (actual vs. allowed) and air draft (bridge clearance)
- Lock maintenance schedules via RIS; port congestion forecast
- Crew certification: boatmaster, helmsman, deckhand (CCNR/CESNI)

## Systems Used

TMS · Barge planning system · RIS · ELWIS / VIANAV / VNF / Danube FIS · Hydrological forecast platforms

# 1.2 Routing & Operational Feasibility



## Route Determination

- Primary waterway + alternate routes (Rhine, Danube, Moselle, Elbe, Seine, Rhône)
- Lock sequence, dimensions, and restrictions
- Convoy configuration: single, double, or triple barge
- Tug/push boat requirements and pilotage zones

## Navigation Checks

- Water level (actual + forecast): low/high water surcharges
- Night navigation, fog, and ice restrictions
- Bridge clearance (air draft); lock closures planned/unplanned
- RIS traffic density and incident data; river flow speed vs. ETA

## Port & Terminal Checks

- Port slot availability and terminal equipment readiness
- Mooring zones availability and safety compliance
- ADN restrictions: flammable, toxic, explosive cargo zones
- Convoy length limits per river section

# 1.3 Quotation & Booking Confirmation

## Cost Components

Barge Freight

Base linehaul rate

Port Handling

Loading/discharge fees

Lock Fees

Per passage, per tonne

Surcharges

LWS, HWS, fuel

## Booking Confirmation Steps

- Send quotation; receive shipper acceptance
- Confirm allocation with barge operator
- Secure terminal slot and tug service
- Notify port authority (if required)
- Engage customs broker for cross-border movements
- Validate ADN approval for dangerous goods
- Lock in rate validity and barge assignment

# Cargo Preparation & Pre-Carriage



## 2.1 Cargo Preparation at Shipper

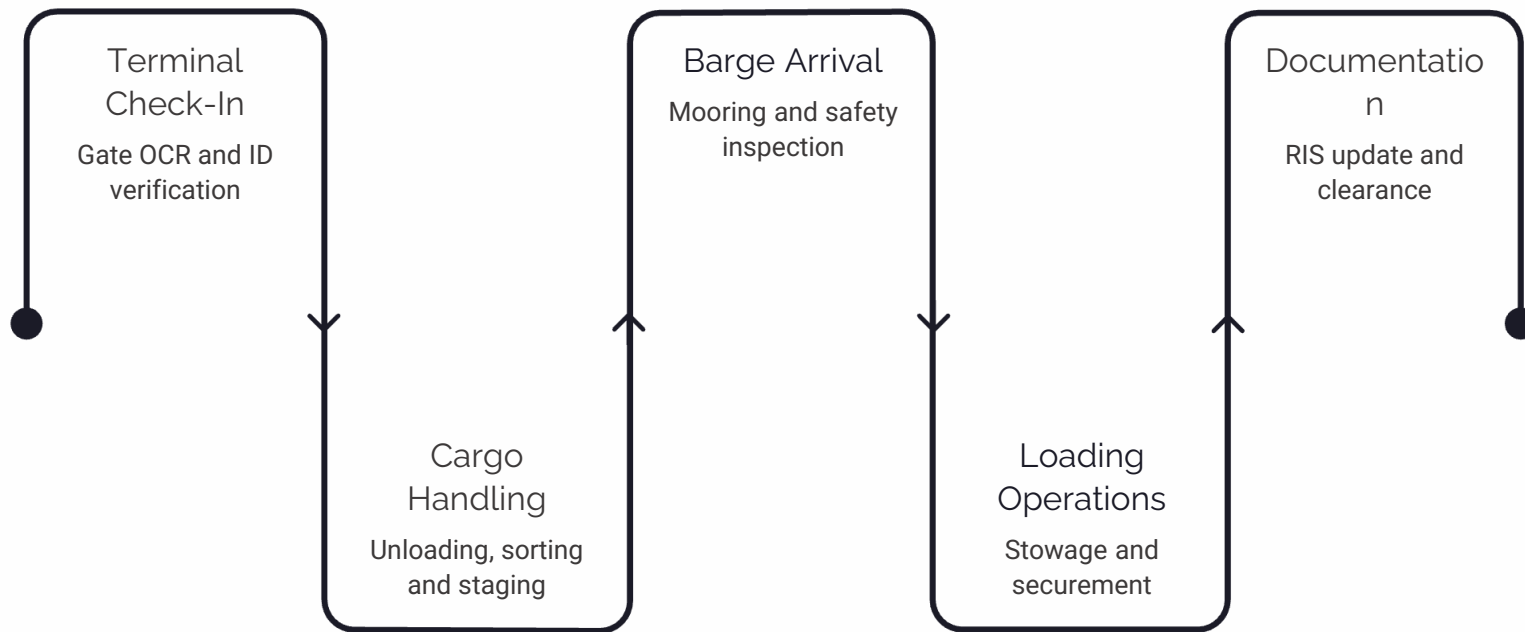
- Packaging: pallets, big bags, bulk loading, tank loading, or crates for project cargo
- Apply handling labels, ADR/ADN labels, moisture protection, and lashings for breakbulk
- Pre-loading checks: moisture content (bulk), temperature (liquid bulk), contamination check (tanks/holds)



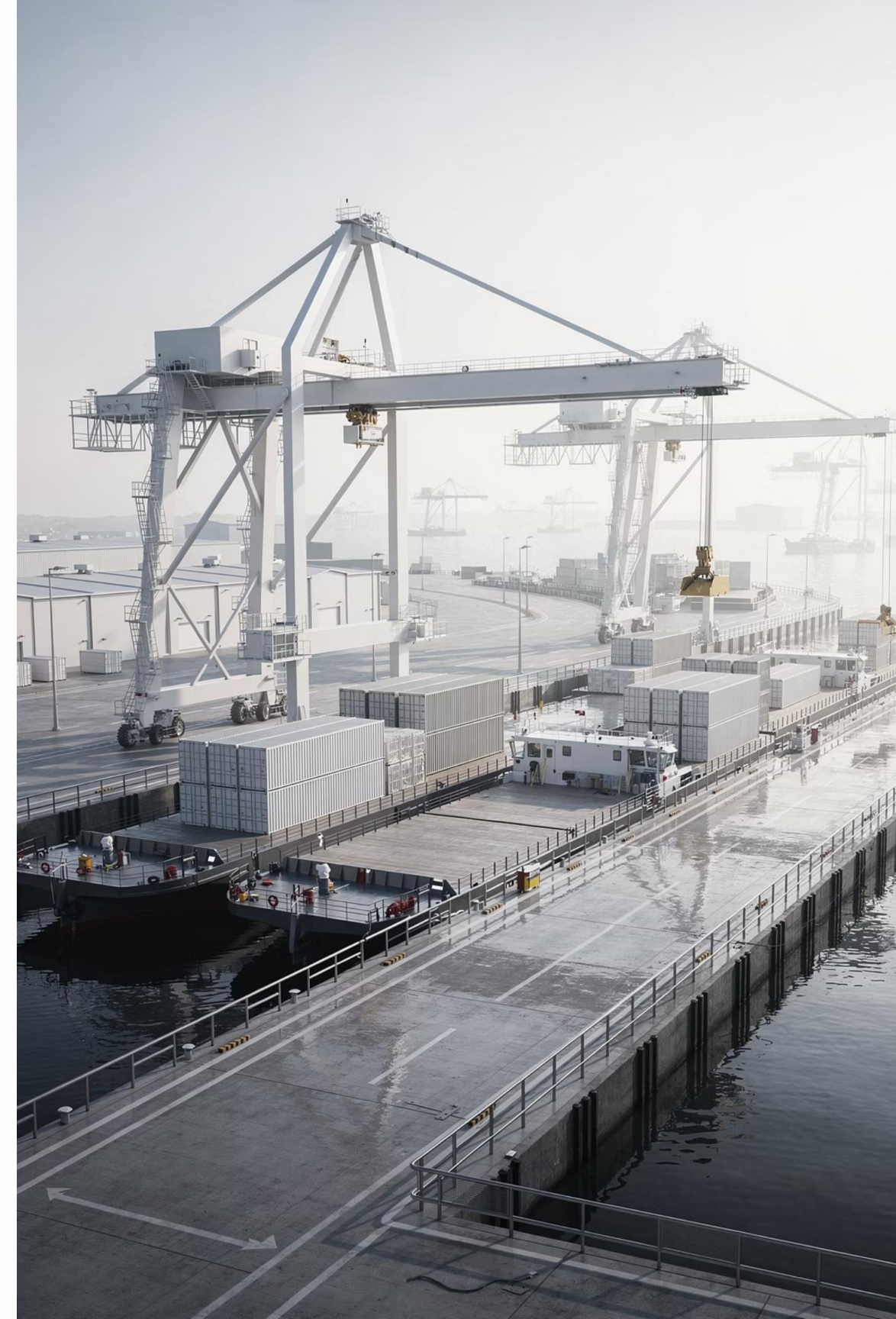
## 2.2 Pre-Carriage by Truck or Rail

- Assign truck or rail wagon; load cargo per consignment note
- Transport to port/terminal; gate-in at terminal checkpoint
- Controls: weight compliance, ADR compliance, gate access control, seal integrity

# Port of Loading (POL) — Terminal Operations



Port of loading operations transform pre-carried cargo into a properly stowed, documented, and cleared barge consignment. Each stage introduces specific compliance gates – from gate OCR and DG verification at check-in through to draft survey and ADN segregation confirmation at loading completion.



## 3.1 Terminal Check-In

### Arrival Procedure

Truck or rail unit arrives at the terminal gate. The terminal team executes a full documentation and physical verification sequence before granting yard access:

- Documentation check: CMR, packing list, ADR consignment note
- Weight check against booking confirmation
- ADR/ADN compliance verification for dangerous goods
- Seal check for containerised or closed cargo units
- Radiation scanning where mandated by port authority

### Gate Controls

- **Gate OCR:** Automatic licence plate and container number recognition
- **Weight discrepancy tolerance:** Typically  $\pm 2\%$  of declared tonnage
- **DG compliance:** UN number, packing group, and emergency contact validation

### Documents Required

- CMR / CIM waybill
- MSDS / Safety Data Sheet (ADN cargo)
- Cargo specification sheet
- Booking confirmation reference

## 3.2 Cargo Handling & Staging

### Unloading & Damage Check

Cargo is unloaded from the vehicle and transferred to the designated staging area. Any damage observed during unloading is recorded immediately via the terminal WMS with photographic evidence, triggering a damage report to shipper and insurer.

### Quality Checks

Moisture content is measured for bulk cargo susceptible to caking or spontaneous combustion. Temperature is logged for reefer or temperature-sensitive liquid bulk. Contamination checks are performed on tanks and holds prior to bulk placement.

### Loading Sequence Assignment

Cargo is assigned a loading order based on the stowage plan: weight distribution, ADN segregation requirements, and discharge port sequence. DG items are staged in compliant zones away from incompatible goods and ignition sources.

## 3.3 Barge Arrival & Mooring

### Arrival Procedure

- Barge notifies port authority via RIS/VHF; port assigns berth number
- Mooring crew secures barge with lines and fendering system
- Barge captain conducts pre-loading stability assessment

### Captain's Pre-Loading Checks

- **Draft:** Actual vs. permitted (water level dependent)
- **Trim:** Longitudinal balance at current load condition
- **Stability:** GM calculation; freeboard verification
- **Mooring lines:** Tension, lead angles, shore attachment points
- **Fendering:** Adequate protection between barge hull and quay
- **Weather/wind limits:** Beaufort scale thresholds for safe mooring



## 3.4 Loading Operations



### Equipment & Methods

- Cranes (mobile harbour, ship-mounted)
- Conveyor belts for bulk commodities
- Pipelines and flexible hoses for liquid bulk
- Reach stackers for containerised units



### Load Securing

- Lashings, dunnage, and securing devices applied per cargo type
- Stowage plan updated in real time during loading
- Container stack stability verified per tier weight limits
- Tank pressure and temperature monitored (liquid bulk)



### Post-Loading Survey

- Draft survey: fore, aft, and mid-ship readings logged
- Trim check: acceptable longitudinal and transverse limits
- Stability calculation: updated KG, GM, and freeboard
- ADN segregation distances verified by dangerous goods officer

## 3.5 Port of Loading Documentation

### Documents Issued at POL

- **Barge manifest:** Full cargo description, tonnes, volumes, marks
- **ADN declaration:** UN number, class, packing group, emergency info
- **Weight certificate:** Certified draft survey or weighbridge result
- **Stowage plan:** Signed and dated by barge captain
- **Port clearance:** Authority authorisation for departure
- **Customs export declaration:** Where cross-border movement applies

### RIS System Update

Upon completion of loading and documentation, the voyage data is pushed to the relevant River Information Services platform. This includes cargo type, vessel ID (ENI number), departure time, destination port, and ADN cargo notification where applicable.

### DG Document Controls

All ADN transport documents must accompany the barge throughout the voyage. Dangerous goods documentation is verified for completeness against the ADN Chapter 5.4 checklist before departure clearance is granted.

CHAPTER 4

# Inland Waterway Transport – Linehaul

## 4.1 Departure

Port clearance, tug connection, departure procedures

## 4.2 En-Route Navigation

Water level monitoring, RIS communication, speed management

## 4.3 Lock Operations

Queue management, chamber entry, water level adjustment

## 4.4 Bridge Passage

Air draft compliance, movable bridge coordination

## 4.5 Convoy Operations

Multi-barge formation, restricted zone navigation

# 4.1 Departure from Port of Loading

## Departure Sequence

- Barge captain receives port clearance from harbour master via VHF channel
- All mooring lines singled up, then released in sequence (head line last)
- Tug or push boat connects; towline tensions verified
- AIS transponder activated; voyage data confirmed on RIS platform
- Barge departs berth under pilot guidance if required by port regulations

## Pre-Departure Controls

- **Port clearance:** All documents sighted and authorisation received
- **Crew certification:** Boatmaster licence valid for waterway type and vessel class
- **Navigation readiness:** Radar, ECDIS/ENC chart set, radio, AIS operational
- **Stability confirmation:** Final draft and trim within permitted limits
- **ADN compliance:** DG cargo documents on board and accessible

## 4.2 En-Route Navigation

### Continuous Monitoring

- Water levels (gauge stations via RIS/ELWIS)
- Current speed and direction (affects fuel consumption and ETA)
- Weather, fog, and ice conditions
- Traffic density via RIS and AIS

### Communications

- Locks: pre-announce arrival, confirm chamber availability
- Bridges: request opening for movable structures
- Port authorities: ETA updates, berth pre-notification
- RIS centres: incident reporting and traffic management

### Speed Management

- Adjust for current (upstream power, downstream caution)
- Observe speed limits in restricted zones
- Fuel-efficient speed selection based on depth and load
- ADN rules: speed limits near sensitive infrastructure



## 4.3 Lock Operations

### Step-by-Step Lock Passage

01

#### Approach & Queue

Barge approaches lock at reduced speed; joins queue; contacts lockmaster on designated VHF channel

02

#### Enter Chamber

On lockmaster signal, barge enters chamber at dead slow; crew stands by with lines

03

#### Secure Inside Lock

Mooring lines attached to lock bollards; fenders deployed; engine on standby

04

#### Water Level Adjustment

Lock sluices operate; barge rises or falls; lines tended continuously to prevent surge

05

#### Exit Lock

Lock gates open; lines released; barge exits under own power or tug assistance

### Lock Controls & Compliance

- **Lock safety rules:** Dead slow entry, no engine reversal during fill/empty
- **DG restrictions:** Certain locks prohibit ADN class 1 or class 2 (explosive/gas) cargo passage
- **Mooring inside lock:** Sufficient lines fore and aft; no crew on lock walls without authorisation
- **Communication:** VHF contact with lockmaster maintained throughout passage

### Operational Note

Lock passage times vary from 20 minutes to over 2 hours depending on lock size, traffic, and filling/emptying rate. Lock delay is a primary cause of ETA variance on inland waterway voyages – accurate pre-planning via RIS is essential.

## 4.4 Bridge Passage & 4.5 Convoy Operations

### Bridge Passage

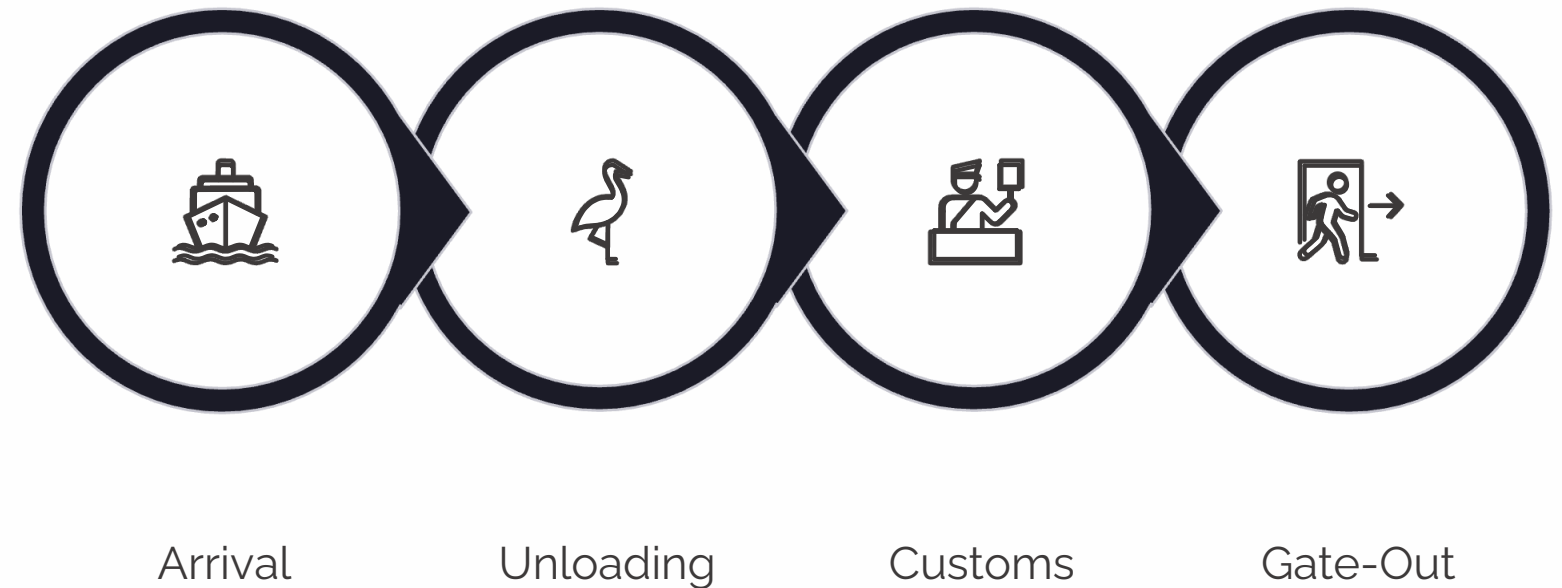
- Verify air draft against current water level and bridge clearance (updated in real time via ELWIS/RIS)
- For movable bridges: request opening via VHF; coordinate with bridge operator on timing
- Reduce speed to minimum steerage for passage; crew on standby fore and aft
- Traffic coordination: one-way traffic rules apply on many single-span structures

### Convoy Operations

- Push boat connects to leading barge; rigid coupling verified by deck crew
- Convoy formation maintained: max lengths vary by river section (e.g. Rhine: up to 185m × 22.8m)
- Maneuvering rules: wider turning radius; advance notice for restricted zones and bridges
- ADN compliance: additional segregation distances required in multi-barge DG convoys
- Night navigation restrictions may apply on specific river sections with full convoy



# Port of Discharge (POD) — Terminal Operations



Port of discharge operations mirror the loading sequence in reverse, with the additional complexity of customs clearance for cross-border shipments. Damage identification at discharge is critical — any discrepancy between the manifest and physical cargo must be noted in the discharge report before cargo leaves the terminal boundary.

# 5.1 Arrival & Berthing at POD

## Arrival Notification

- Barge transmits ETA update to port via RIS/VHF at least 4 hours prior
- Port assigns berth and confirms window; terminal schedules equipment
- Mooring crew secures barge: head lines, stern lines, breast lines, spring lines
- Fendering inspected; gangway rigged for crew and cargo surveyor access

## Barge Captain Checks

- Final draft reading logged: pre-discharge condition confirmed
- Hatch covers or tank valves prepared for opening/connection
- Stability check: sufficient GM throughout discharge sequence

## Controls at Arrival

- **Berth availability:** Slot confirmed against port schedule; congestion managed via RIS
- **Mooring safety:** Wind and current limits observed; tug assistance if berthing in strong stream
- **ADN compliance:** Dangerous goods notification confirmed with terminal DG officer prior to berthing
- **Draft survey:** Independent cargo surveyor may attend for custody transfer purposes

## 5.2 Unloading Operations



### Unloading Equipment

- Cranes: mobile harbour cranes, ship-mounted cranes, grab cranes for bulk
- Conveyor belts for continuous bulk discharge (grain, aggregates, coal)
- Pipelines and centrifugal pumps for liquid bulk (chemical, petroleum products)
- Reach stackers and forklifts for containers and palletised cargo



### Quality & Compliance Checks

- Damage check: each unit or batch inspected and compared against stowage plan
- DG compliance: ADN cargo discharged under DG officer supervision
- Moisture check: bulk cargo sampled at discharge for moisture content
- Contamination check: tank cargo sampled on arrival and post-discharge



### Staging & Transfer

- Cargo moved to designated staging zones in terminal yard
- Bulk cargo conveyed to silo, stockpile, or storage tank
- Containers placed in yard by reach stacker; position logged in TOS
- Discharge completion logged; final draft survey performed

## 5.3 Customs Clearance

### Declaration & Submission

- **Import declaration:** SAD / MRN submitted to customs authority (NCTS/AES)
- **Invoice:** Commercial invoice with agreed terms of trade (Incoterms)
- **Packing list:** Detailed breakdown by package, weight, and marks
- **Certificates:** Certificate of Origin, phytosanitary, quality, ADN documentation

### Customs Inspection Options

- **Physical inspection:** Officers attend terminal; cargo unstuffed or sampled
- **X-ray / scanning:** Non-intrusive inspection equipment used at border ports
- **Sampling:** Bulk commodities sampled for laboratory analysis (e.g. grain quality, chemical purity)

### Controls

- HS code validation: declared vs. actual commodity classification verified
- Permit compliance: import licences, quotas, restrictions
- Customs seal integrity: seal number matched against transport document

## 5.4 Gate-Out & On-Carriage Handover

1

### Truck/Rail Arrival

Carrier arrives at terminal gate; booking reference and driver ID presented; terminal WMS confirms cargo readiness

2

### Load & Seal

Cargo loaded onto vehicle; container or vehicle sealed; seal number recorded in TOS and CMR waybill

3

### Gate-Out Scan

OCR captures vehicle plate and container number; weight check performed; gate-out timestamp recorded in WMS

4

### Controls

Seal integrity verified; weight compliance checked; DG compliance confirmed for road/rail leg; CMR issued

# Final-Mile Delivery

## 6.1 Transport to Consignee

- Truck or rail assigned; CMR/CIM waybill issued with delivery instructions
- ADR compliance maintained for any dangerous goods on the final road leg
- Cargo transported to consignee premises; driver notifies arrival via TMS
- Unloading at consignee: damage check performed, temperature verified where applicable
- DG unloading compliance: ADR Chapter 8.3 procedures followed at consignee site

## 6.2 Proof of Delivery

- **Signature:** Authorised consignee representative signs CMR waybill
- **Timestamp:** Delivery time recorded against booking ETA for KPI measurement
- **Photos:** Photographic evidence captured at delivery for high-value or damage-sensitive cargo
- **POD validation:** Signed POD uploaded to TMS; triggers invoice release by carrier

☐ Any damage or shortage noted at delivery must be recorded on the CMR before the driver departs – once signed clean, liability is significantly harder to establish.

CHAPTER 7

# Post-Shipment Activities

## 7.1 Billing

Invoice consolidation and cost recovery

## 7.2 KPI Reporting

Performance measurement and analytics

## 7.3 Claims Handling

Damage, loss, delay, and incident resolution

## 7.4 Data Archiving

Document retention and RIS log storage

Post-shipment activities close the commercial and operational loop on every barge movement. Accurate billing, performance measurement, and robust archiving are the foundation for continuous improvement and regulatory compliance in inland waterway logistics.



# 7.1 Billing & Cost Recovery

## Barge Freight

Base linehaul rate per tonne or per voyage, per agreed tariff or spot rate. Low water surcharge (LWS) or high water surcharge (HWS) applied where water level thresholds are breached during the voyage.

## Port & Terminal Handling

Loading and discharge handling charges at POL and POD. Includes crane hire, conveyor usage, pipeline connection fees, and terminal dwell time beyond free time allowance.

## Ancillary Charges

Tug assistance fees, lock passage dues, waterway navigation charges, mooring fees, and fuel surcharge (FSC) based on fuel price index. Customs brokerage and port authority fees where applicable.

## Pre- & On-Carriage

Truck and/or rail charges for the inland leg at origin and destination. ADR surcharges for dangerous goods road transport. Final-mile delivery charges to consignee premises.

## 7.2 KPI Reporting

### Operational KPIs

→ On-Time Departure & Arrival

Actual vs. planned departure/arrival timestamps at POL and POD, measured against booking confirmation

→ Lock & Water Level Delays

Total delay minutes attributable to lock waiting time and low/high water restrictions, reported per voyage

→ Terminal Dwell Time

Time from barge mooring to completion of loading/discharge; benchmarked against port productivity norms

### Compliance & Sustainability KPIs

→ Damage Rate

Number of damage claims per 100 voyages or per 1,000 tonnes carried; tracked by cargo type and handling method

→ DG Compliance Rate

Percentage of ADN shipments with zero documentation deficiencies or handling violations

→ CO<sub>2</sub> Emissions & Fuel Consumption

Grammes CO<sub>2</sub> per tonne-kilometre; fuel litres per 100 tonne-km; benchmarked against road and rail alternatives

## 7.3 Claims Handling & 7.4 Data Archiving

### Damage Claims

Physical cargo damage identified at discharge or delivery. Requires survey report, photographic evidence, damage note on CMR/manifest, and notification to P&I club or cargo insurer within contractual timeframe.

### Loss & Shortage Claims

Quantity discrepancy between loaded and discharged tonnage. Resolved via comparison of loading and discharge draft surveys, weight certificates, and independent surveyor reports.

### Delay Claims

Commercial claims arising from late delivery beyond agreed laycan or delivery window. Assessment of cause (force majeure, lock closure, weather) determines carrier liability under contract of carriage.

### Data Archiving

Barge manifest, ADN documents, customs declarations, stowage plans, RIS logs, lock passage logs, and AIS tracks retained per regulatory requirements (minimum 2–5 years depending on jurisdiction) for audit and claims defence.