DLMS — Digital Logistics Management System (Mining)

Product: DLMS v5.6.3 (Build `dlms-2025.08.15-citrine`)
Environments: DEV (amber bar), UAT (indigo bar), PROD (emerald bar) — shown in the top nav
Regions Enabled: GMR (Granite Mountain Range), NVB (North Valley Basin), SRP (Seraph Port)
Data Class: Internal – Operational (retain per §20)
Do Not Distribute Externally

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0) What DLMS Is (for users)

DLMS digitizes **pit → stockpile → plant → rail → port** logistics. It controls dispatch instructions to trucks, validates **weighbridge** mass, tracks **stockpiles** and grades, coordinates **rail consists** and **port loading**, and reconciles the whole chain with finance and HSE (safety) checkpoints.

Golden flow: Dispatch → Load Ticket → Weighbridge → Stockpile Ledger → Plant Feed / Rail Build → Port → Reconciliation

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1) Navigation & Page Anatomy

1.1 Global Top Bar

- **DLMS logo** (click → **Operations Home**)

- **Environment Banner**: DEV/UAT/PROD color band with region chip (e.g., `PROD · SRP`)

- **Quick Search (⌘/Ctrl+K)**: Ticket No, Truck ID, Stockpile ID, RC/Vessel, Driver Badge

- **Create (＋)**: Load Plan, Ad-hoc Ticket, Rail Consist, Vessel Plan

- **Notifications (bell)**: Exceptions, SLA ticks, Job lag

- **User Menu**: Profile, Role Switch (if multi-role), Sign out

1.2 Left Rail (module switcher; permission-aware)

1. **Dispatch Board**

2. **Weighbridge Console**

3. **Stockpile Ledger**

4. **Plant Feed**

5. **Rail Planner**

6. **Port Planner**

7. **Safety Console (HSE)**

8. **Maintenance**

9. **Analytics Studio**

10. **Telemetry Ops**

11. **Admin**

1.3 Footer Telemetry

- Build ID, Tenant (`TEN-4219`), Region, Queue Depth `qd:`, Job Lag `lag:`, Last IoT ingest `ing:`, Assay freshness `as:`

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2) Roles & Permissions

Role	Typical Users	Can Do	Cannot Do
Dispatcher	Control room	Create load plans, assign trucks, issue ad-hoc tickets	Approve weighbridge exceptions >3%

Weighbridge Operator	WB hut	Validate G/T/N, attach photos, dual-approve exception	Edit load plans
Stockpile Controller	Yard	Create/merge/split SPs, adjust moisture %, reconcile	Approve safety events
Plant Operator	ROM/Plant	Start/stop feed, accept blend sequence	Change rail consists
Rail Coordinator	Rail ops	Build RCs, assign wagons, set ETD, link SPs	Edit port laycans
Port Planner	Marine	Plan vessels, blending window, generate SoF events	Change driver rest rules
Maintenance Lead	Mobile assets	Schedule truck downtime, create MO	Change financial dimensions
HSE Officer	Safety	Log/close safety events, enforce stops	Edit inventory tonnage directly
Controller (Finance)	Finance	Approve WB exceptions, close month, certify variances	Schedule truck shifts
System Admin	IT	Manage users, roles, rules, integration, feature flags	—

Hard constraints

- **Dual approval** required for weighbridge variance > **3%** (WB Op + Controller).

- **Driver rest rule**: minimum **10 hours** rest after a night shift (S3) before next check-in.

- **Stockpile cap**: each SP has a hard **max tonnage** per yard layout (§10.4).

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3) Codes & IDs (RAG-targeted, unique)

- **Load Ticket**: DLMS-LT-YYYYMMDD-#### (e.g., DLMS-LT-20250815-0273)

- **Truck ID**: TRK-REG-### (e.g., TRK-GMR-021)

- **Driver Badge**: `DRV-#####`

- **Stockpile ID**: `SP-YARD-ALPHA##` (e.g., `SP-CEN-A03`)

- **Material Grade**: `MG-Fe62`, `MG-Fe58`, `MG-Cu1.2`, `MG-AuOre`

- **Weighbridge Station**: `WB-LOC-#`

- **Rail Consist**: `RC-YYYY-###` (e.g., `RC-2025-118`)

- **Wagon ID**: `WGN-#####`

- **Vessel**: `VES-####`

- **Shift**: `S1` 06:00–14:00, `S2` 14:00–22:00, `S3` 22:00–06:00

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4) Dashboards

4.1 Operations Home

- **OreFlow Gantt**: pit→WB→SP→Plant/Rail stages by ticket status color

- **Exception Ticker**: `EXCEPTION-WB`, `ALERT-SP-CAP`, `ALERT-REST`, `ALERT-MOISTURE`

- **Cycle KPIs**: Haulage Utilization %, WB Exceptions per 100 loads, Feed Rate t/h, Rail Dwell h, Port Blending Accuracy %

4.2 Analytics Studio (for analysts/finance)

- **Drill paths**: Ticket→WB→SP→Plant/Rail→Port

- **Recon tiles**: System vs Survey variance, Moisture impact, Assay delta aging

- **What-if**: Blend optimizer (target Fe), Moisture scenario

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5) Dispatch Board (pit → stockpile)

Toolbar: Shift selector (`S1/S2/S3`), Yard, Grade filter, Map/Grid toggle
 Board: swimlanes per **Route** (e.g., `PIT-03 → SP-CEN-A03`) with cards showing Truck, Driver, Plan t, ETA, Last WB pass

Create Load Plan

1. Choose **Shift**, **Route**, **Target grade**.

2. Select trucks (multi-select) and drivers.

3. Confirm **Planned tonnage** per run (default from route).

4. **Publish** → drivers receive instructions in **DLMS Hauler** app.

Ad-hoc Ticket (when a truck picks at a different face)

- Press **+ Ad-hoc** → fill minimal fields; generates `DLMS-LT-`… immediately.

Driver Rest Validation

- If a driver's last `S3` ended < 10h, card displays red `REST` badge; cannot publish without override from HSE.

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6) Mobile Apps (offline-first)

6.1 DLMS Hauler (driver)

- **Modes**: Online / Offline (stores up to **72h** of tickets)

- **Check-in**: scans truck QR, reads driver badge NFC

- **Face selection**: pick from list (geo-filtered within 300 m)

- **Arrival at WB**: app shows expected station; if different, prompts for reason code

- **Photos**: load bed photo (optional/required by site rule)

- **Sync policy**: attempts every 5 min on LTE/Wi-Fi; hard sync on depot Wi-Fi

6.2 LoaderMate (loader operator)

- Scans **Face ID** and **truck QR**; selects **grade** and **planned t**; can split loads across grades (rare, requires Controller review)

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7) Weighbridge Console

Layout

- Left pane: **Incoming queue** with ANPR plate, Truck/Driver match %

- Center: **Scale live** (Gross / Tare / Net), **Readiness lights**

- Right: **Ticket details** + **Exceptions** + Photo strip

Workflow

1. Truck rolls on: ANPR + RFID handshake (green if matched).

2. **GROSS** captured; truck exits for **TARE** after offload.

3. System computes **NET**; compares to plan and prior passes.

Rules

- Variance > **±3%** → `EXCEPTION-WB` (WB Op must enter reason: moisture, spillage, load overflow, re-weigh).

- Grade mismatch between loader entry and assay horizon → orange **GRADE?** banner; WB Op must confirm.

Dual Approval (Controller)

- If variance remains >3% after re-weigh, Controller must co-approve within **2h** or ticket cannot close.

8) Stockpile Ledger

Stockpile Card: SP ID, Yard map cell, Grade, Moisture %, Tonnage, Cap %, Last sample time
 Actions: Create, Merge, Split, Adjust Moisture, Lock
 Cap rule: e.g., `SP-CEN-A03` cap **45,000 t**; crossing 95% shows yellow; 100% shows red and blocks additional tickets without Controller override.

Reconciliation

- System tonnage = Σ tickets in/out ± moisture correction

- Survey upload (weekly) updates `survey_t` and variance; **variance target**: ± **1.5%**

9) Plant Feed & Blend Planner

Plant Feed Screen

- **Feed lane**: queue of SP pulls with planned t and grade

- Buttons: **FEED START**, **PAUSE**, **FEED END**; records timestamps for reconciliation.

Blend Planner (Fe grades)

- Inputs: target Fe (e.g., **61.8%**), allowable moisture max, available SPs with grades & moisture

- Outputs: mix ratios (e.g., `MG-Fe62` 70%, `MG-Fe58` 30%), expected Fe ±0.2%

- Constraints: moisture must remain ≤ **12%**; otherwise suggest drying delay or alternative SP.

10) Rail Planner

Consist Builder

- Create **RC**; add **WGN-#####** cars; apply **grade mix** and SP allocations.

- Enforce **max axle load**; warn if any wagon overweight.

Dwell & ETD

- Target dwell < **6h**; Gantt shows yard slots.

- ETD predicted from yard readiness + loco availability.

Export

- Generate Rail Manifest PDF and JSON payload to TMS (internal).

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11) Port Planner

Vessel Plan

- Create **VES-####**, set laycan window, target Fe, moisture limits.

- Build **load plan** with SP segments and time windows.

- **SoF (Statement of Facts)** events auto-generated from berth timestamps; editable with audit.

Blending Accuracy KPI

- Target within **±0.3%** of plan across the vessel.

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12) Safety Console (HSE)

- **Event Types**: Near Miss, Incident, Environmental

- **Stop Flags**: can block Dispatch and Weighbridge for affected route/yard cell until cleared.

- **Shift Safety Brief**: digital sign-off required before first dispatch in each shift.

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13) Maintenance

- **MO** (Maintenance Order) creation blocks assignment of **TRK-…** during downtime window.

- MO captures **downtime_start/end**, **work_class**, estimated **impact_tons**.

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14) Algorithms & Business Rules (deterministic, RAG-friendly)

14.1 Variance Calculation

`variance_pct = (net_t - planned_t) / planned_t * 100`

- If `abs(variance_pct) > 3`, ticket requires dual approval.

- If three consecutive tickets for same TRK exceed 2%, auto-trigger **Inspection** task.

14.2 Blend Fe Calculation (two-component)

`Fe_out = r * Fe_A + (1 - r) * Fe_B` (extend to N components)
Constraint: $\Sigma r_i = 1$, Fe_out within ±0.2% of target, $\Sigma(r_i * moisture_i) \leq moisture\_max$

14.3 Driver Rest

- If last `S3` ended at `t_end`, next check-in time must be ≥ `t_end + 10h`.

14.4 Moisture Impact on SP Ledger

- Effective tonnage `t_eff = t_meas * (1 - moisture_pct/100)`

15) Telemetry & Integrations

Event Bus Topics

- `weighbridge.reading`, `identity.checkpoint`, `loadticket.created`, `loadticket.closed`, `stockpile.adjust`, `plant.feed`, `rail.consist`, `port.sof`, `safety.event`, `assay.ingest`

IoT Gateways

- Weighbridge sends SHA-signed **gross/tare** with timestamp and WB Station ID.

- ANPR/RFID pairs produce `identity.checkpoint` with **confidence score** 0–1.

Assay Ingest

- Lab pushes `grade.sample` events; DLMS updates SP grade and triggers re-calc on active blends.

16) Admin — Settings, Rules, Feature Flags

16.1 Sites & Yards

- Define **yard cells** (grid) with cap tonnage and moisture heuristics.

16.2 Grades & Materials

- Maintain catalog of `MG-…` codes with default Fe & moisture; effective-dated.

16.3 Rules

- Variance threshold (default 3%)

- Driver rest hours (default 10)

- SP cap enforcement (on/off per yard)

- Dual approval roles

16.4 Feature Flags

- `ff.mobile.strict_offline_72h` (block >72h offline sync)

- `ff.sof.autogen` (auto Statement of Facts)

- `ff.blend.optimizer.beta` (new solver)

- `ff.rail.axle_guard` (strict axle limits)

17) Background Jobs & Schedules

- `job.wb.reconcile` — every 10m; closes tickets with complete G/T/N and approvals

- `job.assay.ingest` — every 30m; updates SP grades from lab

- `job.stock.recalc` — hourly; recomputes SP tonnage with moisture corrections

- `job.train.eta` — every 5m; refreshes RC ETD from yard state

- `job.iot.watchdog` — every 2m; flags stale ANPR/RFID streams

- `job.port.sof` — on berth events; compiles Statement of Facts

- `job.audit.seal` — daily; hashes yesterday's audit log (immutable chain `DLMS-CHAIN`)

18) Data Model (selected)

LoadTicket

- `ticket_no` (PK), `truck_id`, `driver_badge`, `route_from`, `route_to`, `material_grade`, `planned_t`, `gross_t`, `tare_t`, `net_t`, `wb_station`, `exceptions[]`, `photo_refs[]`, `created_ts`, `closed_ts`

WeighbridgeReading

- `ticket_no`, `wb_station`, `gross`, `tare`, `net`, `variance_pct`, `approved_by[]`, `photos[]`, `notes`

Stockpile

- `sp_id` (PK), `yard_cell`, `grade`, `tonnage`, `moisture_pct`, `cap_t`, `survey_t`, `last_sample_ts`, `locked`

RailConsist

- `rc_id` (PK), `wagons[]`, `grade_mix{}`, `departure_ts`, `eta_port`, `manifest_ref`

Vessel

- `ves_id` (PK), `laycan_start`, `laycan_end`, `target_grade`, `moisture_max`, `load_plan[]`, `sof_events[]`

SafetyEvent

- `sev_id`, `type`, `location`, `severity`, `ack_by`, `close_ts`, `stops[]`

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19) API (synthetic, internal)

```
POST /dlms/v1/loadtickets
GET  /dlms/v1/loadtickets/{ticket_no}
PATCH/dlms/v1/loadtickets/{ticket_no}/wb
```

```
POST /dlms/v1/stockpiles/{sp_id}/adjust
POST /dlms/v1/rail/{rc_id}/attach
POST /dlms/v1/port/{ves_id}/plan
POST /dlms/v1/safety/event
```

Webhook Payload: weighbridge.reading

```
{
  "event": "weighbridge.reading",
  "ticket_no": "DLMS-LT-20250815-0273",
  "wb_station": "WB-GMR-1",
  "gross": 97.3,
  "tare": 29.8,
  "net": 67.5,
  "sign": "sha256:…",
  "ts": "2025-08-15T09:42:11Z"
}
```

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20) Security, Audit, Retention

- **SSO (OIDC)** with Conditional Access; per-module RBAC

- **PII minimization**: drivers stored as badge IDs only; HR join resolves names in UI

- **Audit**: every edit (who/when/what before/after), sealed daily by `job.audit.seal`

- **Retention**: LoadTickets **10y**, WB photos **3y**, SafetyEvents **≥7y**, Assay **5y**, SoF **7y**

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21) Keyboard Shortcuts & Power Tips

- Global search: ⌘/Ctrl+K

- New Load Plan: `l` then `p`

- Approve WB exception (focused card): a / Reject: x

- Rail Planner: g then r (go Rail)

- Toggle Map/Grid in Dispatch: m

- Add wagon row in RC: + (plus)

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22) Error Codes (surface to users; internal causes)

Code	User Message	Internal Cause	Action
WB-301	"Variance above 3%. Re-weigh or submit for approval."	Net vs plan > 3%	Re-weigh; else Controller approval
ID-204	"Truck/Driver mismatch. Present correct badge."	ANPR vs RFID mismatch	Manual verify; attach photo
SP-413	"Stockpile cap reached."	SP tonnage ≥ cap	Move to alternate SP or override
PL-409	"Blend constraint not met (moisture)."	$\Sigma(r_i * moisture_i) >$ limit	Adjust mix or delay
RC-422	"Axle load exceeded on wagon."	Overweight	Re-allocate tonnage
SOF-500	"SoF generation failed (timing gap)."	Missing berth event	Add manual timestamp
MOB-408	"Offline buffer full (72h). Sync required."	Mobile >72h unsynced	Connect Wi-Fi at depot

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23) Troubleshooting Playbooks

23.1 Ticket won't close after WB

- Check **Exceptions** tab for variance; if >3%, obtain Controller co-approval.

- Ensure **TARE** captured; if missing, run **WB Reconcile** manual job.

23.2 Repeated `ID-204` mismatches

- Clean camera lens at WB; re-scan badge.

- If plate changed recently, update **Truck ID** registry; attach photo for audit.

23.3 SP shows negative after survey

- Run **Stock Recalc**; check last assay timestamp.

- If moisture updated after feed, ledger may need back-apply; Controller to approve adjustment note.

23.4 Rail manifest rejected by TMS

- Validate **WGN-#####** format and axle calc.

- Ensure all SP allocations resolved; no "TBD" rows.

23.5 Port blending drift >0.3%

- Review late assay; rerun Blend Planner with latest SP grades.

- Adjust final parcel; log reason in **VES** notes.

23.6 Mobile can't sync

- Advise driver to connect to **Depot Wi-Fi**; app syncs and prunes buffer.

- If still failing, Maintenance checks LTE antenna; use USB cable for forced sync.

24) Paste-Ready Internal Snippets (no links)

- **WB Exception Nudge**:
  "Controller, please review `DLMS-LT-{{ticket}}` variance {{var}}% at `{{wb}}`. Reason noted: `{{reason}}`. Co-approve to close within 2h."

- **Stockpile Cap Alert**:
  "`{{sp}}` at {{pct}}% capacity; next three loads will breach cap. Suggest redirect to `{{alt_sp}}`."

- **Driver Rest Violation Attempt**:
  "`DRV-{{id}}` attempted check-in at {{time}} but <10h rest post-S3. Dispatch blocked pending HSE override."

- **Rail Dwell Breach**:
  "RC `{{rc}}` at {{h}}h dwell (target <6h). Awaiting wagon `{{wgn}}` inspection; ETA {{eta}}."

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25) Release Notes (v5.6.3 "Citrine")

- New **Blend Optimizer** with moisture constraint solver and ±0.2% target band

- **Dual Approval timer** visualized in Weighbridge Console

- **Depot Wi-Fi hard sync** flow for offline mobiles >72h

- **Axle Guard** (feature flag) for rail overweight prevention

- **SoF autogen** refinements (berth gap detection)

- Analytics: added **Assay aging** and **Variance waterfall** visuals

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26) Glossary (DLMS-specific)

- **OreFlow Gantt**: live process bar from pit to port

- **Consist**: configured set of rail wagons for a departure

- **Laycan**: vessel laydays/cancelling window

- **Variance**: `(net - planned) / planned` as percentage

- **SoF**: Statement of Facts — time log used for port demurrage/despatch

- **Depot Hard Sync**: forced mobile data offload over trusted Wi-Fi