**Software Design Document (SDD – Cargo Module Extract)**

**1. Module: Cargo Simulator**

**1.1 Purpose**

The **Cargo Simulator** handles cargo operations and calculates handling costs, containerized logistics, and demurrage charges. It integrates with berth availability, cargo norms, and tariff rules.

**1.2 Input Parameters**

| **Input Parameter** | **Description** | **Type / Constraint** |
| --- | --- | --- |
| **Cargo Name** | Name of the cargo (e.g., Coal, Iron Ore, Cement, Containers). | Text (FK from cargo\_master) |
| **Cargo Group** | Cargo classification (Dry Bulk, Liquid Bulk, Break Bulk, Container). | Enum (from cargo\_master) |
| **Weight of Cargo** | Total weight of cargo (tons). | Decimal (if cargo type ≠ Container) |
| **Value of Cargo** | Commercial value of cargo. | Decimal (if cargo type ≠ Container) |
| **Number of Packages** | Package count (for Break Bulk / Container). | Integer |
| **No. of Load Containers (20 ft)** | Loaded containers (20 ft). | Integer (only if type = Container) |
| **No. of Load Containers (40 ft)** | Loaded containers (40 ft). | Integer |
| **No. of Empty Containers (20 ft)** | Empty containers (20 ft). | Integer |
| **No. of Empty Containers (40 ft)** | Empty containers (40 ft). | Integer |
| **Demurrage Charges Required?** | Option to calculate demurrage. | Boolean (Yes/No) |
| **Delivery Instalment (1..10)** | For each instalment: Days after free days + Quantity delivered. | Dynamic rows (min 1, max 10) |

**1.3 Reference Tables**

**Berth Master**

Used to identify suitable berths for given cargo types.

Refer Berth Master Structure

**Cargo Master**

Provides handling norms & SOR references.

Refer Cargo Master Structure

**Free Days Master**

Defines the number of free days per cargo group.

Need to be prepared

| **Cargo\_group** | **free\_days\_allowed** |
| --- | --- |

**Charges for Demurrage Charges**Need to be prepared

**Wharfage Calculation**Refer SOR table – (but the container tariff needs to be added in this)

**1.4 Operational Logistics Logic**

1. **Berth Allocation**
   * Match cargo type with preferred berth(s) from berth\_master.
   * Check draft suitability.
2. **Cargo Handling Time**
   * Time = Cargo Quantity ÷ Norms (from cargo\_master).
3. **Demurrage Logic**
   * Free days = value from free\_days\_master.
   * If delivery instalment exceeds free days → apply demurrage slab.
   * **Slab (1):** Days 1–3 after free days → Demurrage Rate 1.
   * **Slab (2):** Days 4–7 after free days → Demurrage Rate 2.
   * **Slab (3+):** Beyond 7 days → Higher penalty rate.

**1.5 Cost Components**

**Cargo-Related Charges**

* **Wharfage:**
  + Weight-based: Cargo Weight × Wharfage Rate.
  + Value-based: Cargo Value × %Wharfage Rate.
* **Demurrage:**
  + ∑ (Quantity × Days beyond free limit × Slab Rate).
* **Container Handling Charges:**
  + (No. of Loaded 20ft × Rate20\_Load) +
  + (No. of Loaded 40ft × Rate40\_Load) +
  + (No. of Empty 20ft × Rate20\_Empty) +
  + (No. of Empty 40ft × Rate40\_Empty).

✅ With this structure, the **Cargo Module** of your SDD now includes:

* Inputs (dynamic & conditional fields).
* Reference tables.
* Simulation logic.
* Cost formulas.