

## Seaport Simulator for Logistic Operations and Port Charges

1. Vessel Module
2. Cargo Module
3. Stevedore Module
4. Rail Module
5. Land Module

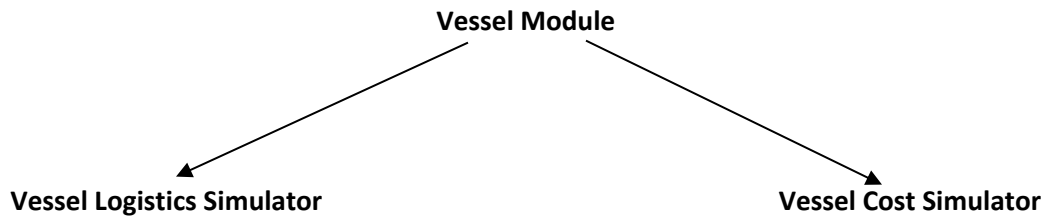
Vessel	Cargo	Stevedore	Rail	Land
LOGISTICS SIMULATOR			COST SIMULATOR	

Vessel Logistics Simulator
Cargo Logistics Simulator
Stevedore Logistics Simulator
Railway Logistics Simulator
Land Logistics Simulator

Vessel Cost Simulator
Cargo Cost Simulator
Stevedore Cost Simulator
Railway Cost Simulator
Land Cost Simulator

## Vessel Module

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The Vessel Module is to Simulate and predict the Logistic planning's and Cost involved in port operations related to the vessels.

### Vessel Logistics Simulator

The Vessel Logistics Simulator is to predict the vessel operation related planning. Based on the input parameter given, it will furnish the following details:

1. **The preferred and eligible berths at which the vessel can be berthed.**
  - This will give minimum two and maximum five suitable berths. This is based on the Vessel Dimensions (Length, Draft, Beam), Cargo carried by the vessel. These details entered by the user will be validated with the Berth Master
2. **How long the vessel need to Stay at Berth?**
  - This will be based on the Norms of the cargo selected by the user from the Cargo Master

### Vessel Cost Simulator

3. **Three categories of Vessel Related Charges** – Port Dues, Pilotage, Berth Hire
4. **Port dues** are calculated from the Port Due Master- referring the GT and Trade Type
5. **Pilotage** is calculated from the Pilotage Master as per the GT Group/Cargo Type and Trade Type
6. **Berth Hire** is calculated per hour, hence the Stay At Berth calculated from the Cargo Norms to be used for this. The charges are as per the Berth Hire Master.

### SQL Tables for Reference

1. Port Dues <VM\_port\_dues.csv>
2. Pilotage <VM\_Pilotage\_Master\_with\_Category.csv>
3. Berth Hire <VM\_berth\_hire.csv>
4. Berth Master <VM\_berth\_master.csv>
5. Cargo Master <CM\_CargoMaster.csv>
6. Exchange Rate Master <>
7. Dock Master <DockMaster.csv>

## The Input Field Structure for the Vessel Module

These inputs fields are for both Vessel Simulator and Cost Simulator.

Input Fields	Field Type	Condition	Reference
Vessel Name	Open AlphaNumeric field	Not Mandatory	Not referred for any purpose
Trade Type	Buttons	Mandatory	Buttons for choosing Coastal or Foreign
GRT/GT	Open Integer field	Mandatory	Important field for calculating the Vessel Related Charges
Beam	Open float field	Mandatory	Important field for deciding with Dock the Vessel can be berthed. The entrance channel of the Bharathi Dock, Ambedkar Dock and Jawahar dock from the berth master to be considered for this
LOA	Open float field	Mandatory	Important field for deciding at which berth the vessel can be berthed. The Berth Length from the berth master to be considered for filtering the choice of the berth
Draft	Open float field	Mandatory	Important field for deciding at which berth the vessel can be berthed. The draft of the berth from the berth master to be considered for filtering the choice of the berth.
Cargo	List field	Mandatory	Important field for deciding which are the feasible berths at which the vessel will be berthed
Parcel Size	Open float field	Mandatory	Important field for deciding how long the vessel will stay at berth, based on the Norm of the Cargo.

Input Fields	Field Type	Condition	Reference
			The Norm field from the cargo master to be considered.

Once the fields are entered, there will be two Tabs – each for Vessel Logistic Simulator and Vessel Cost Simulator.

The expected output from the **Vessel Logistic Simulator** is :-

**Preferred Berths:** <Min Two berths to Maximum Five Berths> - the berth Name will be displayed here

**Stay at Berth:** <Stay in Hours> based on the per day cargo norms for the cargo chosen

The expected output from the **Vessel Cost Simulator** is:-

While calculating the Vessel Related Charges, the exchange rate to be taken from the table and that table may update the values from the Web.

For Foreign Vessels

**Port Dues** (in INR) = GT x Rate x Exchange Rate

**Pilotage** (in INR) = GT x Rate x Exchange Rate

**Berth Hire** (in INR) = GT x Rate x Number of Hours x Exchange Rate

For Coastal Vessels

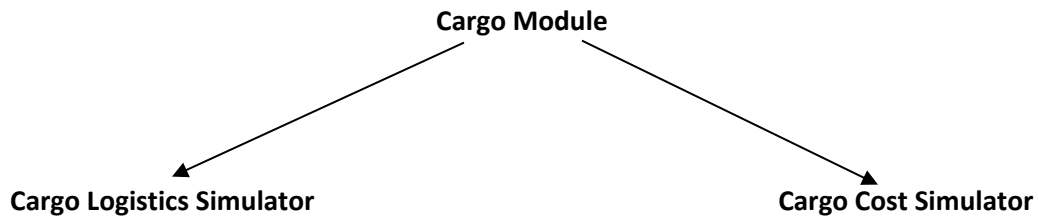
**Port Dues** (in INR) = GT x Rate

**Pilotage** (in INR) = GT x Rate

**Berth Hire** (in INR) = GT x Rate x Number of Hours

## Cargo Module

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### 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.

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#### 1.2 Input Parameters

Input Parameter	Description	Type / Constraint
<b>Cargo Name</b>	Name of the cargo (e.g., Coal, Iron Ore, Cement, Containers).	Text (FK from cargo_master)
<b>Cargo Group</b>	Cargo classification (Dry Bulk, Liquid Bulk, Break Bulk, Container).	Enum (from cargo_master)
<b>Weight of Cargo</b>	Total weight of cargo (tons).	Decimal (if cargo type ≠ Container)
<b>Value of Cargo</b>	Commercial value of cargo.	Decimal (if cargo type ≠ Container)
<b>Number of Packages</b>	Package count (for Break Bulk / Container).	Integer
<b>No. of Load Containers (20 ft)</b>	Loaded containers (20 ft).	Integer (only if type = Container)
<b>No. of Load Containers (40 ft)</b>	Loaded containers (40 ft).	Integer

Input Parameter	Description	Type / Constraint
<b>No. of Empty Containers (20 ft)</b>	Empty containers (20 ft).	Integer
<b>No. of Empty Containers (40 ft)</b>	Empty containers (40 ft).	Integer
<b>Demurrage Charges Required?</b>	Option to calculate demurrage.	Boolean (Yes/No)
<b>Delivery Instalment (1..10)</b>	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.

#### Charges for Demurrage Charges

Defines the Rate of charges to be paid beyond free days

#### Wharfage Calculation

Wharfage charges for cargo as per the SOR Scale rates

### 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

- $\text{Time} = \text{Cargo Quantity} \div \text{Norms (from cargo\_master)}$ .

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

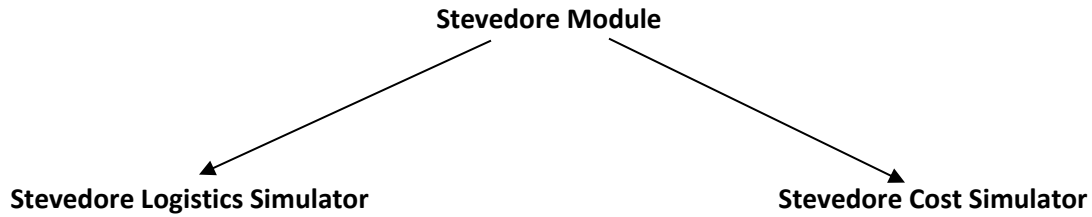
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✅ With this structure, the **Cargo Module** of SDD now includes:

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

## Stevedore Module

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The Purpose of Labour Simulator is to calculate the Number of Gangs to be engaged to load or unload the cargo from the ship and this should align with the Norms to be achieved in loading and discharging the cargo from the Ship.

Further, it is to show the cost to be paid for the total number of Labour Gangs engaged in completing the Loading and Discharging the cargo from the Ship.

Along with the Labour Handling cost, the Charges on the Royalties for Shore Handling and Stevedore Handling also to be calculated.

### Master Data Table to be Used:

Cargo Master <CM\_CargoMaster>

Labour Manning Master <LM\_labourManningMaster>

Labour Datum Master <LM\_labourDatumMaster >

Labour Composite Rate Master <LM\_CompositeRate>

Labour Royalty Master <LM\_RoyaltyMaster >

### Input Fields

Input Parameter	Description	Type / Constraint
Cargo Name	Name of the cargo (e.g., Coal, Iron Ore, Cement, Containers). The Norms of the cargo to be considered for handling the cargo to be handled per day	Text (FK from cargo_master)
Royalty Cargo Type	Cargo classification for choosing the Rate of Royalty to be paid for Stevedoring and Shore handling	List to be shown from Labour Royalty Master
Weight of Cargo	Total weight of cargo (tons).	Decimal (if cargo type ≠ Container)



Input Parameter	Description	Type / Constraint
Labour Gang Line	For choosing the Type of Labour Gangs for the Loading and Unloading Work	List from Datum Master
Use of 100 ton above Crane	This is to decide which datum to be chosen from the Datum Master to know the tonnage to be handled per shift	Yes or No

### Logistics Simulator

The Logistics Simulator will do the following:

- **to predict** the number of days the vessel work will take.  
**Logic to be followed:** This is based on the Cargo Norm or container norm from the input given cargo name and weight of the cargo or based on the total number of containers
- **to predict** the number of Gangs required to complete the Work.  
**Logic to be followed:** This is being done based on the Labour Indent Line Number chosen and the Datum tons.  
Number of Gangs = Weight of the Cargo divided by Datum of the line chosen

The Out put should show:

Time taken to complete the vessel work: (in days)

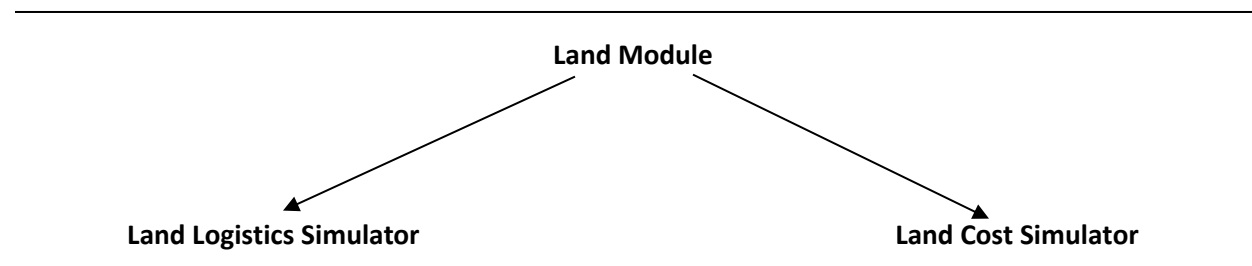
Maximum number of Gangs required: \_\_\_ Gangs

### Cost Simulator

The Cost Simulator will do the following :

- to Calculate the Composite charges  
**Logic to be followed:** From the Labour Indent Line Number chosen – check the category of labour to be engaged under the category On Board and chose the rate for the respective category from the Composite Rate Master. Find the Composite charges for 1 Gang and also find the total gang charges by multiplying this total gang charges by the total Gangs Required.  
**Out put**  
Composite Stevedoring Charges = \_\_\_\_\_
- to Calculate the Royalty on Stevedoring  
**Out put**  
Royalty on Stevedoring = Unit/weight x Rate as per royalty master
- to Calculate the Royalty on Shore Handling
- Royalty on Shore Handling = Unit/weight x Rate as per royalty master

## Land Module



The allotment of storage area inside the Port is categorized into two categories.

- Storage allotment for Immediate Cargo
- Storage allotment for Cargo

The Storage allotment for Immediate cargo is for the cargo landing from the vessel or the cargo to be shipped to the vessel in the immediate future (it is meant to be from 15 days to 180 days). Here the charges are based on the land types such as – Open Space paved, Open Space unpaved and Covered Space and the rate slabs are from 0 -60, 61 – 90, 91 – 120, and Beyond 120 days.

The Storage allotment other than Immediate Cargo allotment is for the area inside the Port and also outside the port premises. License Fee or Lease Rent is collected for this area.

### Master data to be used

- Immediate Cargo Storage Rate Master < SM\_ImmediateCargoFee >
- Leased Plots Storage Rate Master < SM\_LicenceFee >
- Storage Factor Master <SM\_StowageFactor>

### Input Fields

Input Parameter	Description	Type / Constraint
Type of Storage Required	To choose the Storage Area is required for Immediate Cargo or for the Lease	Radio Button
Type of Storage Yard	To choose the type of storage yard like open, closed etc	List to be shown according to the choice of required storage
Type of Cargo	To choose whether the storage area is required for Cargo or Container	Radio Button showing the Cargo or Containers
Cargo type	The type of cargo or the type of cargo like the cargo available in the list to be chosen	List to be shown according to the cargo available in the Stowage Factor Master
Cargo Quantity		
Containers size	The Size of the container to be give	Choice to be made available for 20, 40, 45, 60

Input Parameter	Description	Type / Constraint
Containers Quantity	Number of containers in each size of containers	Entry field only to enter the numbers
Number of Days	Duration of the storage area required for the customer	Entry field only to enter the numbers in days

### Logistics Simulator for Storage Area

The aim of the Logistic Simulator for Storage is

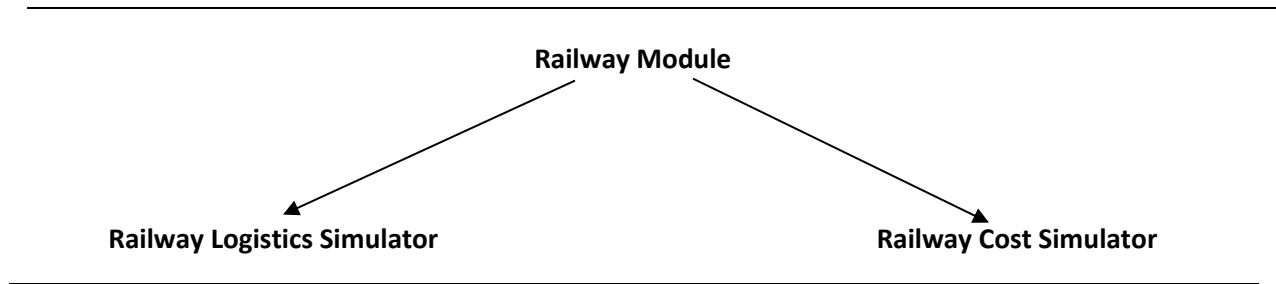
- To estimate the area for the storage of the cargo  
**Logic to be followed:**  
For Cargo – the tonnage of the cargo to be divided by the Stowage Factor  
For Containers – the number of each category of containers to be divided by four (as containers can be stacked 4 high on one above one) and then it must be multiplied by the area for each category given in the stowage factor master  
**Output:**  
Estimated Area for Storage - \_\_\_\_\_ Sq.mts
- To suggest the preferable area at which the cargo can be stored  
**Logic to be followed:**  
As per the choice of the area available in the stowage master, the suitable area to be shown  
**Output:**  
Suggested Area for Storage –  
Option 1  
Option 2  
Option 3  
Option 4

### Cost Simulator for Storage Area

The aim of the Cost Simulator is to find out the Charges to be incurred for the Storage areas.

- To estimate the cost of the storage for the planned during of the storage of the cargo  
**Logic to be followed:**  
The Area to be assessed as per the Logistic Simulator and based on the Area and period the cost of Storage Area to be assessed.  
**Output:**  
Estimated Area - \_\_\_\_\_ Sq. Mts  
Estimated Cost –

## Railway Module



The Railway Module is to provide simulated details for predicting the preferable railway siding for the Rakes transporting the cargo inside the Railway Yards of a Port and the duration for loading or unloading into the Wagons of Rake and how the type of placement & removal of the rakes will be done like partially or full rakes. The Cost Simulator provides the details on the charges to be paid to the port to handle these Rakes and also to calculate the demurrage charges for the wagons if they kept beyond the free time.

### Master Data

Railway Demurrage <RM\_Demurrage>

Railway Haulage <RM\_Haulage>

Railway Terminal Handling <RM\_TerminalHandling>

Railway Wagon Master <RM\_WagonMaster>

Railway Weigh Bridge <RM\_WeighBridge>

Railway Siding Master <RM\_RailwaySidingMaster>

### Input Fields

Input Parameter	Description	Type / Constraint
Cargo Type	The Cargo type in Railway Module is based on the Type of wagons to carry the cargo like Bagged Cargo, Dry Bulk cargo, Steel Cargo, Granite Blocks, Containers	The List as per the wagon Cargo master to be given in the input field
Wagon Type	Wagon Types such as Covered, Flat, Boxes, Container to be given as List	The List as per the wagon Cargo master to be given in the input field
If Container chosen, the Size of containers to be given	Details such as number of 40 feet, 20 feet to be given	A list may be given and it can be hard coded.
Input for demurrage		

Input Parameter	Description	Type / Constraint
Total Hours for Loading/ Unloading		

#### Simulator for Railway Logistics

- To predict – the Suitable Railway Siding for Loading and Unloading Operations
- Logic to be followed – check the type of wagons and predict for Full Loading/Unloading and also for Partial Loading / Unloading -use Railway Siding master for Wagon Type and Siding Number

#### Simulator for Railway Costs

- To predict -the Railway Related charges
- Logic to be followed
  - Haulage Charges – Wagons x Rate
  - Terminal Handling Charges – Carrying Capacity Tons of Rake x Rate
  - Demurrage Charges – ( Total Hours - 8 hours ) x Rate of Demurrage x Number of Wagons