Economical modelling of cement terminals as a means to reduce capital and operating costs

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Economical modelling of cement terminals as a means to reduce capital and operating costs

Contents of presentation

• Bring all cost factors into perspective: develop a logistical and economical calculation model
• Set-up of the calculation model
• Overview of individual cost factors and their impact on the overall import operations
• Effect of annual throughput on terminal costs
• How to apply capital costs
• Use of calculation model to reduce costs
  – reducing capital costs
  – reducing operation costs
  – comparing alternatives
• Conclusions
Calculation model

Terminal concept

Flow diagram

Required operations
“3D” Spreadsheet calculations
Market requirements

Transportation alternatives

Logistics

Required cement types
Bag / bulk ratio
truck / rail / barge distribution
Terminal opening hours
Dock situation
Convey distances
Storage and equipment efficiencies
Ship size / type
Unloading efficiencies

Shipping requirements
storage and equipment capacities
Equipment operating hours
traffic situation
etc.

Site characteristics

Storage and equipment alternatives
<table>
<thead>
<tr>
<th>Frequency unloading time</th>
<th>Dock occupancy</th>
<th>Labour hours</th>
<th>Power consumption</th>
</tr>
</thead>
</table>

### Costs
- Cement FOB
- Shipping cost
- Import duties
- Unloading cost
- Labour
- Energy
- Cleanup
- Maintenance
- Demurrage
- Wharfage / stevedoring
Operations

- **Power consumption**
  - Equipment running hours
  - Power consumption per equipment
  - Overall power consumption

- **Labour**
  - Required shifts
    - reclaim
    - blending
    - bagging
    - distribution

- **Maintenance**
  - Based on time
  - Based on throughput

- **Front-end loader costs (flat storage)**

- **Site lease**

  - Cost allocation
    - Type (blending)
    - Bulk / bag
    - Distribution

- **Overhead costs**
Capital cost

- Site infrastructure
- Foundations / piling
- Ship unloading system
- Storage facility
- Convey systems
- Blending / bagging equipment
- Buildings
- Distribution facilities
- Electrical / automation
- General contractor costs
- Overheads
- Contingency

TOTAL PROJECT COST

Depreciation
Interest cost

Cost allocations
Shipping & unloading

Operations & overhead

Capital cost

Profit & Loss

Revenues
- Sales type 1 bulk
- Sales type 1 bag
- Sales type 2 bulk
- Sales type 2 bag
- etc.

(Costs)
- Shipping & unloading
- Operations & Overheads

EBITDA

(Depreciation)

EBIT

(Interest + Taxes)

Earnings → ROI

Cost allocations
Effect of increasing throughput

Overall costs per year

Tons per year

US$

Ship unloading
Effect of increasing throughput

Ship unloading
The operational costs per ton of ship unloading are almost equal, irrespective of annual throughput.
Effect of increasing throughput

Terminal operations

Cost per year

- Lease of site
- + Energy
- + Labour
- + Maintenance
- + Front-end loader
- + Overhead
Effect of increasing throughput

Terminal operations
Terminal operational costs are highly dependent on annual throughput.

Higher annual throughputs strongly reduce terminal operational costs per ton.
Effect of increasing throughput

Capital cost per year

Capital cost

Annual throughput

- depreciation 10 years
- + interest 7% first year
- depreciation 20 years
Effect of increasing throughput

Capital cost per ton

US$

- depreciation 10 years
- + interest 7% first year
- depreciation 20 years

Annual throughput

Capital cost
• Capital costs can vary very substantially depending on the application

1) Long term depreciation versus short term payback period

2) Cost of money
   Interest cost
   Return on Investment

• Capital costs drop pro rata with increased annual throughput
Effect of increasing throughput

Total cost

![Graph showing the effect of increasing throughput on total cost](image)

- **Total cost**
- **Capital cost**
- **+ Operational cost**
- **+ Unloading cost**

Annual throughput

Total cost
Effect of increasing throughput

Total cost
Use of calculation model to reduce cost

- Reduce capital costs
- Reduce operational costs
- Compare alternatives
How important are terminal operating costs?

Example:
Large terminal USA
Throughput 500,000 tpa
Cement from Asia

FOB price US$ 22
CIF price US$ 40
Sales price US$ 70

Cement production cost
Margin towards capital cost / profit cement plant
Shipping cost
Shipunloading and terminal operating cost
Margin toward Capital costs / profit terminal
For a cement import operation there are three factors that really matter

- Cement price F.O.B
- Shipping cost
- Sales price cement ex terminal

Look at the past 15 - 20 years to see how much these factors have fluctuated. Based on that best case and worst case scenarios can be prepared.
Reducing capital costs

Where does the capital cost go to?

1. Key terminal facilities (shipunloader, storage facility / reclaim system, truckloadout)
2. Secondary terminal equipment (conveying equipment, intermediate buffer storage)
3. Support systems (electrical, plant air, steel support structures)
4. Foundations and piling
5. Infrastructure (roads, power supply, utilities, drainage, etc.)
6. Overheads (general contractor costs, engineering, project management)
Good terminal design only partially consists of selecting the optimal key facilities.

Good terminal design mainly focuses on reducing secondary terminal equipment, support systems, foundations and piling, infrastructure and overheads!!!
Reducing capital cost without sacrificing storage size or equipment performance

• “No piling” solutions

• Optimal use of existing infrastructure

• Terminal design based on logistics and economics

• Make optimal use of engineering from contractors and equipment suppliers

• Be your own general contractor and project manager
Reducing capital cost
“No piling solutions”

Ringbeam foundation
for storage facility

Floating floor for cement load

Allow settlement!

Flat storage

Dome storage
Reducing capital cost

Optimal use of existing infrastructure

• Roads / paved areas
• Power supply
• Foundations
• Dewatering
• Utilities
• Buildings
Reducing capital cost
Terminal design based on logistics and economics

Get the cement through the terminal with a minimum of handling and intermediate storage
Reducing capital cost

Terminal design based on logistics and economics

- Avoid intermediate buffer storage as much as possible
- Use a single main storage facility
- Short conveying distances
- Group vertical conveying together
- Build compact!

Reduces both capital and operational costs
Optimising logistics

Bad logistical concept

Better logistical concept
Reducing capital cost

Make optimal use of engineering from contractors and equipment suppliers.

When properly co-ordinated over 80% of engineering can be supplied by contractors and equipment suppliers at no or very low cost.
Reducing capital cost

Be your own general contractor and project manager.

Saves 10 - 20% but this does require experience!
A different perspective on terminals

Independents

• Make money only on “one side of the ocean”

• Capital cost of terminal is high compared to their ready mix / concrete plants

• Relatively low market control (short term payback required)

• Focus on capital cost

Low capital cost terminal design which is often innovative

Multinationals

• Make money on the whole operation
  - export plant
  - trading
  - import operation

• Capital cost of terminal is low compared to their cement plants

• Relatively high market control (long term project)

• Focus on “proven” design

Traditional terminal design, often at high capital (and operational) cost
Reducing operational cost

• Terminal design based on logistics and economics
• Bring terminal activities and labour shifts in line with each other
• Subcontract irregular work
• Reduce terminal operations to one shift per day whilst enabling 24 hr/day despatch
• Focus on planning and good organisation
• Operational costs are subdivided in many relatively small components. Just focussing to improve one or two of them has hardly any impact.

• Operational costs are directly linked to capital costs. Terminals with a high capital cost in general also have a high operational cost.

• To reduce capital and operational costs a terminal design is required that focuses on logistics and economics.
Comparing different design, storage facility and equipment alternatives

The calculation model allows for comparisons providing the effects on the complete terminal operation
Conclusions

• A cement import operation has many factors that influence its performance

• All these factors and their relation with each other can be put into perspective using a logistical and economical calculation model

• Capital cost and operational costs have a direct relation with each other, which is shown in the model

• Optimal terminal design is based on the specific logistics and economics of that operation and not on “proven” concepts.

• Optimal terminal design strongly focuses on reducing the costs of secondary terminal equipment, support systems, piling and foundations, infrastructure and overheads.