

Summary

The Delft University of Technology initiated a research on the design of new dry bulk terminals due to the absence of a comprehensive and detailed design method for it. The first results of the investigation (Van Vianen, 2010) showed that many rules-of-thumb for stockyard design have a wide variation. Extra research on the stockyard and the used stockyard equipment was necessary. Important stockyard equipment of dry bulk terminals are stackers, reclaimers and stacker/reclaimers. The aim of this literature study was to gather real-world technical data of available stackers, reclaimers and stacker/reclaimers worldwide and to make an overview.

The function of the stacker is to pile bulk materials such as coal and iron ore onto a stockpile. Stackers normally travel on a rail between stockpiles in the stockyard. Three groups are distinguished: 1. Stackers that can travel along the rail and by luffing its boom (luffing stackers). 2. Stackers that in addition to travelling and luffing of the boom, also are able to slew (rotate) the boom (luffing + slewing stackers). 3. Stackers that are positioned on a fixed place and stockpile material in a circular storage system by slewing the boom up to 360° (Radial stackers).

Reclaimers are used to reclaim the bulk material back from stockpile. The reclaimers also travel normally on rails between the stockpiles. Three groups are again distinguished, based on their reclaiming mechanism. 1. Reclaimers that use buckets to scoop up material. The buckets are mounted on a revolving wheel. The bucket wheel can be either placed on a boom or a bridge (bucket wheel reclaimers). 2. Reclaimers that use a chain with gathering scrapers (scraper reclaimers). These scraper reclaimers are used in bridge, portal and side scraper constructions. 3. Reclaimers that use a rotating drum fitted with a series of buckets along its length. The drum spans the stockpile and is mounted on rails on both sides of the stockpile (Drum-type reclaimers).

The third equipment type is the stacker/reclaimer which combines the functions of a stacker and reclaimer into a single unit. Basically, the two groups are: 1. Boom-type stacker/reclaimers, also known as bucket wheel combi's. The design is similar to a bucket wheel reclaimer, only the boom conveyor can work in two directions; stacking and reclaiming. 2. Radial stacker/reclaimers. This machine is actually a combination of a radial stacker and one of the scraper reclaimers. Radial stacker/reclaimers are commonly used in circular blending systems.

Different world-wide manufacturers and users are approached to get technical details of existing equipment to be able to compare them and to derive technical design indicators for future stockyard design. The gathered technical details comprise: available brands and types, capacity, boom length, belt speed and width, year of delivery, pile width and height, number of machines worldwide, total installed power, investment cost and maintenance cost.

This information is put in an Excel database consisting in total 86 stackers, 142 reclaimers and 92 stacker/reclaimers. During the research it became clear all stockyard equipment is tailor made and adapted to the customer. No standard types are available.

The most important design indicators for the different equipment types are summarized in Table 1. The other characteristics are dependent on these properties or can be chosen arbitrary.

Table 1: Summary of the most important design indicators for the observed stockyard equipment

Machine	Capacity [mT/h]	Dimension [m]	Stockyard capacity [m ³]	Blending ¹
Luffing Stacker	Min: 150 Max: 10000 Average: 2604	< 60 boom length	< 1,000,000	Small-moderate
Luffing + slewing stacker	Min: 250 Max: 6100 Average: 2672	< 60 boom length	< 1,000,000	Good
Radial stacker	Min: 100 Max: 7700 Average: 2511	< 120 diameter	< 250,000	Good
BucketWheel reclaimers	Min:800 Max: 15000 Average: 3235	< 60 boom length	< 1,000,000	Small
Portal reclaimers	Min: 5 Max: 2750 Average: 2295	< 60 portal span	< 100,000	Small -Moderate
Bridge-type scraper reclaimers	Min: 50 Max: 3000 Average: 2335	< 63 gauge	< 10,000	Good
Bridge-type BucketWheel reclaimers	Min: 600 Max: 13500 Average: 2959	< 60 gauge	< 500,000	Good
Side scraper reclaimers	Min: 250 Max: 1500 Average: 623	< 27 boom length	< 10,000	Small -Moderate
Drum-type reclaimers	Min: 500 Max: 5500 Average: 1737	< 42 gauge	< 500,000	Very good
BucketWheel stacker/reclaimers	Min: 820/300 Max: 10000/8000 Average: 3085/2548	< 60 boom length	< 1,000,000	Small
Circular stacker/reclaimers	Min: 500/300 Max: 7700/1650 Average: 2525/1079	< 125 diameter	< 250,000	Good

Using the details, insight is obtained in the characteristics of the different machines. The variety and range of available options in these machines is such that selection of stockyard equipment is still very difficult. A selection guide is presented to help selecting suitable stockyard equipment. Although expert consult is of paramount importance at designing a new stockyard or expansion of existing ones, the rough selection guideline described in chapter 3.8 and presented in an overview in Appendix B can be followed to select suitable equipment types.

The report is concluded with a discussion and some recommendations towards new research about capacity definitions and costs.

¹ Highly dependent on stacking and reclaiming method (Chapter 2.4)