

Summary

At dry bulk terminals, bulk materials are imported to or exported from the terminal using rail cars or trucks. At export terminals, the bulk materials (only focus in this literature assignment on coal and iron ore) are dumped out of the rail cars and/or trucks. At import terminals, railcars and trucks are loaded with coal or iron ore.

Transportation by train can be done with different types of railcars like open box cars, hopper cars and self-discharging cars. All of these railcars are loaded from the top with a batch weighing system or volumetric system. Batch weighing systems weight the material in batches before loading railcars. Volumetric systems load railcars directly from a silo. The unload process from the types of railcars is different from each other. The open box car is unloaded with a rotary car dumper, which rotate the railcar to unload the material. Hopper cars and self discharging cars are both bottom dump cars. They unload material by opening their doors, whereby material drops in a hopper under the rail track. Under the hopper there are rotary plow feeders to transport the material to a conveyor, which conveys it to for example a storage pile. During unloading railcars problems can occur with frozen material, which is stuck to the railcar. Solutions to encounter this problem is using a thaw shed, car shaker, hammermill or a combination of the mentioned solutions. Automation of the loading and unloading process is already used nowadays.

Trucks can be loaded in the same way as trains. The unload process of trucks is done by dumping the material in a surge bin or storage pile. This dumping can be done from the side and rear, but also with a hopper on a trailer. Trucks have also problems with frozen coal, but therefore no special equipment is available. Automation of the loading and unloading process is already used nowadays.

For train transport from and to the terminal a rail layout has to be designed. In general the layout design depends on the geographical conditions. Also the rail is mostly parallel opposite to the quay behind the stockyard. Furthermore the classification yard, when present mostly outside of terminal area, is after loading or unloading operation. Besides, export terminals have a rail layout with rails positioned in a curve and import terminals have a rail layout whereby the train has to go forwards and backwards. When terminals have rail layout with a curve the radius is on average 242 m.

Truck transport is economical favourable for distance up to 160 km with low annual volumes and difficult terrain for placing rail tracks. Train transport can be done by bottom dump car or open box car. Bottom dump cars are economical favourable for distance under 563 km (350 miles). This because until than investment for bottom dump train unloaders combined with bottom dump cars, which have lower load capacities than open box cars, are cheaper compared to open box cars.

Thereby the number of railcars used depends on the transport distance. Also bottom dump cars have to be in warmer (without long winters) climates where frozen material give less problems. Open box cars are economical favourable for distance from 129 km (80 miles), thereby the number of railcars

used depends on the transport distance. Furthermore open box cars can be used in cold and warm climates.

When designing a terminal trains and trucks have to be loaded. Thereby the most used loading process is batch weighing. For a truck loading station the loading capacity goes up to 1000 tons per hour (tph). A train loading station has a load capacity between 2500-7800 tph and the required load capacity compared to annual throughput is 180 tph/Mt. Thereby a remark has to be made that it's based on a small number of loading stations. With the unload process a truck can be unload without frozen or sticky material in less than a minute. For a train unloading station is the unload capacity 6250 tph and the required unload capacity compared to annual throughput is 340 tph/Mt. An explanation for the difference between loading and unloading capacities is that import terminals can have more transport modes like truck and barge, which take a share of the annual throughput from the terminal.