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Material Handling Machines at Terminals

In the Nordic contexts, there are four main terminal types (Kons 2016) each of them with its own specific material turnover intensity, size and requirements for different kind of machines. There are two main types of machines at the terminals, for log handling and for handling of loose materials as wood chips, bark etc. Big terminals are often specialized in logs or another loose material assortments. It is however not excluded that both, logs and loose material are handled at the same terminal.

LOOSE MATERIAL HANDLING

Wheel Loader/Front-End Loader for Loose Materials

Figure 1. Volvo L120H loading bark into the trailer

Wheel loader or front-end loader is perhaps the most widespread machine at the terminals and definitely one to find at the terminals handling loose materials. It is also a very universal machine since its construction allows to change material handling tools from buckets to forks etc. Wheel loaders are almost exclusively used at all wood chip train and truck loadings at the Swedish biomass terminals.

The range of wheel loader sizes is wide, from ca. 11 t up to 56 t operating weight. However, the most common size at the terminals is in the range of 18.5 – 28.5 tonnes operating weight. The wheel loader's and bucket size is usually chosen to match the distances the material has to be carried from the storage area to the train. The longer distance, the bigger bucket is used. The machine and bucket size are less crucial when loading trucks.

At smaller terminals, as transshipement terminals, wheel loaders are owned by contractors and are used on campaign bases when a chipping operation is underway or loose material from the terminal has been emptied and more intense truck traffic is planned. The rest of the time wheel loaders can be used in other work activities at construction sites, snow ploughing etc, therefore ensuring high utilization rates of the machine during the whole year.

Port material Handler

Especially in the Swedish context, the industry is often located close to the coast and substantial volumes of raw materials are delivered overseas. Since the biggest costs in the overseas transport are associated with loading and unloading of the ships it is of high importance to have high machine productivity at the ports.

Figure 2. Multidocker material handler at the port

Port material handlers or cargo handlers are multi-purpose build machines for port operations. Those are big and expensive machines with a productivity in the ballpark of around 1400 m3/h of wood chips. The maneuverability of the machines are low and they operate in a rather static location, close to the storage area or at the wharf.

Reach Stacker

Reach stacker is quite a unique machine to be found at the biomass terminals. Reach stackers are mainly used for small intermodal terminals or medium size ports handling container shipments. It can quickly carry containers within short distances and stack them in various rows. There are also reach stackers for log handling e.g. Liebherr LRS 645 LH. However, all wood chip trains in Sweden are using one or another kind of containers on the carriages.

Usually these containers are left on the carriages while being loaded with wheel loaders, however, containers can also be lifted and placed closer to the wood chip piles for loading. In this case, it is easier for the wheel loader to feel the container and the cycle time of the wheel loader is shorter. The drawback of using reach stacker is that there is still need for the wheel loader, however, under the right conditions reach stacker can be found useful.

Figure 3. Reach stacker for container handling

LOG HANDLING

Logs are the most common assortment at all terminals. Early terminal development mainly started to secure pulpwood supplies for the pulp&papper industry. Even at the biomass terminals for energy ca. 70% of all incoming biomass are energy wood logs (Kons et al. 2014). Today almost all big terminals are purely roundwood or partly roundwood terminals.

Wheel Loader/Front-End Loader for Roundwood Handling

As mentioned before wheel loaders/front-end loaders are a very universal machine to have around terminals. In the Nordic context, the most common front-end loader size at the terminals is in the range of 18.5 – 28.5 tonnes operating weight. In other regions of the World, the size of these machines can substantially increase. The front-end loader is good alternative and one machine can do all at the smaller terminals where both loose material and logs are handled at the same time giving the space to use the machine outside terminal operations as well.

Figure 4. Volvo 180G wheel loader equipped with log grapple at the mill log yard.

Usually, the front-end log loaders can be equipped with different grapples depending on the work task. The machine can be used for loading/unloading of trucks and for placing logs onto feeding decks at mills. It is also fast at carrying small volumes of logs over short distances. Front-end log loaders are very common at the terminals in countries like New Zealand but less so in Nordics. And some of the main considerations when choosing front-end log loaders should be the yearly turnover at the terminal, the stack height of logs, available terminal space and time constraints, especially when loading/unloading trains.

Front-end loaders typically can operate up to ca. 5 m stack height. Since it is front-end loader the grapple cannot be rotated and the loader must always approach stacks from the ends of the stacks, perpendicular to the long side of the logs. This means that terminal layout will be different compared to using other log handling machines which can rotate the grapple and approach the stacks from the top/bottom end of the logs. Because of the way front-end log loader can be used, the required space for maneuvering the machine should be accounted for. Also, the productivity of front-end loader is lower compared to high lifts which are based on wheel loader base and material handlers. Productivity should be taking into consideration if train loading is considered, since, usually it is time constraint operation.

High Lift

High lift is purpose build machine on wheel loader's base for log handling. Typically it will be a slightly heavier machine at ca. 35 – 38 t compared to the most commonly used front-end loaders.

Figure 5. Volvo 180E high lift at the saellite terminal in Sweden.

Since high lift is purpose build machine it cannot be used for other activities despite log handling. However, it gives high productivity in applications like unloading/loading logs on trucks and trains as well as stacking, unloading sorting hoppers and loading feed tables. Since the grapple on the high lift can rotate 360o the cycle times are shorter and the stacks can be approached from every side.

The high lift can also operate at the stack heights at about 7 m, therefore, reducing the needed storage space for about 60% compared to when using front-end loaders. As with most machines the good ground bearing capacity is of high importance. When having full grapple the load on the front axles can reach ca. 70 t. As terminal activities are repetitive over the time the ground conditions can be seriously affected. High lifts are well suited for the terminals with high turnover and train loading/unloading activities. However, for terminal maintenance, a wheel loader will be necessary.

Material Handler

Figure 6. Liebherr LH50 material handler at the feed-in pulp log terminal.

Material handlers are widely used across sever sectors. Material handlers can work in tight spaces at the mill stockyards and other terminals. They provide good visibility for the operator when loading and unloading. A common operating weight for the material handler is in the range of 30 – 45 t and crane reach is ca. 13 – 18 m depending on the model. However, material handlers are not the most common machine at the Nordic forest terminals. Main reason being, they are not as good as other types of the machine carrying logs over longer distances between storages areas at the terminals. But due to the economies of scale, the sawmills and pulp mills in Nordics are becoming bigger and more terminals are looking to increase storage capacity without expending terminal area. Material handlers can operate at the higher heights than any other mobile log handling machine on the market. Most other machines max out at ca. 7 m due to safety reasons. Material handlers can operate up to 10 m height, leaving a small margin before max out. In cases when log transporting is necessary, some of the material handlers can be equipped with a trailer to haul logs from one point to another. Train unloading and mill yards are common situations when trailers are used.

At the big terminals, it is common to see material handlers working together with high lifts or log/reach stackers. Usually, the last one is used to build the log stacks up to 7m leaving the top heights to the material handlers. Due to the high crane and grabble mobility material handlers are well adapted for stack building and log adjusting and in combination with the skilled operator the risk of stacks to fall over can be significantly reduced even at high heights.

Log/Reach Stacker

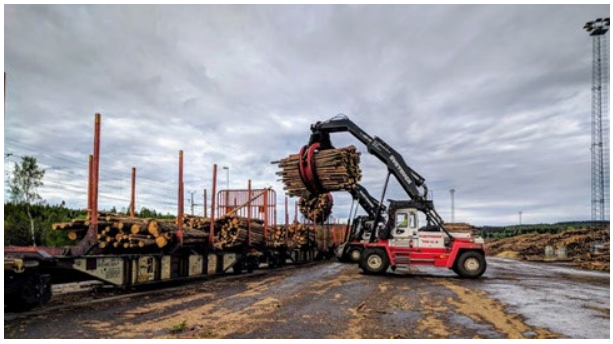

Figure 7. Swetruck TMF 12-9 log stackers unloading train at the log feed-in terminal in Sweden.

Log stacker is one of the most common machines at the pulp mills, big unloading terminals and big sawmills in the Nordic countries. These machines have a high lift capacity (9 – 30 t) and they are very efficient at unloading trucks and trains and carrying logs over short distances at the mills and terminals. The grapple as for the material handlers and high lifts can be rotated improving overall machine maneuverability. If the log stacks are high, log stackers cannot easily approach log stacks in the same way as front-end loaders without safety risks of logs rolling down.

Therefore terminal layout has to be planned so that log stacks can be approached from the top/bottom end of the logs. Due to grapple size and construction, these machines are not suited for loading logs and you will not find these machines at the terminals loading trains and truck. Also, a higher fuel consumption can be expected compared to material handlers.

Port Material Handler

As mentioned earlier, port material handlers or cargo handlers are multi-purpose build machines for port operations. The productivity of port material handler for pulpwood logs is in the ballpark of around 300 - 600 m3/h. The maneuverability of the machines are low and they operate in a rather static location, close to the storage area or at the wharf. (Figure 8) However, port size material handlers like Multidocker CH1100 can be used also at the roundwood terminals when high volumes of timber handling are expected.

This type of machines is very effective when unloading, loading and building high storage stacks of logs. However, they are difficult to move around longer distances at the terminals. Therefore a shuttle transport should be considered if logs are supposed to be carried from one point to another even within terminal borders.

Figure 8. Multidocker CH65 port material handlers unloading pulpwood from the boat.

Links to the some of the main machine manufactures for forest terminal operations

Volvo Construction Equipment
https://www.volvoce.com/europe/en/products/wheel-loaders/large/
https://www.volvoce.com/-/media/volvoce/global/global-site/product-archive/documents/03-wheel-loaders/09-volvo-f-series/all-common-f-series/v-l60ftol350f-loghandl-22a1003717-2009-03.pdf?v=FiEyPw
Sennebogen
https://www.sennebogen.com/en/products/material-handler.html
Liebherr
https://www.liebherr.com/external/products/products-assets/282614-2/Bildprospekt%20Holzumschlag.pdf
Swetruck
https://www.svetruck.se/en/logstackers/
CAT
https://www.cat.com/en_GB/products/new/equipment/wheel-loaders.html
Multidocker
http://multidocker.com/products/
Kalmar
https://www.kalmarglobal.com/en-BE/newsroom/press_releases/2014/kalmar-launches-its-fifth-generation-gloria-reachstackers-into-the-americas/

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Kons, Kalvis, Dan Bergström, Ulf Eriksson, Dimitris Athanassiadis, and Tomas Nordfjell. 2014. “Characteristics of Swedish Forest Biomass Terminals for Energy.” International Journal of Forest Engineering 25 (3): 238–46. doi:10.1080/14942119.2014.980494.

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