How to choose the right compactor

A short guide to choosing the optimal waste compactor for maximizing profits

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From Waste to Value®

Introduction to waste compactors

Compactors come in many shapes and sizes, each with their own characteristics and uses. This guide will help you in choosing the right type and optimal size waste compactor for your waste streams.

The guide focuses on the following topics:

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Different types of compactors

A landfill can be managed and operated in many ways and with different equipment. Each type of equipment has its uses, but most landfills can increase their profits by choosing the right equipment for the right job.

Different machines have their unique pro's and con's, which you will find listed in this guide along a short recap of their features. In the end you find an example calculation of the profits and landfill life expectancy using different equipment for waste compaction.

The compactors can be divided into three categories:

1. **Track-type tractors (TTT)**
2. **Four-wheel compactors**
3. **Two-drum compactors**



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Track-type tracktors (TTT)

Track-type tractor (TTT's) is a very popular machine in the landfill. A TTT usually prepares the site by spreading the first waste layer because bottom layers of a new site can be damaged when real landfill compactor is used. During the normal landfill operation a TTT is usually used for building access and haul roads and spreading cover soil. It can be also used as a feeding machine for landfill compactor by pushing and spreading waste during peak hours and when the waste needs to be pushed long distances.

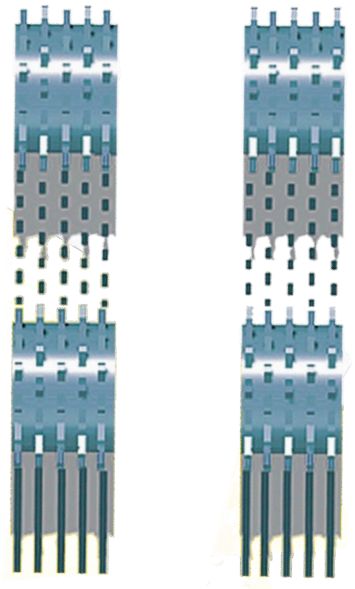
A Track-type tractor can also be used as a "compactor" but then the achieved compaction rate is essentially lower compared to a real landfill compactor. This is due to the fact that a TTT´s ground contact area (=area of the tracks against ground) has been designed as large as possible in order to ensure the maximum traction and to keep the machine on the surface.

When a TTT is used as a compactor, the landfill working method is in most cases so called open face method meaning that the waste is pushed over the landfill edge instead of working in the down slope. Down slope operation with a TTT is practically impossible because the low ground clearance of the TTT makes the machine get stuck in loose waste.

Pros of TTT as a landfill compactor	Cons of TTT as a landfill compactor
Capable to push long distances effeciently	Low ground clearance
High pushing capacity	Poor climbing ability in soft waste
	Low compaction ratio
	Low ground pressure

Four-wheel compactors

A four-wheel compactor is an adaptation of the four-wheel loader where a heavy frame is combined with four large wheels that have steel teeth for compaction. This construction has been in use for a long time and is the most common way to build a compactor today.



Four-wheel compactors can provide the most weight per square meter, but the overall compaction rate stays lower than that of a two-drum compactor due to waste extruding around the wheels. Waste compacted with a four-wheel compactor is also uneven following several passes of the same area.

A landfill operating a four-wheel compactor often needs a TTT to push the waste from a tipping area around the landfill for the compactor, because the trucks can't get around the uneven ground left by the four-wheel compactor.

Pros of a four-wheel compactor	Cons of a four-wheel compactor
Good maneuverability	Uneven ground after compaction
Good ground pressure	Needs several passes to compact area
Good compaction rate	Poor traction in soft waste

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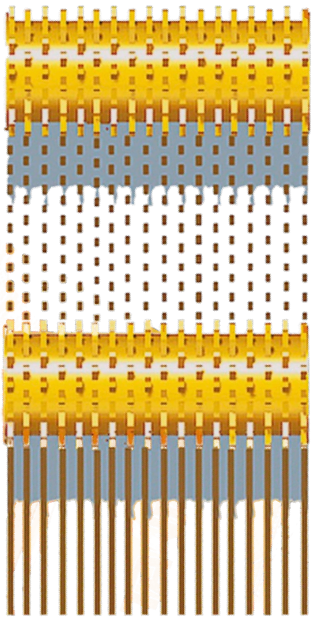
Two-drum compactors



A two-drum compactor is the modern way of designing a waste compactor. A higher crushing power than traditional designs is achieved by combining full-width twin drums, crushing teeth and a rigid, non-oscillating frame.

The compaction force of the full-width drums is directed straight down thus preventing waste extrusion from underneath the compactor. Being elastic the waste wants to escape to all possible directions while it is being compacted. Too small width of the wheel will allow an extrusion at both ends and between the wheels. This will result in the already compacted area to become again non-compacted. Two-drum design is developed in a way that it will gain compaction with one pass and extrusion will happen only at both ends of the drums.

Compaction teeth are pressing the material deeper and the pan around the drum/wheel is causing ground pressure (together with the teeth). Ground pressure only compacts the top surface as the teeth compact the waste deeper. The more teeth are in contact with the waste the better and a two-drum design maximizes the number of teeth in contact at any given time.

A rigid frame has several advantages for a compactor:

- it has +/- 40 degree articulation but zero oscillation, providing maximum crushing
- force
- even load spreading with the wide, level-staying blade
- minimizing undesirable cabin swing
- yields maximum compaction
- is of very simple design and extremely robust construction

Pros of a two-drum compactor	Cons of a two-drum compactor
Best compaction ratio	Slow top speed
Less passes per layer = fuel & time savings	
Best traction in soft waste	
Good climbing ability	

Example calculations with different types of compactors

Track-type tractor	500-700 km/m³
Four-wheel compactor	700-1000 kg/m³
Two-drum compactor	800-1200 kg/m³

The compaction rates shown above are depending on:

- weight of the machine
- content of the waste
- waste moisture
- operation method
- driver skills

Compaction rate related to landfill revenue and life time (annual waste amount 150 000 t)

Compacted with	Free airspace of the landfill	Tipping fee EUR/ton	Compaction rate ton/m³
TTT	3.000.000	80,00	0,6
Four-wheeler	3.000.000	80,00	0,9
Two-drum	3.000.000	80,00	1,0

Compacted with	Expected cumulative landfill revenue EUR	Expected lifetime in years	Extended lifetime in years
TTT	144.000.000	12	0
Four-wheeler	216.000.000	18	6
Two-drum	240.000.000	20	8

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Why size matters for a compactor

Waste compactors are typically marketed based on their weight, for example Tana's product line includes compactors with operating weight from 26 to 52 tons.

Operating weight determines how much waste a compactor can process and compact. The heavier a compactor is, the more waste it can compact with one pass, thus compacting more waste per hour.

If the compactor is too small, it can't process incoming waste quickly enough, resulting in stoppages or clogging of waste input. Every moment that incoming waste waits to be unloaded is revenue lost.

Heavier compactors cost more to purchase and operate. Maximizing revenue is therefore not based on getting the biggest compactor, but rather the correct size.

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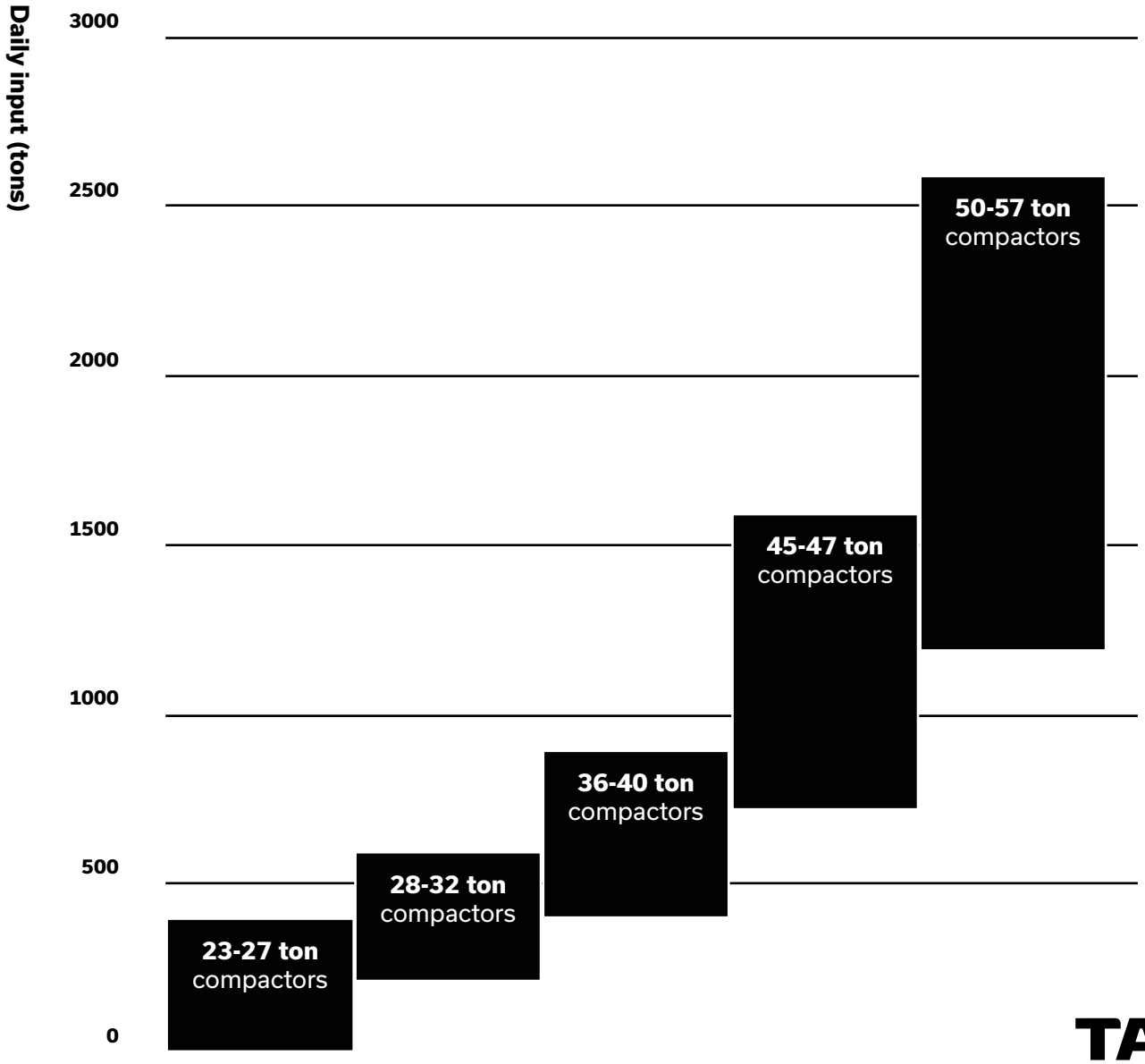
Daily Input

A compactor's capability to manage a certain amount of waste is based on its weight and width. For example a compactor weighing 32 tons is capable of compacting 200-650 tons of waste per day. This is the compactors theoretical capacity.



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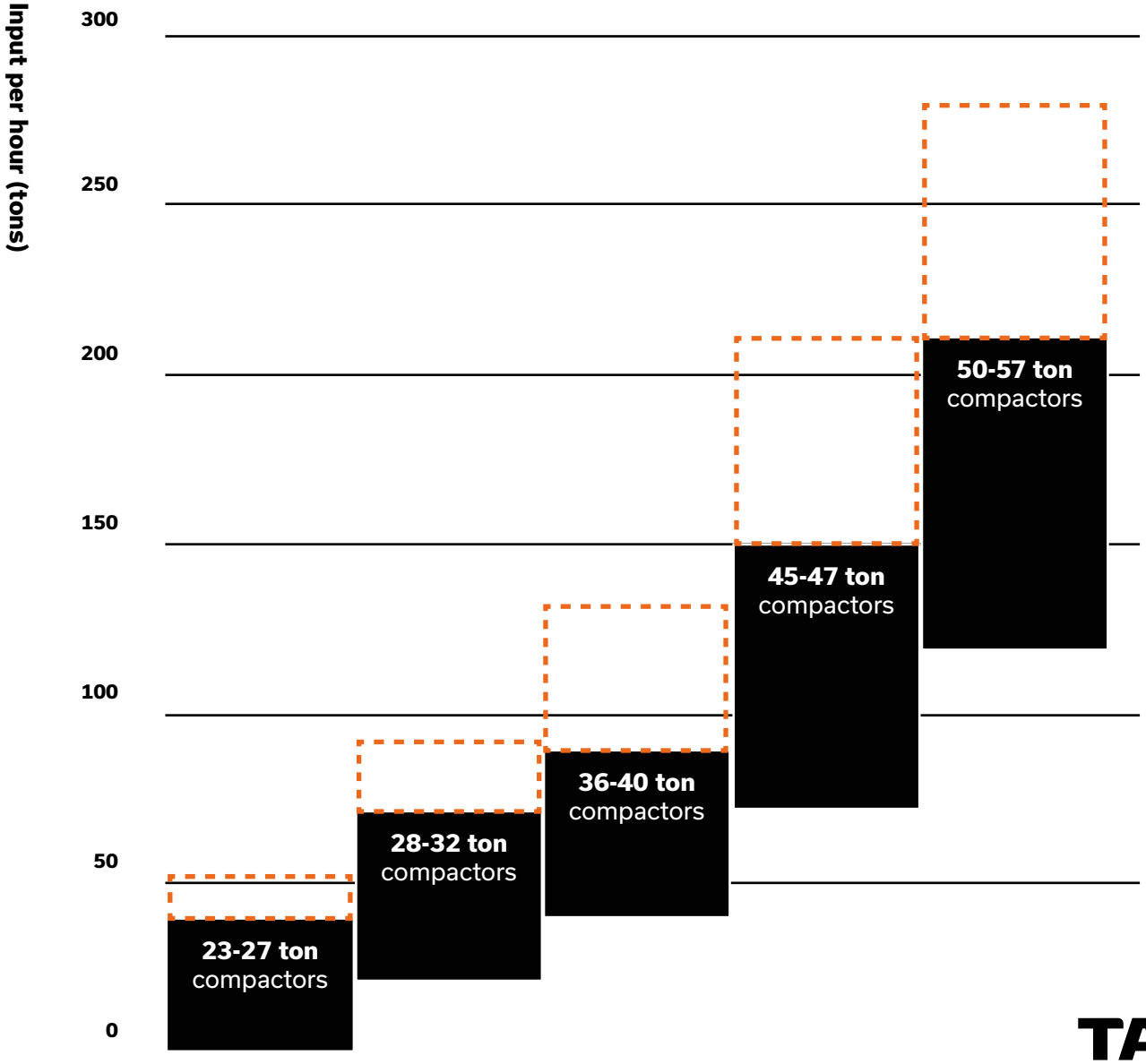
Input per hour

In real life use it's not smart to continuously operate a compactor at the upper limit of its theoretical capacity. A 32 ton compactor is enough to compact 20-65 tons of waste per hour. It can handle 65-85 tons when needed, but continuous operation at the upper limit increases wear and shortens the service periods.



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Peak hours

A landfill never receives exactly the same amount of waste each hour of each day. The variance in waste amounts and types means there are peak hours, when a lot of waste comes in and slow hours when there is very little incoming waste.

Few landfills even operate 24/7/365, so simply calculating daily or hourly tonnages from the total tons per year does not result in the correct compactor choice.

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Customer case

A municipally operated landfill receiving 250,000 tons of waste per year.

Facts:

Incoming waste mix

- 50% household/kerbside
- 35% Industrial and Commercial waste
- 15% Construction and Demolition waste
- Weekly average input of waste 5,069 tons
- Open 12 hours per day, 7 days per week

Estimations:

- Estimated daily average was 724 tons of waste per day (tpd)
  If this were true, the site could manage with a 32-ton compactor
- In reality, the site takes and average of 950 tpd during weekdays and approximately 150-250 tpd on weekends
- This would necessitate the use of a 36-40 -ton compactor
- The hourly average during weekdays was 80 tons per hour, but this was not the whole picture
- A peak hour traffic chart was drafted to determine true capacity requirement
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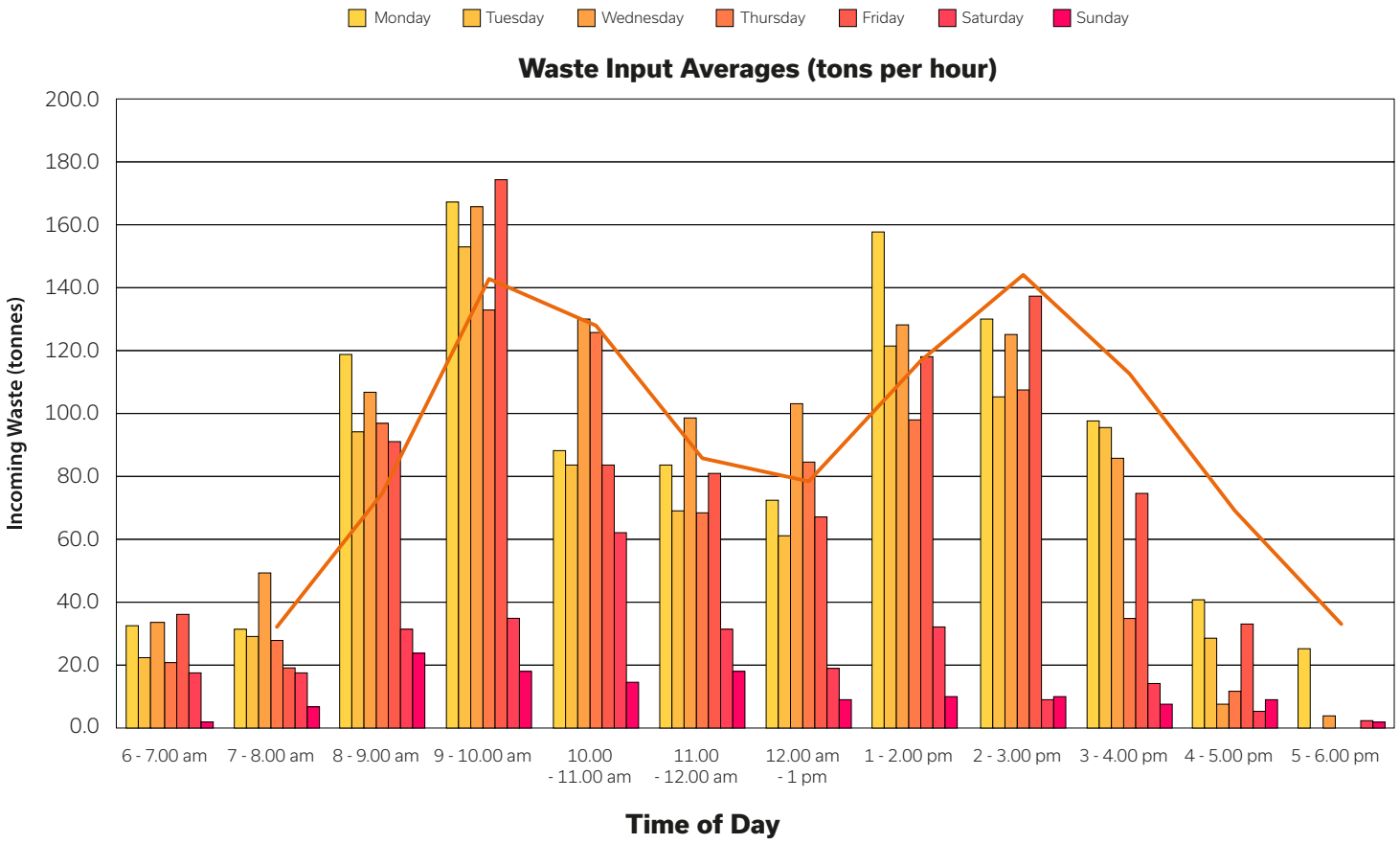

Looking at the input of waste per hour, the resulting minimum hourly capacity to be managed at all times would have to be approximately 130 tph.

What we can conclude from the data:

- 45-47 –ton compactor would be the recommended option
- It has enough power and peak hour capacity for incoming waste
- Not working as hard as a smaller unit at its upper limits
- This results in less downtime due to breakdowns
- A single unit would manage the site
- Could also make a dozer redundant

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Conclusions

- **Start by choosing the right type of compactor based on your landfill type, waste streams and requirements**
- **Selecting the size of a compactor is not a straightforward calculation exercise based on incoming waste per year**
- **Examining the hourly waste input streams gives a better view on the needed compactor size**

Choosing the right compactor:

1. Two-drum compactors
2. Four-wheel compactors
3. Track-type tractors (TTT)
4. Choosing a too small compactor for the waste stream forces the compactor to work harder, resulting in more breakdowns and maintenance
5. It's better for a compactor to work on the lower 2/3 of capacity than last 1/3

Learn more about TANA landfill operations at
www.tana.fi/landfill-operations

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