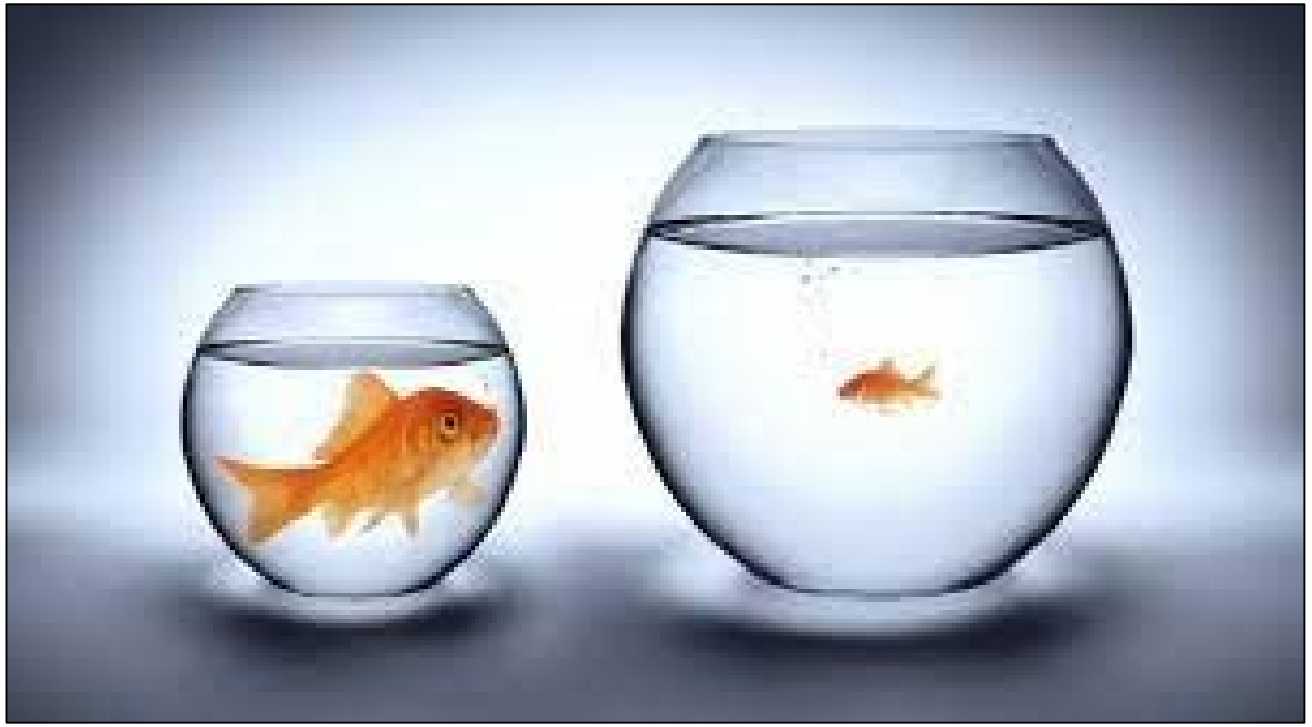
Right Sizing Heavy Equipment – Bigger isn't always better!

APRIL 5, 2022

Right-Sizing Definition

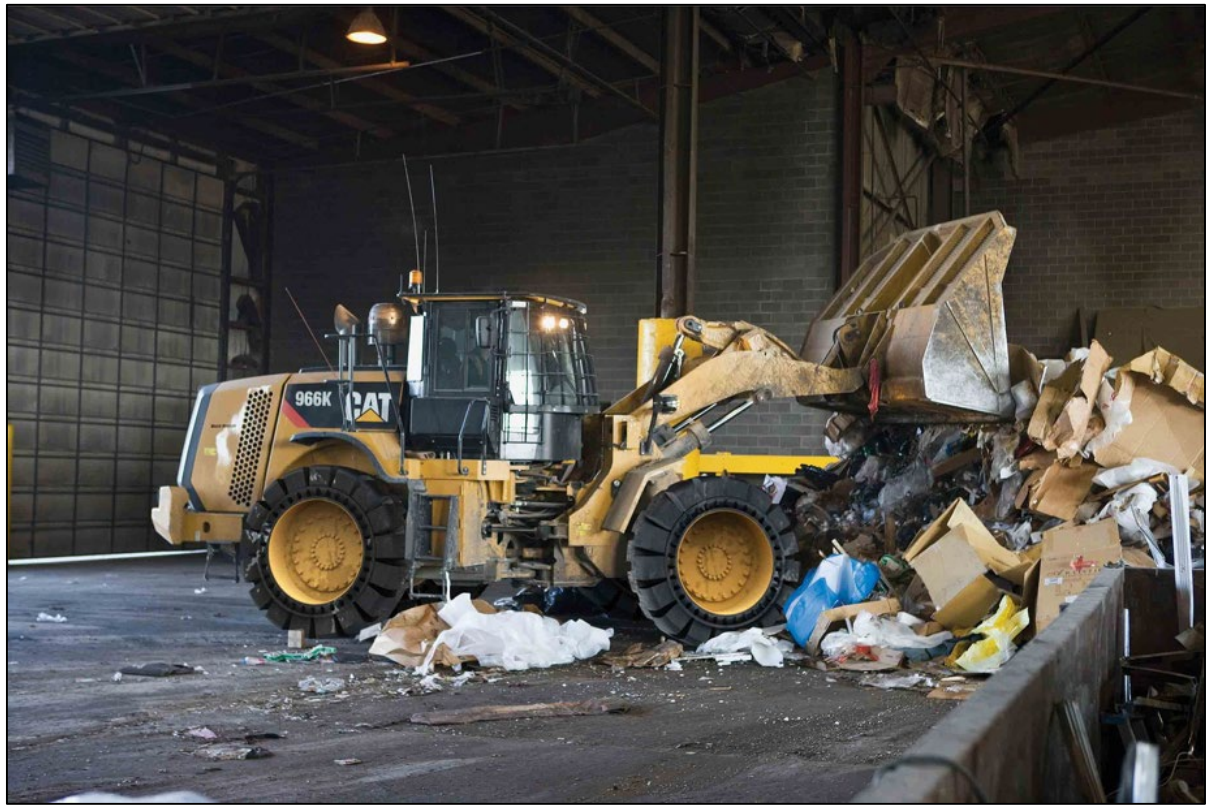
The act of converting (something) to an appropriate or optimum size



Heavy Equipment In Our Industry

Heavy Equipment is vital to our entire industry.

- Landfills
- Transfer Stations
- Recycling Operations
- Organics Processing
- Waste collections (bulky item pick up)



Heavy Equipment Budgeting

According to SWANA:

Most landfills spend around 4% of their annual budget on engineering, 18% on equipment and more than 60 % on daily operational costs.

In Our Travels

- Firsthand look at heavy equipment fleets of all sizes and configurations
- Some fleets have been right sized, some have not
- Ongoing trend to go with bigger equipment without detailed analysis of key factors

This Really Happened

At a small (130tpd) landfill, one of their operators asked us to recommend they replace their 627 scraper with a 637 scraper.

Did they need a bigger scraper?

Do they need a scraper at all?

This Really Happened

At another small (150tpd) landfill, one of their operators asked me to recommend they replace their 60,000# landfill compactor with a 135,000# landfill compactor

Did they need a bigger compactor?

Question No. 1

How did you select your current machines?

1. *Replaced with same size as previous machines*
2. *Equipment Dealer's recommendation*
3. *Performed a detailed analysis factoring in (production rates and owning and operating costs)*
4. *Equipment operators told us what we needed to purchase*

So, Are There Standards?

When it comes to right sizing heavy equipment, are there industry standards?

The Problem With Standards?

You could simply look at what is typical in the industry, but there is a problem.

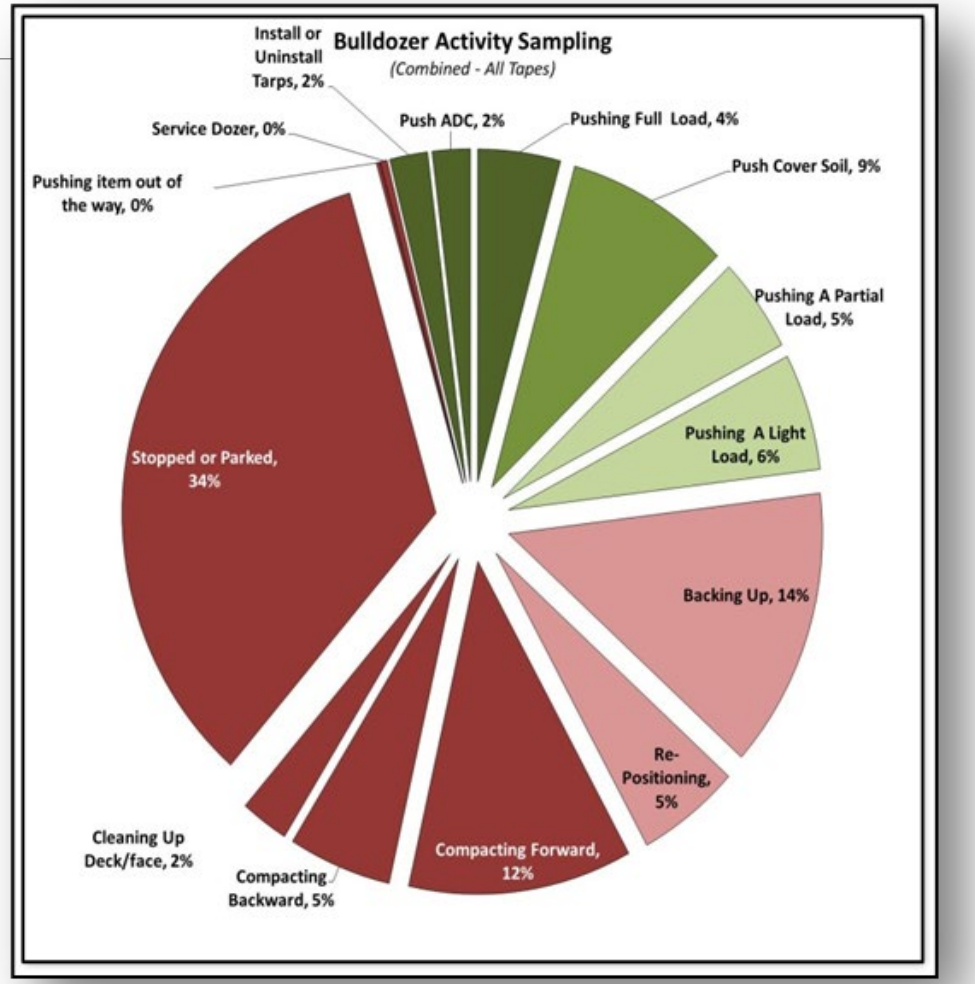
1. Every single operation is unique
2. The typical operation is not nearly as productive as it could be!

Non-Value Added

Beside making production cycles, some operators perform non-value added activities:

- Make lots of cleanup pushes/passes
- Spend hours idling
- Keep busy to look busy
- Wait for the next load to be dumped
- Don't have room to work effeciently

Non-value added requires bigger machines



Bulldozer – Non-Value Added

Right - Sizing Primary Factors

In order to right - size equipment, you must understand:

1. Equipment Production Rates
2. Owning and Operating Costs
3. (Landfill Compactor) airspace values

You Have Options..

Go big, more expensive but higher production

Go small, cheaper with lower production

The selection process must be optimized!

Example – Bulldozer Production Rate

- Under ideal conditions a bulldozer has the power and traction to push about 40% of its gross weight

Machine	Gross Weight	Max Load
D6	46,000 (23 T)	9 T
D7	58,000 (29 T)	12T
D8	86,000 (43 T)	17 T
D9	106,000 (53 T)	21 T

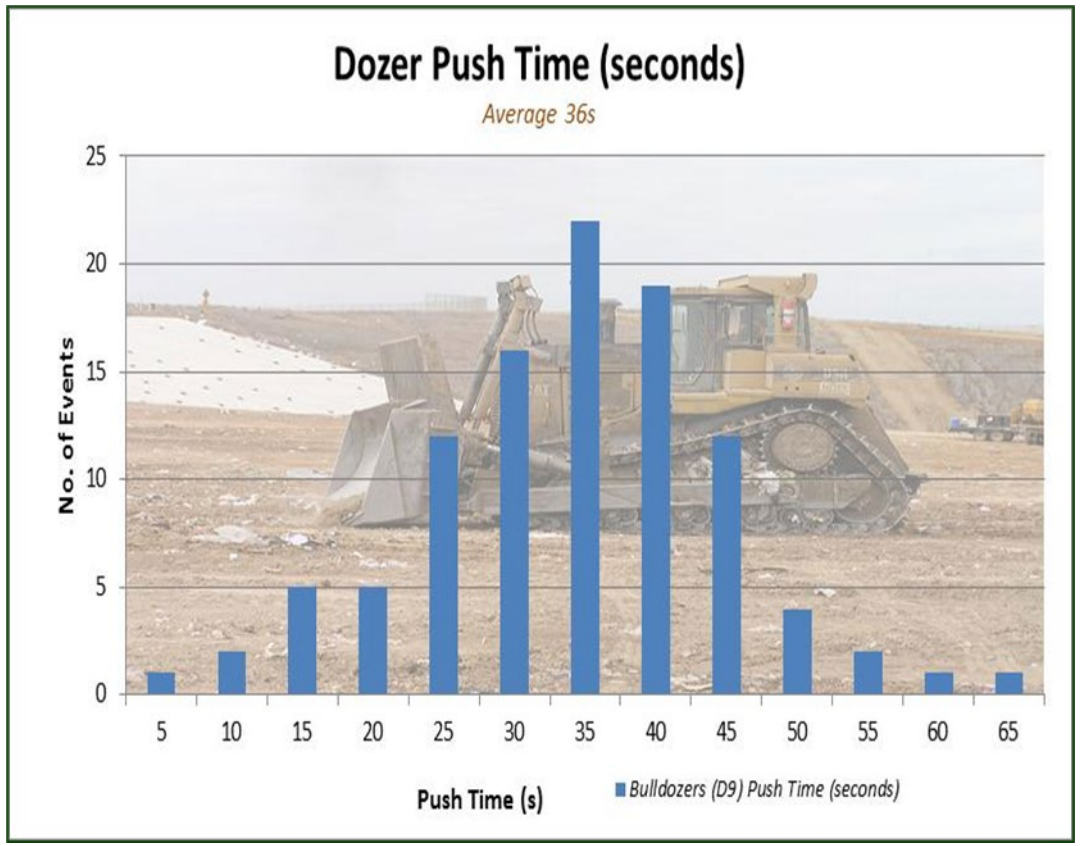
Example – Bulldozer Production Rate

- However, a dozer can only push what the blade can hold

Machine	Max Load	Typical (route)	*Typical (Transfer)*
D6	9 Tons	5 Tons	7 Tons
D7	12Tons	7 Tons	9 Tons
D8	17 Tons	10 Tons*	13 Tons
D9	21 Tons	13 Tons*	18 Tons

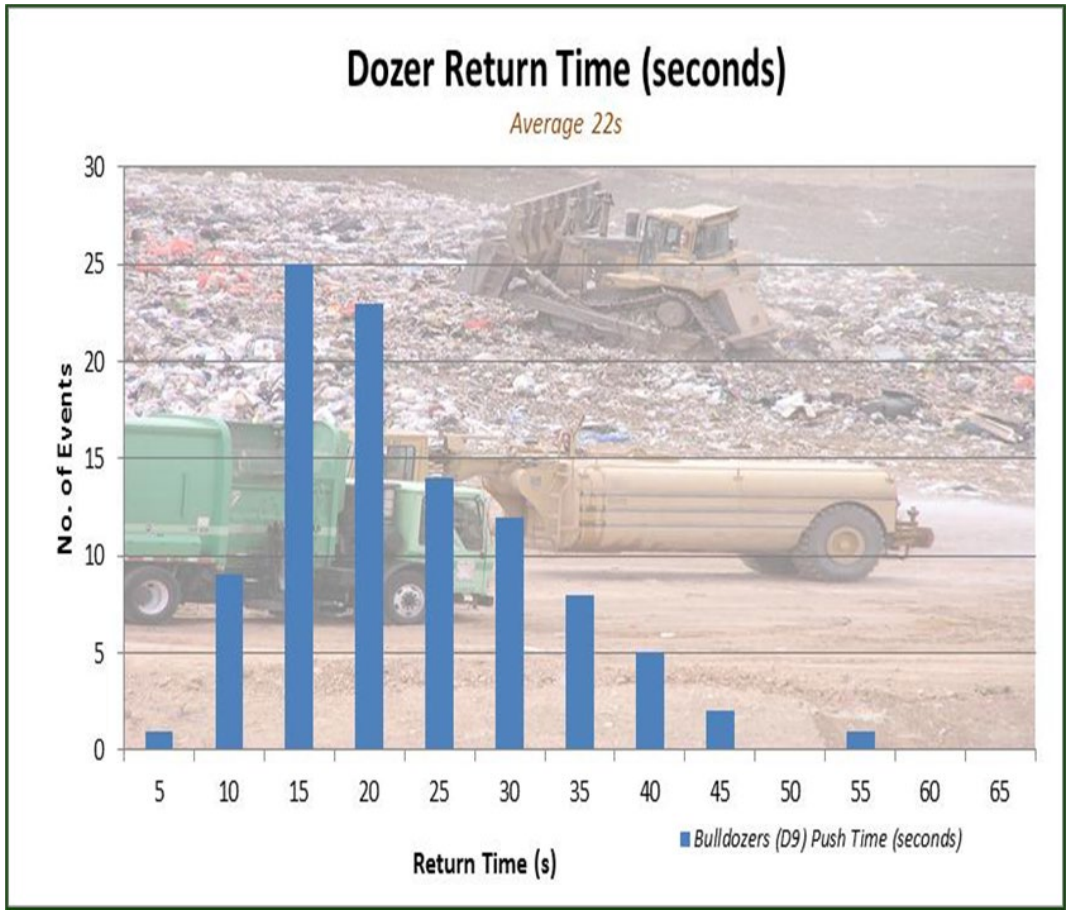
Example – Bulldozer Production Rate

If it takes an average of 36s for the dozer to push from the tipping pad…to the face.



Example – Bulldozer Production Rates

And an average of 22s to return to make another push



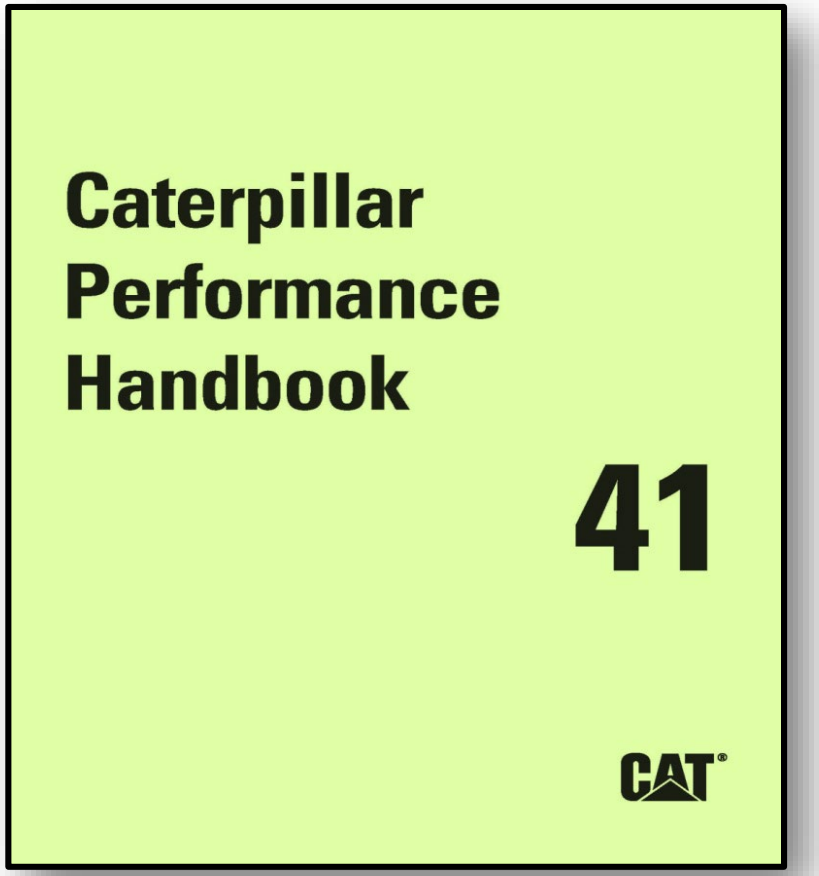
Example – Bulldozer Production Rates

- The D9 bulldozer's total cycle time is 58s.
- So, the bulldozer can make 62 pushes per working hour.
- Using an average of 15 tons/push, the dozer could process 930 tons per working hour.
- But we rarely see this level of production due to NVA activities.
- Adjust production rates as needed

Equipment Owning & Operating Costs

Estimate hourly owning & operating costs for equipment

- Owning Costs
  - Capital costs
  - Finance charges
  - Subtract salvage value
  - Amortize by projected equipment life span
- Operating Cost
  - Fuel
  - Maintenance/Repairs
  - Labor
- Caterpillar Performance Handboook…*a great resource*



The Process

1. Calculate hourly production rates of various machines
2. Calculate hourly machine owning and operating costs for each machine
3. Compare and evaluate different machines based on production rates and costs

Question No. 2

Do you know the optimum production rate for your landfill compactor?

1. *Yes, we have a stated target*
2. *Not really, we rely on the operator(s)*
3. *No, we have not addressed this issue*

Landfill Compactor Production Rates

In order to determine a landfill compactor's optimum production rate, we must go through a slightly different 4-step process.

The goal is to find the lowest overall cost including:

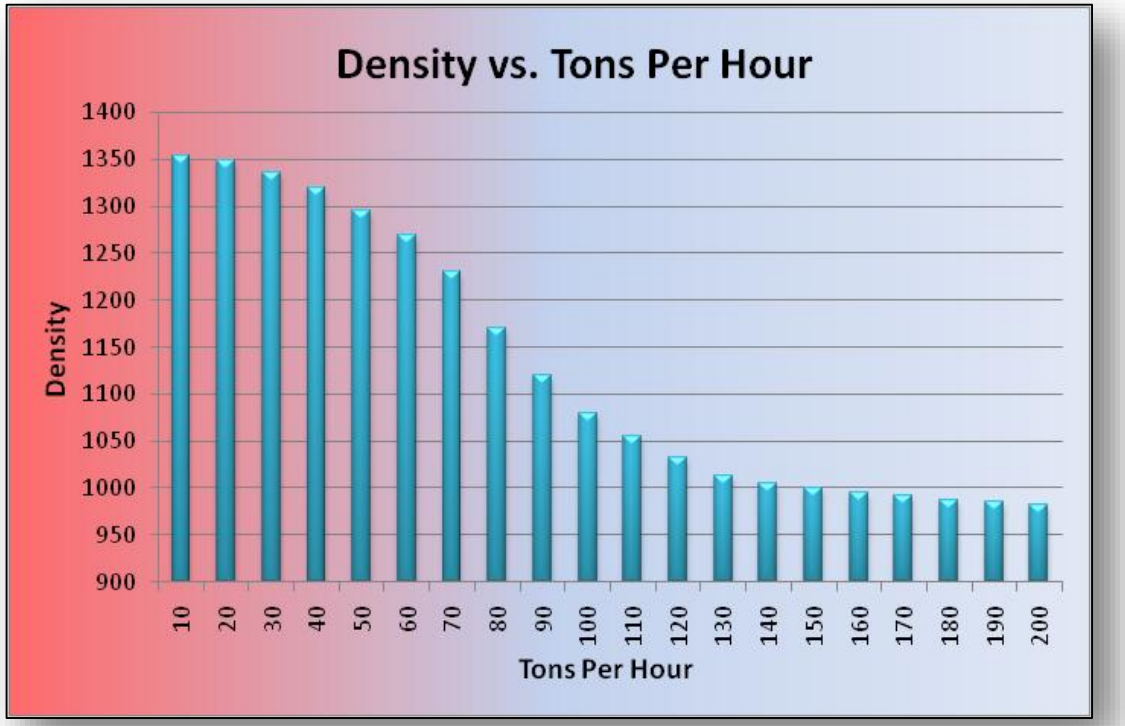
- Compactor costs
- Airspace costs

1 – Production Curve

This example is for a 70,000-80,000 lb machine.

As the compactor handles more tons of waste per hour, the resulting density will decrease .

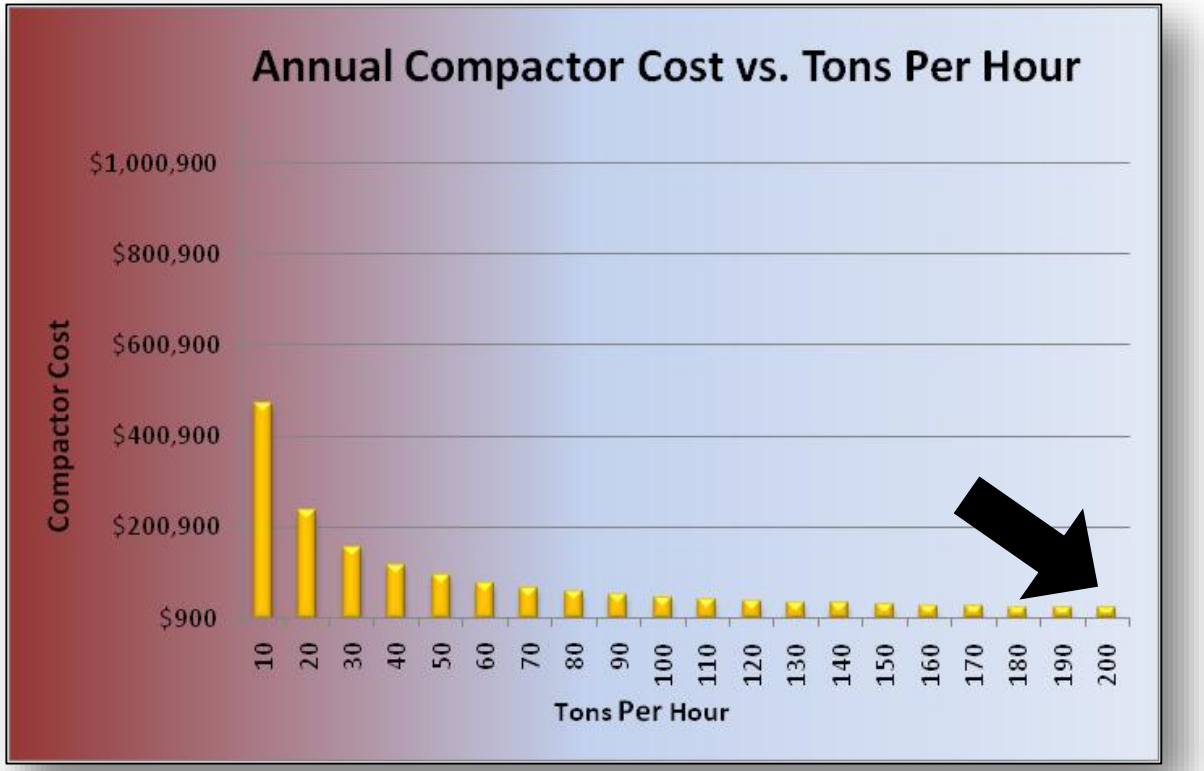
…it's overworked.



2 – Compactor Cost

- But if our goal is to decrease compactor cost, we'd want it to handle lots of tons per hour.

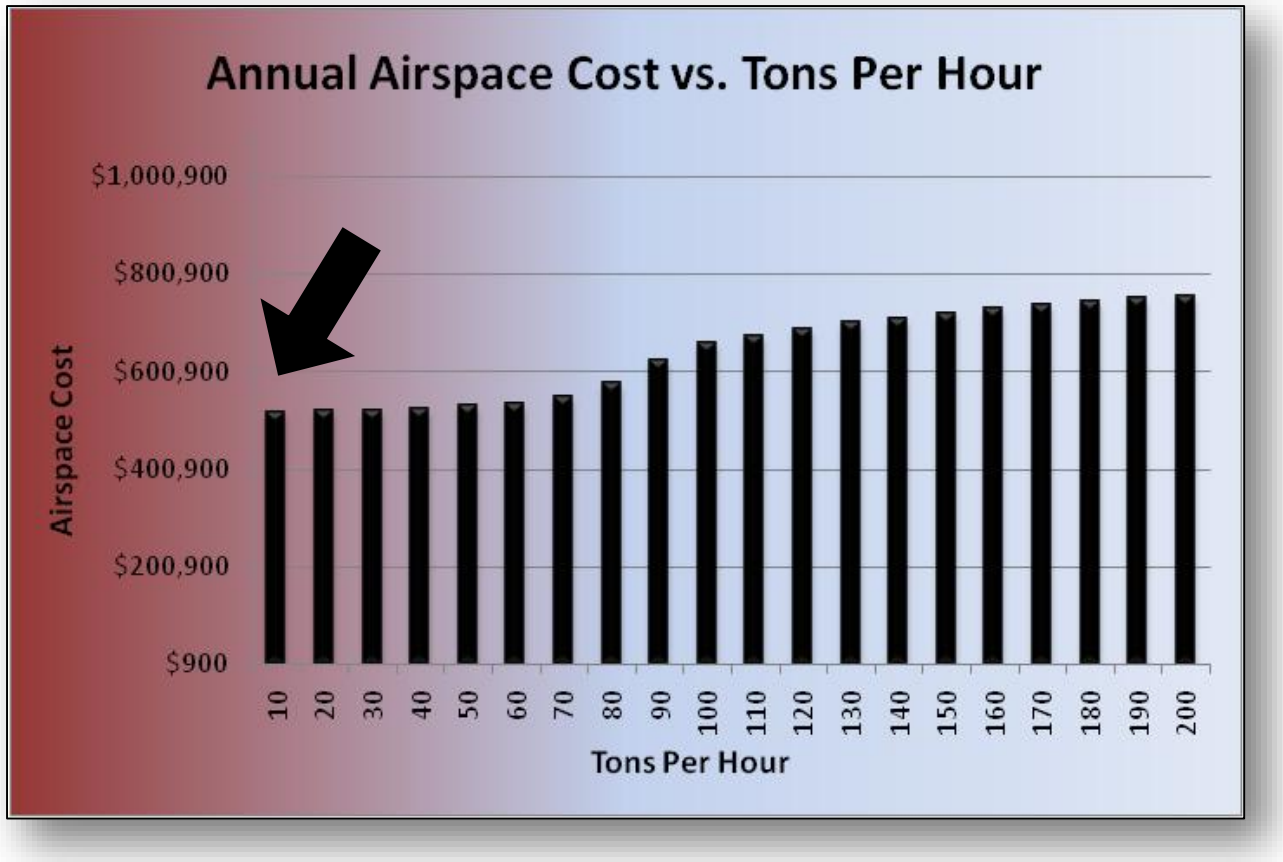
  More tons per hour means fewer machine hours per day …and very low compactor cost.



3 – Airspace Cost

But if our goal is to minimize airspace costs, we'd want the compactor to spend lots of hours on just a few tons of waste.

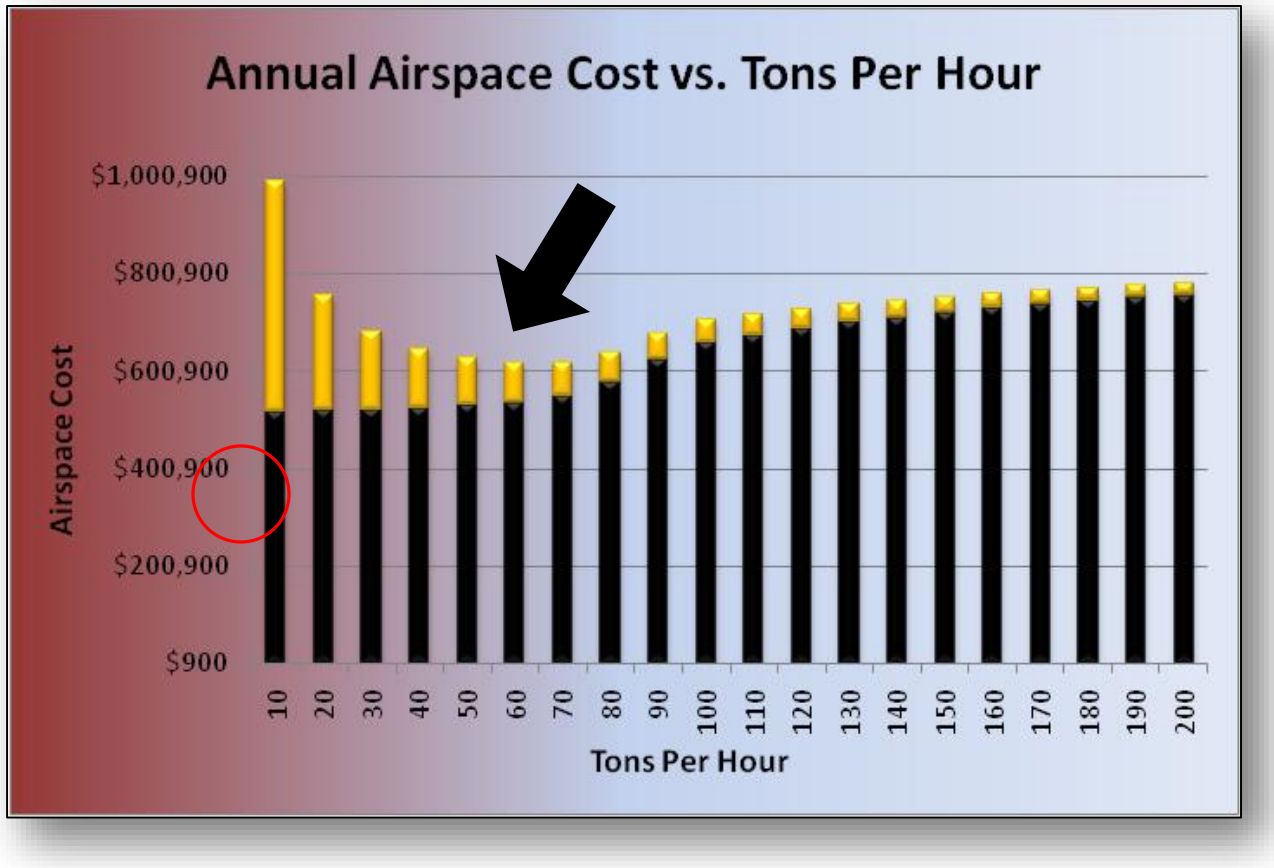
…this yields the highest possible density, fills the landfill slowly and keeps airspace costs low.



4 – Combine Both Costs

To find the lowest overall cost, we combine both the compactor and airspace costs.

The lowest overall cost directs us to the optimum production rate …in this example, it's 60 tons/hr.



Typical Landfill Compactor Production Rates

Right – Sizing Equipment Recap

Understand…

- Equipment payloads and capacity limitations
- Typical cycle times
- NVA activities
- Identify realistic hourly production rates
- Identify Hourly owning and operating costs
- Compare and evaluate different machines based on production rates and costs

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