Equipment Issues & Best Practices in a Landfill Application

Mark Welch
Caterpillar Global Waste Industry Specialist
Landfill Application & Equipment
What Is the Highest Cost of Operating a Sanitary Landfill?

Equipment Concerns & Issues
Machine Selection

• Choosing the Correct Machine
  – Waste Handling & Compaction
  – Soil / Cover Material Handling
    • Excavation, Loading, Hauling, Spreading
  – Support / Maintenance
    • Roads, Slopes, Trenching, Channeling, Constructing, Dust Control, etc…
The Problems of...

- Machine Failures
- High Operation costs
- Inefficient landfill operation

**WILL increase** when machines...

- are not the right **type**
- are not **sized** correctly
- are **Not Reliable**!
Shortcutting on costs

- Cost cutting on machine selection at startup
  - Landfill filling up too fast
  - High O&O costs
  - Poor reliability
- HUGE implications of this as apposed to getting the **correct machines** at the start of the project?
Primary Purpose of a Landfill Compactor

To obtain the highest density possible for the type of material being compacted

- Landfill Compactors
  - Compress and shred better
  - Are designed to limit material rebound when utilized correctly on passes and patterns
  - Designed for highest area coverage in shortest amount of time

*Not as easy to spread with blade design*
Compaction Equipment ??

• Basics of COMPACTION?
  – Spread the layers thin
  – Run over the trash multiple times
Primary Purpose of Dozer

To quickly move material from the truck unload to the work face
  - Pushing material to working face
  - Spreading the material into thin layers

- Cover
  - Soils, ADC / Tarp deployment

- Utility work
  - Road maintenance, slope remediation

• Dozers
  - Move material faster over a longer distance
  - Layer more evenly
  - Have better traction on slopes
  - Have a lower visual reference to the layer, thus thinner layering
Waste & Soil are Totally Different

• 7 Tons of dirt
• Dry packed earth – 2275 lb/yd³
• = 6 yd³ material to push

VOLUME!

• 7 Tons of waste
• Dumped onto tip floor ~ 465 lb/yd³
• = 30 yd³ material to push
Soil is different in traction

Landfill Operations

COT?

COT = .90

COT = .20 - .40

Dry packed earth

WASTE

Material Differences
Evaluation of Equipment Needs

- Not just one solution
  - Equipment working alone, System, Size of work area, distance push
- **All** the factors are important
  - Uphill, Load size, Peak periods, Operators, etc
- Do not make your decision in isolation
  - Discuss and Research others
    - Here, Events, Call, References, etc
- Understand what your equipment **“must”** do
  - Also what would be **“nice”** to do

There is not one “best fit” for all applications
Summary

- What is ‘most’ important to you?
  - Handling inbound loads quickly?
    - Keep the trucks moving…
  - Increase density?
    - Keep the landfill operating…

- Compactor Working Alone
  - Percentage of work Compactor spent pushing & spreading
    - 65 – 70%
  - Top 3 studies indicate (75’ X 75’ face with 50’ push)
    - Avg. 135 ton / hr – 836 LFC Push/Spread & Compacting
    - Avg. 300 ton / hr – Compacting only (TTT / LFC System, working together)
      (numbers could be slightly lower with traffic and daily influences)
  - Compactor compacting (smashing trash)
    - 30 – 35% of the time on 5 different sites / 10 different studies.
Let’s Talk Tips
What is their Purpose?

Understanding Tips on the Wheels

2019 SWANA FL Summer Conference
July 24-30 | Grand Hyatt Tampa Bay
What Differentiates Wheels & Tip Design on a Landfill Compactor?

• Designed to *compliment* the “MACHINE”
  – Keep the machine Productive

• **Traction**
  – Keep compactor ‘moving’
    » COMPACTION

• **Performance**
  – Keep the wheels clean from plugging
    » Puncture, Shred & Pulverize various materials
  – Keep the power where you need it
    » As-needed cleaner finger system
Wheels provides Compaction

- Tip Layout
- Allows wheel to sink into trash for even and thorough **COMPACTION** while maintaining **TRACTION & STABILITY**
  - Keeping clean
<table>
<thead>
<tr>
<th>Weight (lb)</th>
<th>Level Ground</th>
<th>27% Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>120k</td>
<td>LUC 4</td>
<td></td>
</tr>
<tr>
<td>119k</td>
<td>LUC 4</td>
<td></td>
</tr>
<tr>
<td>118k</td>
<td>LUC 0</td>
<td></td>
</tr>
<tr>
<td>117k</td>
<td>LUC 0</td>
<td></td>
</tr>
<tr>
<td>116k</td>
<td>LUC 0</td>
<td></td>
</tr>
</tbody>
</table>

*Time: 0.0000 sec*
## Speed/Coverage Comparison

<table>
<thead>
<tr>
<th>Unit</th>
<th>Idle Time</th>
<th>Work Time</th>
<th>Fuel Rate</th>
<th>Fuel Burned</th>
<th>Grd Speed</th>
<th>Grd Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15.0%</td>
<td>10.0 Hour</td>
<td>18.7 GPH</td>
<td>187 Gals</td>
<td>3.0 MPH</td>
<td>161249 YD</td>
</tr>
<tr>
<td>100' x 100'</td>
<td>15.0%</td>
<td>10.0 Hour</td>
<td>18.7 GPH</td>
<td>187 Gals</td>
<td>2.74 MPH</td>
<td>147775 YD</td>
</tr>
<tr>
<td>75' x 100'</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50' x 100'</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Additional Weight / Lost Production

- **25.4 Days lost**
- **3031 Machine passes lost**
- **625 Miles lost in 2500 machine hours**
Landfill Operations Best Practices

Various Studies conducted around the world.
Dozing / Pushing

- Avoid spills
  - spilling means cleanup
  - straight blade
- Sweep large loads
  - at 30 - 45°
  - 2/3 to 3/4 blade
  - toward next sweep
  - criss-cross sweeps
  - usually 3 passes
- Keep blade low
Push Distance CONSUMES Time

Too Far of Push = Need for More Equipment
- Smooth Operation -

• Plan travel distances
  – heavy flow = shorter distances
  – face size (be careful!)

• Run even patterns

• Keep uniform face
  – blend material
  – spotter guides placement

Flow
more time = more distance

Distance
less time = less distance
Importance of THICKNESS or Layer

- More fuel
- More heat
- More damage / maintenance
- **MORE WORK FOR THE OPERATOR!**

**VS**

- Faster cycles
- Greater efficiency
- Less machine damage
**Layer Height**

- **Fuel** — extra fuel used due to thick layers

---

**Layer Height vs Fuel**

- **Layer Height** — inches above thinnest layer

- **.6m Layer**
- **.9m Layer**
Layer Height or Thickness

- Thick layers only compact the surface
  - Subsequent passes only compact the surface
  - Waste below the surface compacts slightly but remains spongy
- Thin layers, blend, bind, shred, compact uniformly
  - Subsequent passes keep binding together

Approx. 1 – 2 meter + layer

20 to 60 cm layers

Operations & Efficiencies
Layering (Spreading) Material

- Develop compaction from bottom up
  - layers .4 m - .6 m
  - new layer covers old

- Problems compound as you build

- As thin as possible
  - short cycle times
  - less effort

Soft spot grows with each layer
Influence of number of passes on solid waste layer on final compaction
Full 4 Pass Coverage

- Straight up & down
  - Move off face at ends
  - Reverse in same tracks

- Side step
  - One wheel width
  - Make turn off of face

- Compacts all material
Uphill or Downhill Operation ??


Landfill Best Practices

Other considerations

Flat layering
The following slide depicts the new trend towards flat layering material for maximum compaction

• Determine amount of area that will be used, stake the area, start layering and compacting

• You can either push uphill or downhill
  • Downhill works best

Working face

100 ft. Wide

50 Feet
Landfill Best Practices

Other considerations
• Plan ahead to reach planned lift height
• If you reach lift height early – normal uphill operation / compaction
  • TTT push up / down - to compactor
  • TTT keeps 5:1 or 4:1 as day progresses
    • Or..run less grade and push up final grade at end of day
• Keep push / working distances short for push machines
• Downhill dump / push is faster
  • Uphill might get you better shredding - compaction

Plan the length of the advance
Layer depth – approx. .5 meter
Finally…

Take the time to pick the Right Machine

What “must” be done, how fast, how well

What else would be “nice”

Understand the configuration differences

Necessary options?

Weight isn’t always your friend within same size-class

Don’t be afraid to “try” something new

If you don’t try new ideas or ways of operation

Nothing will ever change

You can always “Go Back” to the way we’ve always done it.
Helping our customers BUILD A BETTER WORLD