Pay Dirt: Mass Excavating

Objectives:
• Choose the right combination of equipment for your particular application – rock vs. sand vs. clay vs. mud.
• Choose a dirt-moving system that can change with material changes
• Determine how telematics can help with the right selection of equipment to fulfill job requirements
• Discover how to apply telematics through real world scenarios
What is Mass Excavation?

• Definition may be different for every contractor
  – Can be 1000 yards to small contractor
  – Could be several million yards for a contractor like Peter Kiewit or Ryan Central

• What determines the mix of machines?
  – Total yardage
  – Type of material
  – Job conditions - terrain
  – Length of haul
Excavation Facts

• 10,000 bank cubic yards of dry loam...

100%

...becomes 13,500 loose/fluff cubic yards when the soil is excavated...

135%

• When you compact this 13,500 loose cubic yards, it becomes 8,800 compacted cubic yards

88%
Is there a perfect machine for you?

- **Terrain**
  - Soft
  - Hard

- **Grade**
  - Flat
  - Steep

- **Volume**
  - Small
  - Large

- **Distance**
  - Short
  - Long

- **Types of Machines**
  - Dozer
  - Articulated Dump Trucks
  - Dozer Scraper
  - Tractor Scraper
  - Rigid Dump Truck
## Off-Road Haulers Comparison

<table>
<thead>
<tr>
<th>Site Condition</th>
<th>Scraper Tractor &amp; Pans</th>
<th>Motor Scrapers</th>
<th>ADT Trucks</th>
<th>Crawler Scraper</th>
<th>Crawler Dozer</th>
<th>Rigid Dump Truck</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Self Loaded</td>
<td>Top Loaded</td>
<td>Single Pan</td>
<td>Double Pans</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hard Surface</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Soft Haul Road</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Greasy Surface</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Moderately Steep Grade (&lt;25%)</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Steep Grades (25%+)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>++</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Haul Length</th>
<th>Scraper Tractor &amp; Pans</th>
<th>Motor Scrapers</th>
<th>ADT Trucks</th>
<th>Crawler Scraper</th>
<th>Crawler Dozer</th>
<th>Rigid Dump Truck</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 750 ft</td>
<td>-</td>
<td>+</td>
<td>++</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>750 – 1000 ft</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>1000 ft – 1 mi.</td>
<td>++</td>
<td>++</td>
<td>+</td>
<td>++</td>
<td>++</td>
<td>-</td>
</tr>
<tr>
<td>1 – 3 mi</td>
<td>++</td>
<td>++</td>
<td>+</td>
<td>++</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>&gt;3 mi</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Material</th>
<th>Scraper Tractor &amp; Pans</th>
<th>Motor Scrapers</th>
<th>ADT Trucks</th>
<th>Crawler Scraper</th>
<th>Crawler Dozer</th>
<th>Rigid Dump Truck</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good Dirt</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Mud</td>
<td>+</td>
<td>++</td>
<td>+</td>
<td>-</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Bad Mud</td>
<td>-</td>
<td>++</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>++</td>
</tr>
<tr>
<td>Sand &amp; Gravel</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td>Shot Rock &lt;1 ft in diameter</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Shot Rock 1 – 1.5 ft</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Shot Rock &gt;1.5 ft</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Telematics
Telematics

History of North American Units

After-Market Telematics
Outside the machine brains:
- Hours
- Location
- Geofence
- Preventative Maintenance

OEM Telematics
With machine brains:
- Hours
- Location
- Geofence
- Preventative Maintenance
- Fuel consumption
- Utilization
- Machine health
- Remote software updates
- Operator behavior
- Payload data

Telematics!!!
Telematics – Overview

- Track fleets in multiple locations
- Maximize equipment utilization
- Monitor machine and operator productivity
- Monitor machine health and performance
- Maximize fuel efficiency
- Enhance machine security
- Reduce insurance premiums on equipment
- Increase machine resale value
- Increase accuracy of job costing
- Improve future bidding
- Enhance maintenance scheduling, recording

Telematics!!!
Telematics
Remote Diagnostics and Programming

• Dealer connects remotely to machines
  - Read diagnostic codes
  - Record machine performance
  - Remote software updates

Reduces time and cost of repairs
Previous Repair Cycle
10 Hours or more

Customer calls machine down

Machine on job site

2-hour drive to dealership for correct parts

2-hour travel To machine down.

2-hour return trip with correct parts.
New Repair Cycle

3 Hours

Machine on Job Site
(Customer not aware of machine issue)

Transmission Overheat Condition

Dealership

Remote diagnostics and reprogramming

Dealer views JDLink Web & views actual temps/pressures

Telematics!!!
Telematics – Looking Inside The Machine
You’ll Never See Your Fleet the Same Way Again
So what about the iron????
Production Machines

What is a Production Machine?

• Any machine that makes you money by moving material usually to the fill or waste area depending on the project.

• These machines may haul, push or carry material.
Production Machines

Scrapers – Why?
1. Very durable but not fuel efficient
2. Used for all types of dirt/rock
3. Need medium experienced operator
4. Have been the mainstay hauling dirt for years

Pull tractor and Pans – Why?
1. Lower acquisition and operating cost
2. Good for good dirt, medium haul lengths and medium grade
3. Need good operator
4. Need no support machines and fairly fast (25 mph)
Production Machines

Dozers – Why?
1. Usually first machine on jobsite
2. Used for all types of dirt/rock
3. Need experienced operator
4. Limited on distance to be productive

Articulated Dump Trucks (ADT) – Why?
1. Fuel efficient
2. Good in mud, long haul, and steep terrain
3. Can use inexperienced operator
4. Fast (34 mph) and can dump on the go if needed
Production Machines

Rigid Frame Trucks – Why?

1. Long life (reliable) and fuel efficient
2. Excellent choices with good long haul road and flat
3. Medium operator
4. Excellent speed on haul road (35 mph)
5. Can haul large rocks
6. Good wide target to load material
7. Very pricey
Support Machines

What are Support machines?

- Any machine that support the movement of materials.
- These machines may:
  - Load or push haul machines
  - Level or push off fill/waste areas
  - Mix material by drying or adding water
  - Compact fill
  - Maintenance haul roads
Support Machines

**Excavators** – Why?
1. Very fuel efficient way to load material
2. Good for all types of materials
3. Need experienced operator
4. One of the quickest ways to load material (dirt, rock, bad mud & sand)

**Dozer** – Why?
1. Cleans and levels area
2. Pushes scraper
3. Needs experienced operator
4. Trim slopes to grade as needed
5. Level haul road in cut area
Support Machines

Dozer & Disk - Why?
1. Disk used to aerates material to dry excel drying and mixing
2. Dozer trims high spots and levels
3. Dozer can get through mud areas

Compactor – Why?
1. Stabilize fill area for specified compaction
2. Levels fill
3. Push scrapers through soft areas
Support Machines

**Four wheel drive loader** – Why?
1. Good way to load material on solid ground
2. Used to load all materials, wet or dry
3. Need experienced operator
4. Fast cycle times on good footing
5. Could be production machine on load & carry operation

**Roller box blade** – Why?
1. Levels, fills and compacts at 10 mph
2. Used in good or wet material
3. Can use less experienced operator
4. Also can be used in fill to smooth to get ready for rain
Support Machine

**Front Shovel – Why?**
1. Plenty of breakout for hard material
2. Used where digability is needed
3. Good cycle time
4. Experienced operator for front shovel operational technique
5. Initial cost expensive

![Front Shovel Image]
Motorgrader – Why?
1. Effective way to keep haul road smooth for faster cycle time for ADTs and Scrapers especially when empty
2. Good on all materials except shot rock
3. Requires proficient operator
4. Can do other jobs when not maintaining haul road
5. Excellent machine for finish grade
Support Machines

**Water wagon/truck – Why?**

1. Need be able to travel all types of haul roads to keep dust down
2. Same controls as ADT’s

3. Plenty of water quickly, with use of all nozzles
4. Pricey for small operations rental may be better
Choosing the Right Machines for Rock

• Shot Rock – Machines of Choice
# Maximum Hourly Production

**Perfect World**

<table>
<thead>
<tr>
<th>Hourly Production</th>
<th>Loader/Excavator</th>
<th>Bucket Size</th>
<th>Number of Passes</th>
<th>Truck</th>
<th>Loads Per Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,400 - 1,600 Tons per Hours</td>
<td><img src="image1" alt="Loader/Excavator" /></td>
<td>13.5 -15 Cubic Yard, 3,200 lbs/Yd</td>
<td>4</td>
<td><img src="image2" alt="Truck" /></td>
<td>85-ton Class, 17</td>
</tr>
<tr>
<td>1,200 - 1,400 Tons per Hours</td>
<td><img src="image1" alt="Loader/Excavator" /></td>
<td>13.5 -15 Cubic Yard, 3,200 lbs/Yd</td>
<td>3</td>
<td><img src="image2" alt="Truck" /></td>
<td>50-ton Class, 21</td>
</tr>
<tr>
<td>700 - 800 Tons per Hours</td>
<td><img src="image1" alt="Loader/Excavator" /></td>
<td>7.0 - 9.0 Cubic Yard, 3,200 lbs/Yd</td>
<td>5</td>
<td><img src="image2" alt="Truck" /></td>
<td>50-ton Class, 16</td>
</tr>
<tr>
<td>700 - 800 Tons per Hours</td>
<td><img src="image1" alt="Loader/Excavator" /></td>
<td>7.0 - 9.0 Cubic Yard, 3,200 lbs/Yd</td>
<td>4</td>
<td><img src="image2" alt="Truck" /></td>
<td>35-ton Class, 19</td>
</tr>
<tr>
<td>978 - 1,141 Tons per Hours</td>
<td><img src="image1" alt="Loader/Excavator" /></td>
<td>7.8 - 8.8 Cubic Yard, 3,200 lbs/Yd</td>
<td>6</td>
<td><img src="image2" alt="Truck" /></td>
<td>65-ton Class, 16</td>
</tr>
<tr>
<td>1,062 - 1,239 Tons per Hours</td>
<td><img src="image1" alt="Loader/Excavator" /></td>
<td>7.8 - 8.8 Cubic Yard, 3,200 lbs/Yd</td>
<td>6</td>
<td><img src="image2" alt="Truck" /></td>
<td>65-ton Class, 17</td>
</tr>
</tbody>
</table>
Payload Weighing – Loaders
Payload Weighing – Loaders

<table>
<thead>
<tr>
<th>Payload Information</th>
<th>Buckets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Bucket Loads</td>
<td>168</td>
</tr>
<tr>
<td>Total Time Loading</td>
<td>3.3 hr</td>
</tr>
<tr>
<td>Loading Average Fuel Rate</td>
<td>23.1 l/h</td>
</tr>
<tr>
<td>Total Loading Fuel Consumed</td>
<td>75.5 l</td>
</tr>
<tr>
<td>Number of Trucks Loaded</td>
<td>56</td>
</tr>
<tr>
<td>Min Truck Payload Weight</td>
<td>24 t</td>
</tr>
<tr>
<td>Max Truck Payload Weight</td>
<td>27 t</td>
</tr>
<tr>
<td>Average Truck Payload Weight</td>
<td>26.5 t</td>
</tr>
<tr>
<td>Truck Cycle Time</td>
<td>3.5 min</td>
</tr>
<tr>
<td>Total Payload</td>
<td>1,784 t</td>
</tr>
</tbody>
</table>

Average 8.8 tons/bucket

Telematics!!!
Payload Weighing – Shovels

Data Reporting

A range of reports available for easy-to-understand feedback on your operations.
Rigid Frame Trucks

- Advantages
  - Hauls large chunks
  - Fast 35 mph
  - Operator friendly
  - Good visibility with loader
  - Large bed area – easy target
  - Easy loading
  - Steep dump angle
Rigid Frame Trucks

- Limitations
  - Trucks weigh more to be long lasting – trucks heavy
  - Better on hard surfaces
  - Limited traction in mud
  - Higher side height
  - Expensive
  - Requires support machines to load
Support Machine for Rigid Frame

Trucks can be loaded with:
- Loader
- Front Shovel
- Excavator

Support machine is determined by:
- Dig-ability of the material
- Material abrasiveness
- Productivity needed
- Machines available
Choosing the Right Machines for All Other Conditions
# Maximum Hourly Production

**Perfect World**

## Right Number of Trucks

<table>
<thead>
<tr>
<th>Hourly Production</th>
<th>Excavator</th>
<th>Bucket Size</th>
<th>Number of Passes</th>
<th>Truck</th>
<th>Loads Per Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,133 - 1,359 Tons per Hours</td>
<td>4.5 Cubic Yard, 2400 lbs/Yd</td>
<td>7</td>
<td>46-ton Class</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>1,357 - 1,629 Tons per Hours</td>
<td>5.5 Cubic Yard</td>
<td>6</td>
<td>46-ton Class</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>1,625 - 1,951 Tons per Hours</td>
<td>6.5 Cubic Yard</td>
<td>5</td>
<td>46-ton Class</td>
<td>38</td>
<td></td>
</tr>
</tbody>
</table>

Excavator operator and ADT operators understand production goals

Where are the bottlenecks to slow operation – tough haul – dusty haul roads – too much water on haul road – compaction in the fill no place to dump – mud – dust – rain/weather
Articulated Dump Trucks

• Advantages
  – Can dump on-the-go
    • Piles will not be even
    • Easier for support tractor to level

• Popular options
  – Tail gates
  – Bed liners
  – Body heaters
Articulated Dump Trucks

- Advantages
  - Diff locks or Inter-axle lock or use both for muddy/steep areas
  - Good for adverse conditions
    - Rough areas
    - Steep areas
    - Soft areas
Articulated Dump Trucks

- Limitations
  - Needs level dump area
  - Requires support machines in cut and fill
  - Must be pulled out when struck

Tip: Do not push on truck. If stuck, use cable.
Rocks – All Part of Production

- Excavator wrestles large rock into truck
- Large rocks that will not fit into trucks are moved to the side
- An excavator with hammer breaks into manageable pieces
Sticky Material

- Periodically trucks need to be cleaned
- Carryback reduces opportunity for maximum production
- Material builds up from continuously loading muddy, sticky or frozen material
- Excavator gently scrapes the bed of truck to eliminate carryback to the cut

Body heaters lower amount of carryback with frozen materials
## Flotation: ADTs vs. Scrapers

<table>
<thead>
<tr>
<th></th>
<th>ADT 46 Ton</th>
<th>Twin Engine Scrapper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Empty Weight</td>
<td>71,024 lbs</td>
<td>114,744 lbs</td>
</tr>
<tr>
<td>Cubic Yards</td>
<td>33.4 yd³</td>
<td>31.6 yd³</td>
</tr>
<tr>
<td>(2600 lbs per yard)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Loaded Weight</td>
<td>157,864 lbs</td>
<td>196,944 lbs</td>
</tr>
<tr>
<td>Number Of Tires</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Load Per Tire</td>
<td>26,310 lbs</td>
<td>49,236 lbs</td>
</tr>
</tbody>
</table>

Less support machines for haul road
Truck Loading

10 wheelers

18 wheelers

...triples, quads, etc, etc
## Truck Loading

### Perfect World

<table>
<thead>
<tr>
<th>Hourly Production</th>
<th>Excavator</th>
<th>Bucket Size</th>
<th>Number of Passes</th>
<th>Truck</th>
<th>Loads Per Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>681 - 817 Yards per Hours</td>
<td><img src="image1" alt="Excavator Image" /></td>
<td>2.75 Cubic Yard 2400 lbs/Yd</td>
<td>4</td>
<td><img src="image2" alt="Truck Image" /> 12-14 tons Class 9-12 yds</td>
<td>56</td>
</tr>
<tr>
<td>881 - 1,056 Yards per Hours</td>
<td><img src="image1" alt="Excavator Image" /></td>
<td>4 Cubic Yard</td>
<td>2.75</td>
<td><img src="image2" alt="Truck Image" /> 12-14 tons Class 9-12 yds</td>
<td>73</td>
</tr>
<tr>
<td>681 - 817 Yards per Hours</td>
<td><img src="image1" alt="Excavator Image" /></td>
<td>2.75 Cubic Yard 2400 lbs/Yd</td>
<td>7</td>
<td><img src="image2" alt="Truck Image" /> 22-25 tons Class 18-21 yds</td>
<td>34</td>
</tr>
<tr>
<td>881 - 1,056 Tons per Hours</td>
<td><img src="image1" alt="Excavator Image" /></td>
<td>4 Cubic Yard</td>
<td>5.2</td>
<td><img src="image2" alt="Truck Image" /> 22-25 tons Class 18-21 yds</td>
<td>44</td>
</tr>
</tbody>
</table>
Truck Loading
Real World

Larger excavators in many cases – no more production – just cost

<table>
<thead>
<tr>
<th>Hourly Production</th>
<th>Excavator Bucket Size</th>
<th>Number of Passes</th>
<th>Truck</th>
<th>Loads Per Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>681 - 817 Yards per Hours</td>
<td>2.75 Cubic Yard 2400 lbs/Yd</td>
<td>4</td>
<td>12-14 tons Class 9-12 yds</td>
<td>30</td>
</tr>
<tr>
<td>881 - 1,056 Yards per Hours</td>
<td>4 Cubic Yard</td>
<td>2.75</td>
<td>12-14 tons Class 9-12 yds</td>
<td>30</td>
</tr>
<tr>
<td>681 - 817 Yards per Hours</td>
<td>2.75 Cubic Yard 2400 lbs/Yd</td>
<td>7</td>
<td>22-25 tons Class 18-21 yds</td>
<td>30</td>
</tr>
<tr>
<td>881 - 1,056 Tons per Hours</td>
<td>4 Cubic Yard</td>
<td>5.2</td>
<td>22-25 tons Class 18-21 yds</td>
<td>30</td>
</tr>
</tbody>
</table>

Trucks cycle times make the difference – many times they all come back to the cut together – backing into excavator – one truck usually sets pace
On Board Weighing

- Load indicators
- Track actual productivity
  - Total tonnage
  - Integrated carry back calculation
  - Cycles
- Automatic add of payload after dump

Payload 16.3 T

Integrated into monitor
On Board Weighing (OBW)

- Productivity tracking through telematics
- Reduce tire wear
- Calibration for accuracy – material/moisture, tailgate

<table>
<thead>
<tr>
<th>Blink</th>
<th>&lt;75%</th>
</tr>
</thead>
<tbody>
<tr>
<td>On</td>
<td>75 – 90%</td>
</tr>
<tr>
<td>On</td>
<td>90 – 110%</td>
</tr>
<tr>
<td>On</td>
<td>&gt;110%</td>
</tr>
</tbody>
</table>

*Slope must be <5% (2.5°) or shows last known value
*If loaded on slope >5% (2.5°), no value shown until slope levels
Dump Body Rollover Protection

• Benefits
  – Minimizes operator raising dump body with rear chassis on less than ideal sloped surfaces
  – Application examples:
    • Worksites without dumping area maintenance
    • Limiting new operators in training
  – Owner-enabled and selected
    • “Prevent Raise” dump body will not raise if percentage is greater than owner selected

![Dump Body Rollover Protection](image)

20° Maximum
## Payload Weighing in Action

<table>
<thead>
<tr>
<th>Payload Information</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unloaded Time</td>
<td>151.7 hr</td>
</tr>
<tr>
<td>Unloaded Idle Time</td>
<td>74.2 hr</td>
</tr>
<tr>
<td>Total Payload</td>
<td>73943.9 tn</td>
</tr>
<tr>
<td>Average Speed Loaded</td>
<td>6.4 mi/h</td>
</tr>
<tr>
<td>Average Speed Unloaded</td>
<td>6.4 mi/h</td>
</tr>
<tr>
<td>TripCounter</td>
<td>1740.0</td>
</tr>
<tr>
<td>Loaded Time</td>
<td>98.3 hr</td>
</tr>
<tr>
<td>Loaded Idle Time</td>
<td>23.9 hr</td>
</tr>
<tr>
<td>Distance Traveled While Unloaded</td>
<td>351.6 mi</td>
</tr>
<tr>
<td>Distance Traveled While Loaded</td>
<td>225.4 mi</td>
</tr>
<tr>
<td>Fuel Consumption</td>
<td>4.4 gal/h</td>
</tr>
<tr>
<td>Fuel Consumption per Mile</td>
<td>8.7 gal/h</td>
</tr>
</tbody>
</table>

**5.23 minutes per load**

**42.5 Tons per load**

**3.4 minutes per load**

**0.2 miles per trip**

**0.18 miles per trip**

Telematics!!!
Tire Pressure Monitoring System

Sensor for Pressure, Temperature and Battery Life
Tire Pressure Monitoring (GPS)

Max Tire Temperature

<table>
<thead>
<tr>
<th>Tire Type</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mid Rear Left Tire</td>
<td>60.8 F</td>
</tr>
<tr>
<td>Rear Left Tire</td>
<td>62.6 F</td>
</tr>
<tr>
<td>Mid Rear Right Tire</td>
<td>60.8 F</td>
</tr>
<tr>
<td>Rear Right Tire</td>
<td>59.0 F</td>
</tr>
<tr>
<td>Front Left Tire</td>
<td>66.2 F</td>
</tr>
<tr>
<td>Front Right Tire</td>
<td>66.2 F</td>
</tr>
</tbody>
</table>

Faster speeds low tire pressure will have high temperature
Higher temperature causes extra wear internal and external

Notice: Front tires are lower for traction and floatation

Last Tire Pressure

<table>
<thead>
<tr>
<th>Tire Type</th>
<th>Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mid Rear Right Tire</td>
<td>54.0 PSI</td>
</tr>
<tr>
<td>Front Left Tire</td>
<td>45.3 PSI</td>
</tr>
<tr>
<td>Rear Left Tire</td>
<td>54.0 PSI</td>
</tr>
<tr>
<td>Mid Rear Left Tire</td>
<td>53.7 PSI</td>
</tr>
<tr>
<td>Rear Right Tire</td>
<td>54.0 PSI</td>
</tr>
<tr>
<td>Front Right Tire</td>
<td>45.5 PSI</td>
</tr>
</tbody>
</table>

Telematics!!!
Recommended Tire Pressure

![Table]

- Each tire manufacturer will have a recommended tire pressure for application and ground conditions.
- Sand will have a lower pressure than clay because of the needed flotation and traction.
- Information usually in the operator’s manual or on the periodical maintenance chart on machine.
Continuous overloading so tire capacity is exceeded or, under inflation
Tires and Tire Pressure Monitoring

Incorrect inflation pressure or, tire capacity is exceeded
Managing the Fill

• Dozer operator spots area for ADTs to dump
• Spreads material after ADT dumps
• Keep haul road level for ADTs
Positioning Excavator

Better production on a bench

- Difference in Production (470G)
  - From Bench – 1163 yds/hour
  - Ground Level – 940 yds/hour
- 21% Difference
Positioning Excavator for Fast Cycle Times

Fast Cycles Times

- Reason for bench – great visibility into ADT
- Load beside excavator
- Bottom of track and ADT side boards same height
- Boom/arm point over closest side board
- Dump bucket just enough for material to drop out smoothly and steady
Area to Load Bucket

Fast load time
• Less than 90 degree to the truck
• Try to load high spot for quicker cycle time
• Clean up only when trucks are gone
• Use support machine to keep bottom smoothed up
Arm Forces – Excavator

- Shorter arms
  - Easier to control
  - Easier to meter
  - Have more crowd force
  - Use bigger buckets

- Longer Arms
  - Further Reach
  - Deeper depth

- **470GLC**
  - 9’ 6” (2.9m)
    - 44,063 lbs (196 kN)
  - 11’ 2” (3.4m)
    - 48,334 lbs (215 kN)
  - 12’ 10” (3.9m)
    - 55,977 lbs (249 kN)
Bucket Sizing

- Goal is to load truck as fast as possible
- Cycle time is more important than bucket fill
- Correct bucket size and shape will be quicker
- Important factors
  - Bucket tip radius
  - Width of bucket
  - Depth of tub
Bucket – Tip Radius

- Measure tip radius
  - Distance from end of bucket tooth to center of arm/bucket pin
- Bucket width – foot narrower than bed of ADT
- Higher capacity, greater width, and longer tip radius mean slower cycle times (Weight of Bucket)

Tip: Match the bucket width to the truck capacity & digging conditions
Bucket – Tub Depth

- Advantages
  - Short tub depth for truck loading
    - Short tip radius
    - Wide bucket
    - Results in faster cycle times
      - Quicker bucket fill
      - Faster dump
  - Deep tub
    - Trenching deep more material per cycle
Frequently Asked Questions: Buckets

- If I am not using full reach, can I use a bigger bucket than recommended?

Yes. Be advised: Increasing bucket size will boost productivity up to a point. Beyond that point, the machine’s performance will start to decline. If the load is too large, pump flow will decrease and cycle speed will drop.

Tip: Remember that the additional weight of larger buckets increases load on pins, bushings, swing bearing, and pumps.
Penetration Force – Choosing the right teeth

Which bucket will load easier?
Which teeth might make you money?
Right Teeth for Material

Penetration Force with different teeth

- 3,133 PSI = \frac{19,580 \text{ lbs}}{6.25 \text{ sq. in.}}

- 19,959 PSI = \frac{19,580 \text{ lbs}}{0.981 \text{ sq. in.}}
Excavator Telematics

Idle Time

Total: 1142.1hr

68% Idle Time!

Telematics!!!
Excavator Telematics

Idle Time

Engine Utilization hr

- Key-On: 0.8 hr
- Idle: 12.8 hr
- Low Load: 25.3 hr
- Medium Load: 9% Idle Time
- High Load: 47%

Total: 135.4 hr

Telematics!!!
James King – DeKalb Pipeline
Talks about telematics system

• “From 600 miles away in Atlanta, I can look and see things such as production statistics, idle time, fuel consumption, running time and service notifications,” King says. “It’s very useful information. For instance, reports showed that during the first month in Ohio, our machines were idling 33 percent of the time.

• “I’m a real stickler about productivity … every hour that machine is running costs money in terms of things like ownership depreciation, maintenance costs, and fuel expenses,” he continues. “So it’s critical to minimize idle time. We made a correction, and the next report showed an 8 percent drop in idle time. So we trimmed 24 percent of that cost.”
Telematics

Location: Reasons
1. Fuel truck
2. Service truck
3. Haul to different location
Dozers – Production

• Advantages
  – Usually first machine on job
  – Only machine needed
  – Work in adverse conditions (rock, steep slopes, trees, mud, etc)
  – Many jobs (push tractor also)
  – Utilize ripper or attachments
  – *Try to load blade pushing down hill to increase production*

• Limitations
  – Usually push up to 300 ft.
  – Extra track wear (high speed & reverse)
  – Slow travel speeds
Dozers – Blade Pitch

- Hydraulic or manual tilt cylinder
- Blade pitch adjustable
  - Cut and roll material
  - Better penetration
  - Easier to dump blade
  - More carrying capacity
  - Corner load
Dozers and Excavators – Support

- Combination
- Excavators lifts material usually in muddy area
- Dozer
  - Pushes material to excavator in the cut
  - Spreads and levels material in the fill or to dry material
- Operators need to work together (timing important)
Two Dozers – Production

- Advantages
  - Increase productivity by 20%

- Limitations
  - Operators have to team up
  - Slightly slower cycle times because of coordination
High Speed Dozer 764

- Excellent visibility
- Blades fast
- Grade Control
  - 8 mph

- Travels fast
  - 16 mph travel speed forward and reverse
Dozer and Pull Scrapers

- **Advantages**
  - Swiss army knife
  - Short haul
    - Up to 750 ft
  - Steep grade
  - Soft condition
  - Confined cut and fill areas
  - Self load 85%
  - Dump and spreads fill
  - Could be one man show

- **Limitations**
  - Limited haul distance
  - Slow travel speeds
  - Sandy jobs
  - High travel speeds increase undercarriage wear
Dedicated Scraper Tractors

• Advantages
  – Muddy conditions
  – Short haul
    • 1,000 ft with larger machines
  – Steep conditions
  – Good maneuverability
  – No support machine - Level fill or cut area with scraper

• Limitations
  – Slow travel speeds
  – Wet sandy material
Push Load Scraper Tractors

- **Advantage**
  - Quicker load time
  - Push through soft area

- **Limitation**
  - Dozer blade into rear tire of scraper

**Tip:** If push loading with dozer, the blade needs extra steel push plate to limit wear.
Excavator Top Loading

- Advantage
  - Good flotation in muddy areas (Less chance of getting stuck)
  - Excavator mixes material for better compaction in fill
  - Easy target to load with excavator
  - Good visibility into scraper with small bench
  - Start 3 tires instead of 4

Tip: Always lower the bowl before loading
Scrapers

Single Engine

Twin Engine (Double Barrel)

Scrapers is general
Durable, heavy, long lasting, used for over 50 years

Tip: Get a nice load and go – don’t spend too long in the cut
Top Loading Scrapers

- **Advantages**
  - Load soft material
  - Mix materials
  - Scraper and excavator stays on hard ground (out of mud)

- **Limitation**
  - Limited load area between bowl cylinders and ejector rack. Excavator operator has to be careful

**Tip:** Always have bowl on ground when loading
Elevating Scrapers

Advantages
- One operator
- Usually works with finish crew
- Crumbles the material for better compaction
- Depending on the material no support machines
- Scraper weight compacts the fill

Limitations
- Mud
- Rock
- Dust
Pull Tractors and Scrapers
When compared to comparable methods of moving material, Scraper Systems provide a distinct value advantage:

- 1/3 the initial investment
- 1/2 the labor
- 30 to 50 cents cheaper per Yd³*

* 23-38 cents cheaper per cubic meter.
Pull-Tractor and Scraper(s)

Singles used for short hauls and soft conditions

Tandems used for medium haul distances and good dirt

Triples used for long haul, good haul road, and good dirt
Pull-Scraper Types

**Carry All**
- Lighter for lower ground pressures and better flotation
- Unloads faster for improved cycle times
- Loads sand better than Ejector scrapers
- Lower initial investment than Ejector scrapers

**Ejector**
- Unloads stickier materials better
- Staggered wheel design minimizes duck walking
- Front pivot design allows push loading
- Faster blade response and greater blade visibility
- Fixed blade allows for more precise grading
# Selecting blade configurations

<table>
<thead>
<tr>
<th>Caliche</th>
<th>Sand</th>
<th>Sandy Loam</th>
<th>Topsoil</th>
<th>Adobe Clay</th>
<th>Heavy Clay</th>
<th>Gumbo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teeth</td>
<td>Straight</td>
<td>Tooth Drop Center Combo</td>
<td>Drop Center</td>
<td>Teeth</td>
<td>Drop Center</td>
<td>Drop Center</td>
</tr>
<tr>
<td>Tooth Drop Center Combo</td>
<td>Center Teeth</td>
<td>Center Teeth</td>
<td>Alt. Drop Center</td>
<td>Comp. Drop Center</td>
<td>Alt. Drop Center</td>
<td>Alt. Drop Center</td>
</tr>
<tr>
<td>Center Teeth</td>
<td>Tooth Drop Center Combo</td>
<td>Straight</td>
<td>Comp. Drop Center</td>
<td>Alt. Drop Center</td>
<td>Comp. Drop Center</td>
<td>Comp. Drop Center</td>
</tr>
</tbody>
</table>

Recommendations may vary in different conditions. The vast majority of units will work well with the drop center or straight blades offered by the factory.

As a general rule:
- Drop Center blades work best in clay
- Straight blades work best in sand
Selecting the right scraper type

- **Wheel**:
  - Sand: Approved
  - Sandy Loam: Recommended
  - Topsoil: Ideal
  - Clay: Approved
  - Gumbo: Recommended

- **Track**:
  - Ideal
  - Recommended
  - Approved

- **Ejector**:
  - Approved
  - Recommended
  - Ideal

- **Carry All**:
  - Ideal
  - Recommended
  - Approved
Capacity Ratings

• Heaped or Struck
• All Scrapers are rated for “heaped” capacity in Yards$^3$.

Heaped capacity – The maximum capacity of the scraper
Struck capacity – The level capacity of the scraper
Loading Scrapers

Push Loading
- Quicker larger long
- Soft material
- Need extra material in scraper for long haul

Direct Loading

Tip: Always cut the high spot for ease of loading
Top Loading Scrapers

Always put the bowl on the ground – why?
1. Damage lift cylinders and bowl
2. Can harm hitch system and scraper durability
3. Jars operator in pull tractor
Pull-Tractor Telematics

- Differential lock usage

Positives on Differential lock
1. Even pull
2. Less tire spillage
3. Less tire wear
4. More production

What needs to be done?
- Talk to the operator
- Training to understand usage

Telematics!!!
Summary

• Review the right combination of equipment to meet your production requirements
• Review how to choose the right combination of equipment for your particular application – sand vs. clay vs. mud vs. rock
• Contractors using telematics to remotely monitor, check, and manage their fleet and jobsites
• Tips to help operators and managers improve productivity from experience and real world application of telematics data

Stay tuned for Pay Dirt: Mass Excavating...Part 2 Thursday 8:30-9:30 Room N114
Mass Excavation Class

Mike Boyle & Bryan Tallyn
John Deere Product Consultants
Objectives:

- Choose the right combination of equipment for your particular application – rock vs. sand vs. clay vs. mud.
- Choose a dirt-moving system that can change with material changes
- Determine how telematics can help with the right selection of equipment to fulfill job requirements
- Discover how to apply telematics through real world scenarios
**What is Mass Excavation?**

- Definition may be different for every contractor
  - Can be 1000 yards to small contractor
  - Could be several million yards for a contractor like Peter Kiewit or Ryan Central

- What determines the mix of machines?
  - Total yardage
  - Type of material
  - Job conditions - terrain
  - Length of haul
Excavation Facts

• 10,000 bank cubic yards of dry loam...

…becomes 13,500 loose/fluff cubic yards when the soil is excavated...

• When you compact this 13,500 loose cubic yards, it becomes 8,800 compacted cubic yards
Is there a perfect machine for you?

Volume
- Small
- Large

Distance
- Short
- Long

Terrain
- Hard
- Soft

Grade
- Flat
- Steep

Dozer
Articulated Dump Trucks
Dozer Scraper
Rigid Dump Truck
Tractor Scraper
# Off-Road Haulers Comparison

<table>
<thead>
<tr>
<th>Site Condition</th>
<th>Scaper Tractor &amp; Pans</th>
<th>Motor Scrapers</th>
<th>ADT Trucks</th>
<th>Crawler Scraper</th>
<th>Crawler Dozer</th>
<th>Rigid Dump Truck</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard Surface</td>
<td>++ ++</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Soft Haul Road</td>
<td>++ ++</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Greasy Surface</td>
<td>+ +</td>
<td>+</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td>Moderately Steep Grade (&lt;25%)</td>
<td>+ +</td>
<td>+</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td>Steep Grades (25%+)</td>
<td>- -</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>++</td>
</tr>
</tbody>
</table>

## Haul Length

<table>
<thead>
<tr>
<th>Haul Length</th>
<th>Self Loaded</th>
<th>Top Loaded</th>
<th>Single Pan</th>
<th>Double Pans</th>
<th>Motor Scrapers</th>
<th>ADT Trucks</th>
<th>Crawler Scraper</th>
<th>Crawler Dozer</th>
<th>Rigid Dump Truck</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 750 ft</td>
<td>-</td>
<td>+</td>
<td>++</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>++</td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td>750 – 1000 ft</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>++</td>
</tr>
<tr>
<td>1000 ft – 1 mi.</td>
<td>++</td>
<td>++</td>
<td>+</td>
<td>++</td>
<td>++</td>
<td>+</td>
<td>++</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1 – 3 mi</td>
<td>++</td>
<td>++</td>
<td>-</td>
<td>++</td>
<td>+</td>
<td>++</td>
<td>-</td>
<td>-</td>
<td>+++</td>
</tr>
<tr>
<td>&gt;3 mi</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+++++</td>
</tr>
</tbody>
</table>

## Material

<table>
<thead>
<tr>
<th>Material</th>
<th>Good Dirt</th>
<th>Mud</th>
<th>Bad Mud</th>
<th>Sand &amp; Gravel</th>
<th>Shot Rock &lt;1 ft in diameter</th>
<th>Shot Rock 1 – 1.5 ft</th>
<th>Shot Rock &gt;1.5 ft</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>++</td>
<td>++</td>
<td>-</td>
<td>++</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>+</td>
<td>++</td>
<td>-</td>
<td>++</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>++</td>
<td>-</td>
<td>-</td>
<td>++</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>++</td>
<td>++</td>
</tr>
</tbody>
</table>
Telematics
History of North American Units

After-Market Telematics
Outside the machine brains:
• Hours
• Location
• Geofence
• Preventative Maintenance

OEM Telematics
With machine brains:
• Hours
• Location
• Geofence
• Preventative Maintenance
• Fuel consumption
• Utilization
• Machine health
• Remote software updates
• Operator behavior
• Payload data

CE Industry Sales
Units w/ Telematics
Telematics – Overview

- Track fleets in multiple locations
- Maximize equipment utilization
- Monitor machine and operator productivity
- Monitor machine health and performance
- Maximize fuel efficiency
- Enhance machine security
- Reduce insurance premiums on equipment
- Increase machine resale value
- Increase accuracy of job costing
- Improve future bidding
- Enhance maintenance scheduling, recording, and reporting
Remote Diagnostics

• Problem = Customer receives trouble code and contacts dealer for assistance.

• Solution = Remote connection reveals restricted filter. Customer changes filter and avoids costly technician trip to field.
Grade Control

- Machine control system for earth moving equipment
- Optimizes machine:
  - Speed
  - Accuracy
  - Productivity
  - Data management
- Reduces
  - Staking costs
  - Cut to grade “fewer passes”
  - Material cost
  - Machine wear and tear
  - Need for high skill operator
Grade Control

- GPS controls blade direction and depth
- Optimizes earth moving
- Requires training
- Reduces cost and increases control
  - Labor
  - Material
  - Engineering

Telematics monitor Grade Control and Cross Slope Utilization
GPS or Laser System

**GPS**
- Accuracy ++
- Simple
- Operator friendly
- Memory stick loadable

**Laser**
- Accuracy +
- More training
Grade Control Example

• Medium Size Job
  – 250,000 ft$^2$ parking lot
  – Utilize grade control on:
    • Graders
    • Crawlers
    • High Speed Dozers
      – Finish speeds up to 5 mph
      – Finish tolerances of 3-4 mm
Grade Control Example

Without Grade Control
• 20,000 ft² per day
• 250,000 ÷ 20,000 per day
• = 12.5 days

With Grade Control
• 40,000–60,000 ft² per day
• 6 to 8 day reduction per grading pass
• = 4.5—6.5 days

Average Crew assumed: 2 laborers and 2 machines

$300/hour = $28,000—$38,000 Savings
Superintendent GPS
Production Machines

What is a Production Machine?

• Any machine that makes you money by moving material usually to the fill or waste area depending on the project.

• These machines may haul, push or carry material.
Support Machines

What are Support machines?

• Any machine that support the movement of materials.

• These machines may:
  – Load or push haul machines
  – Level or push off fill/waste areas
  – Mix material by drying or adding water
  – Compact fill
  – Maintenance haul roads
Rigid Frame Trucks

- Advantages
  - Hauls large chunks
  - Good visibility with loader
  - Large bed area – easy target
  - Easy loading
  - Steep dump angle
Rigid Frame Trucks

- Limitations
  - Trucks weigh more to be long lasting – trucks heavy
  - Better on hard surfaces
  - Limited traction in mud
  - Higher side height
  - Expensive
  - Requires support machines to load
Support Machine for Rigid Frame

Trucks can be loaded with:
- Loader
- Front Shovel
- Excavator

Support machine is determined by dig-ability of the material, material abrasiveness, productivity needed, and machines available.
Articulated Dump Trucks

• Advantages
  – Can dump on the go
  – Easier for support tractor to level

• Popular options
  – Tail gates
  – Bed liners
  – Body heaters
Articulated Dump Trucks

- Advantages
  - Diff locks or Inter-axle lock or use both for muddy/steep areas
  - Good for adverse conditions
    - Rough areas
    - Steep areas
    - Soft areas
Articulated Dump Trucks

- Limitations
  - Needs level dump area
  - Requires support machines in cut and fill
  - Must be pulled out when struck

**Tip:** Do not push on truck. If stuck, use cable.
On Board Weighing

- Load indicators
- Track actual productivity
  - Total tonnage
  - Integrated carry back calculation
  - Cycles
- Automatic add of payload after dump

Payload 16.3 T

Integrated into monitor
OBW (On Board Weighing)

- Productivity tracking through telematics
- Reduce tire wear
- Calibration for accuracy – material/moisture, tailgate

<table>
<thead>
<tr>
<th>Blink</th>
<th>&lt;75%</th>
</tr>
</thead>
<tbody>
<tr>
<td>On</td>
<td>75 – 90%</td>
</tr>
<tr>
<td>On</td>
<td>90 – 110%</td>
</tr>
<tr>
<td>On</td>
<td>&gt;110%</td>
</tr>
</tbody>
</table>

*Slope must be <5% (2.5°) or shows last known value
*If loaded on slope >5% (2.5°), no value shown until slope levels
Dump Body Rollover Protection

• **Benefits**
  – Minimizes operator raising dump body with rear chassis on less than ideal sloped surfaces
  – Application examples:
    • Worksites without dumping area maintenance
    • Limiting new operators in training
  – Owner-enabled and selected
    • “Prevent Raise” dump body will not raise if percentage is greater than owner selected

![Dump Body Rollover Protection](image)

20° Maximum
### Payload Weighing in Action

<table>
<thead>
<tr>
<th>Payload Information</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unloaded Time</td>
<td>151.7 hr</td>
</tr>
<tr>
<td>Unloaded Idle Time</td>
<td>74.2 hr</td>
</tr>
<tr>
<td>Total Payload</td>
<td>73943.9 tn</td>
</tr>
<tr>
<td>Average Speed Loaded</td>
<td>6.4 mi/h</td>
</tr>
<tr>
<td>Average Speed Unloaded</td>
<td>6.4 mi/h</td>
</tr>
<tr>
<td>TripCounter</td>
<td>1740.0</td>
</tr>
<tr>
<td>Loaded Time</td>
<td>98.3 hr</td>
</tr>
<tr>
<td>Loaded Idle Time</td>
<td>23.9 hr</td>
</tr>
<tr>
<td>Distance Traveled While Loaded</td>
<td>351.6 mi</td>
</tr>
<tr>
<td>Distance Traveled While Unloaded</td>
<td>325.4 mi</td>
</tr>
<tr>
<td>Unloaded Average Fuel Rate</td>
<td>4.4 gal/h</td>
</tr>
<tr>
<td>Loaded Average Fuel Rate</td>
<td>8.7 gal/h</td>
</tr>
</tbody>
</table>

- 5.23 minutes per load
- 42.5 Tons per load
- 3.4 minutes per load
- 0.2 miles per trip
- 0.18 miles per trip
Managing the Fill

- Dozer operator spots area for ADTs to dump
- Spreads material after ADT dumps
- Keep haul road level for ADTs
Better production on a bench

- Difference in Production (470G)
  - From Bench – 1163 yds/hour
  - Ground Level – 940 yds/hour
- 21% Difference
Positioning Excavator for Fast Cycle Times

Fast Cycles Times

- Reason for bench – great visibility into ADT
- Load beside excavator
- Bottom of track and ADT side boards same height
- Boom/arm point over closest side board
- Dump bucket just enough for material to drop out smoothly and steady
- Less than 90 degree to the truck
Dozers – Production

• Advantages
  – Usually first machine on job
  – Only machine needed
  – Work in adverse conditions (rock, steep slopes, trees, mud, etc)
  – Many jobs (push tractor also)
  – Utilize ripper or attachments
  – Try to load blade pushing down hill to increase production

• Limitations
  – Usually push up to 300 ft.
  – Extra track wear (high speed & reverse)
  – Slow travel speeds
Dozers and Excavators – Support

- Combination
- Excavators lifts material usually in muddy area
- Dozer
  - Pushes material to excavator in the cut
  - Spreads and levels material in the fill or to dry material
- Operators need to work together (timing important)
Two Dozers – Production

• Advantages
  – Increase productivity by 20%

• Limitations
  – Operators have to team up
  – Slightly slower cycle times because of coordination
Scrapers

Scrapers is general
Durable, heavy, long lasting, used for over 50 years

Tip: Get a nice load and go – don’t spend too long in the cut
Top Loading Scrapers

- **Advantages**
  - Load soft material
  - Mix materials
  - Scraper and excavator stays on hard ground (out of mud)

- **Limitation**
  - Limited load area between bowl cylinders and ejector rack. Excavator operator has to be careful

**Tip:** Always have bowl on ground when loading
Dozer and Pull Scrapers

- Reasons for Use
  - Swiss army knife
  - Production and support machine
  - Use both ends of machine because of hydraulics
  - Peak production 700 to 800 ft
  - Dolly wheels on scraper keep weight off the crawler
Dozer and Pull Scrapers

- Advantages
  - Short haul
  - Steep grade
  - Soft condition
  - Confined cut and fill areas
  - Self load 85%
  - Dump and spreads fill
  - Could be one man show

- Limitations
  - Limited haul distance
  - Slow travel speeds
  - Sandy jobs
  - High travel speeds increase undercarriage wear
Dedicated Scraper Tractors

- **Advantages**
  - Muddy conditions
  - Short hauls 400 to 1000 ft
  - Steep conditions
  - Good maneuverability
  - No support machine - Level fill or cut area with scraper

- **Limitations**
  - Slow travel speeds
  - Wet sandy material
Push Load Scraper Tractors

• Advantage
  – Quicker load time
  – Push through soft area

• Limitation
  – Dozer blade into rear tire of scraper

Tip: If push loading with dozer, the blade needs extra steel push plate to limit wear.
When compared to comparable methods of moving material, Scraper Systems provide a distinct value advantage:

- **1/3 the initial investment**
- **1/2 the labor**
- **30 to 50 cents cheaper per Yd³**

*23-38 cents cheaper per cubic meter.*
Selecting the right scraper type

- **Sand**: Wheel, Approved
- **Sandy Loam**: Track, Ideal
- **Topsoil**: Ejector, Approved
- **Clay**: Carry All, Recommended
- **Gumbo**: Ideal

www.conexpoconagg.com
Capacity Ratings

Heaped or Struck
All Scrapers are rated for “heaped” capacity in Yards$^3$.

Heaped capacity - The maximum capacity of the scraper.

Struck capacity - The level capacity of the scraper.
Loading Scrapers

Top Loading
- Stock pile material
- Muddy material
- Short loading area & long haul

Tip: Always cut the high spot for ease of loading
Top Loading Scrapers

Always put the bowl on the ground – why?
1. Damage lift cylinders and bowl
2. Can harm hitch system and scraper durability
3. Jars operator in pull tractor
Summary

- Contractors using GPS finish jobs quicker and right on grade
- Contractors using telematics to watch, check and manage their fleet
- Tips to help operators and managers improve productivity from experience and telematics