

Partnering for Higher Productivity & A Cleaner Future

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- Managing to Achieve Lowest Cost/Ton
- Information Based Quarrying
- A Cleaner Future

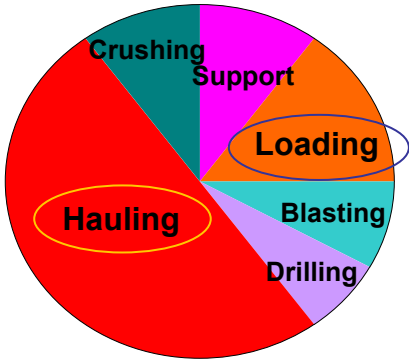
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Operations Excellence



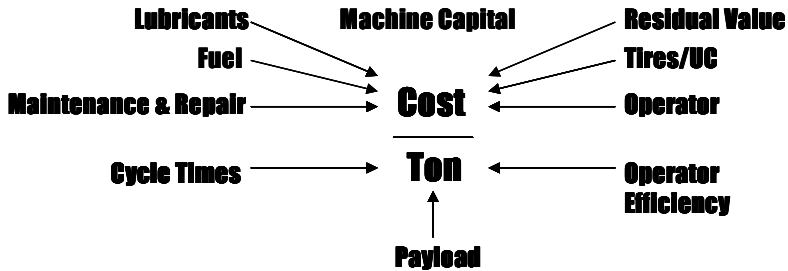
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Getting Back to Basics



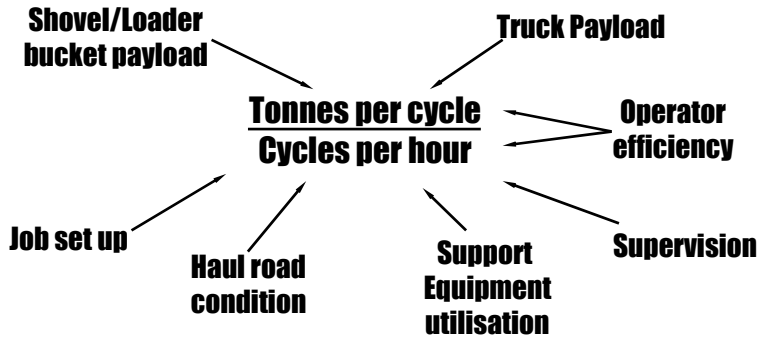
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Tonnes per Hour



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Tonnes per Cycle - Loader

- Shovel/Loader bucket payload
 - Rated Payload
 - Bucket Fill Factor
 - Is the bucket matched to the truck (i.e. whole number of passes)?
 - Has the blast given the operator a chance to get good bucket fill factors?
 - Overprotected Bucket?



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Performance Benchmarks

■ Wheel Loaders

- Cycle time
 - 30-40 seconds (38-second average)
- Bucket fill factor - well shot rock
 - 90-110%
- Pass match
 - 4-6 passes



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Performance Benchmarks

■ Hydraulic Backhoes

- Cycle time
 - 24-28 seconds (26-second average)
- Bucket fill factor - well shot rock
 - 90-110%
- Pass match
 - 4-6 passes



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Performance Benchmarks

- Hydraulic Front Shovels

- Cycle time
 - 27-30 seconds (28-second average)
- Bucket fill factor - well shot rock
- 90-100%
- Pass match
 - 4-6 passes



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Tonnes per Cycle – Job set up

- Bench Height
- Digging Pattern
- Material Fragmentation



Loading Tool	Reference Bench Height
Wheel Loader	Bucket Pin @ max lift
Hyd Backhoe	Stick Length
Hyd. F.S.	Boom-Stick Pivot

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Tonnes per Cycle – Digging Pattern

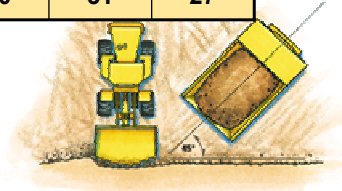
■ Elements of Loading

- Dump bucket into Hauler →
- Swing/Travel Empty →
- Load Bucket →
- Swing/Travel Loaded →

Wheel Loader	Front Shovel	Mass Exc.
6	4	4
9	6	5
14	13	12
11	8	6
40	31	27

■ Positioning

- Loader operator spots truck.
- Position for fastest cycle times.
 - Wheel loaders - 45°
 - Other loading tools - angle varies



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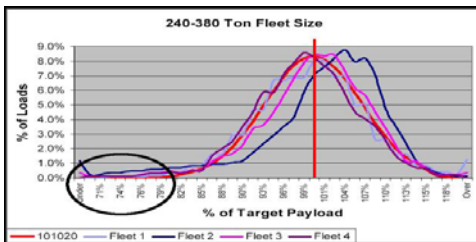


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Tonnes per Cycle - Truck

■ Truck payload

- Payload history: overloading *and* underloading?



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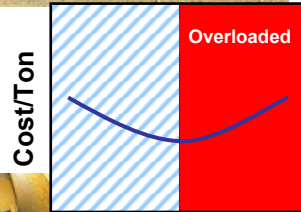
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Why optimize payload?

- Maintain safety certification
- Approximate 1:1 ratio in reducing cost per ton
- Achieve optimum component lives
- Minimize spillage
- Impacts component life, fuel consumption, tire life, cycle times, and availability



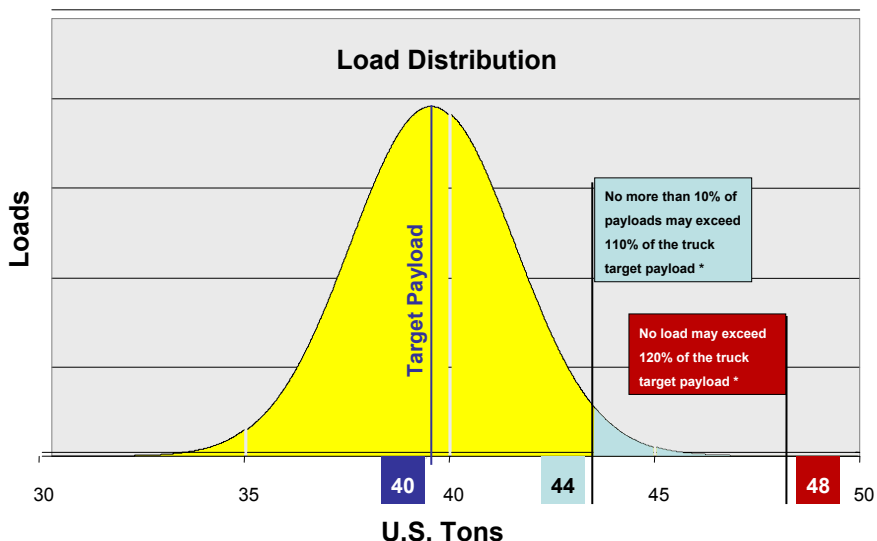
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* Required to Meet Caterpillar's 10/10/20 Loading Policy for Quarry & Construction Trucks

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10/10/20 Truck Overload Policy

- 10/10/20 Truck Overload Policy for Caterpillar Quarry & Construction Trucks

“No more than 10% of payloads may exceed 1.1 times the target payload and no single payload shall ever exceed 1.2 times the target payload*”*

* Refer to Machine Specalogs for Target Payload Calculation for that model.

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Cycles per Hour – support equipment

- You've got support equipment – are you helping your team get results with it?
- Training?
- Dispatch?
- Supervision?



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Cycles per hour – haul road condition

- Rule of Thumb: Can I do 60km/h in a light vehicle on this road?



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Load & Haul Operations

- **Basic Goals**
 - Safe and efficient operations
 - Meet target production
 - Lowest cost per tonne

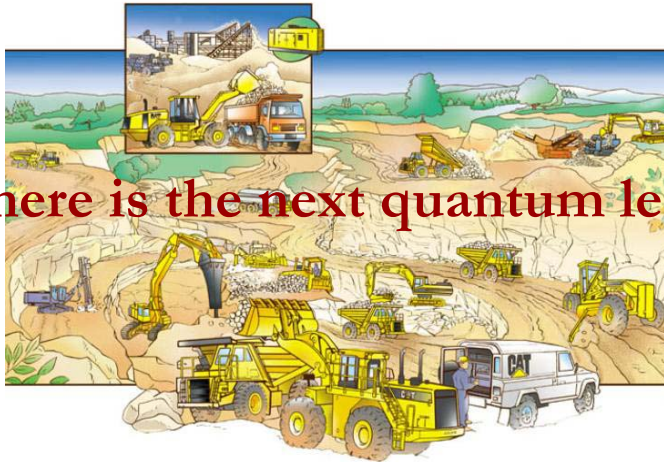


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Where is the next quantum leap?

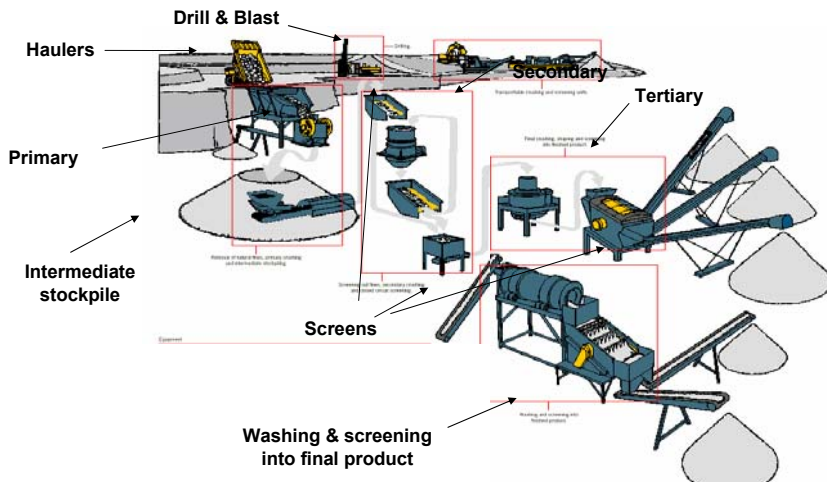
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Its all about total ASSET optimisation !!!



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To be **WORLD CLASS**

& Maximise ROA/Margin

excess capacity will not be possible

Risk will equal return !!

- Availability ↑95%
- Idle time ↓10%
- Utilisation ↑98%
- Actual/Theoretical ↑92%

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Optimize!

It most likely won't be iron !!



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The macro picture :

The Information Age

- It's here and it's rapidly changing our day to day lives. We must embrace it and obtain significant competitive advantage....

It has significant Cost per Tonne reduction capability !!

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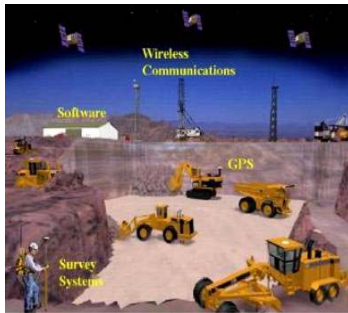
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New Technology: Enabling Process Control in Quarry

- Global Positioning System (GPS)
- Wireless Mobile Communications
- On-Board Computing/Sensing
- Off-Board Information Management



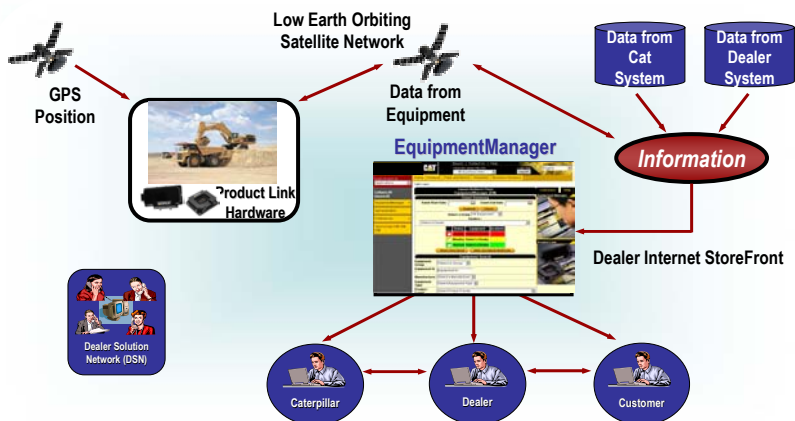
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Product Link



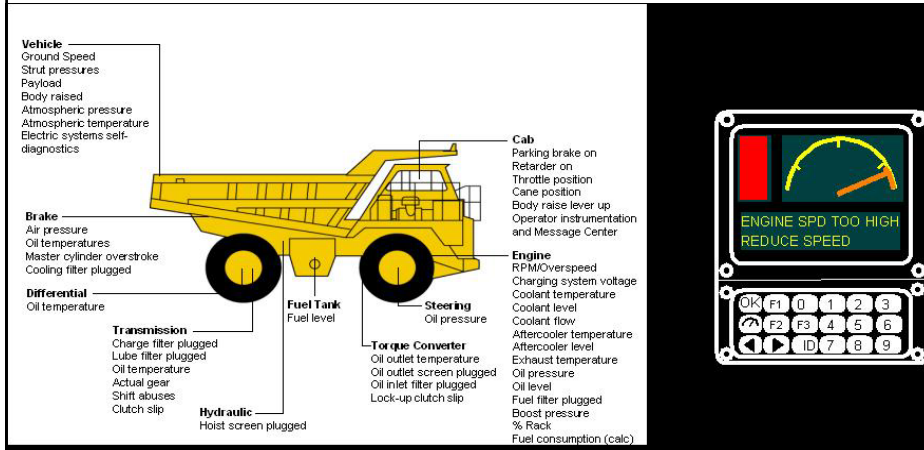
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What we have on the large trucks today ...



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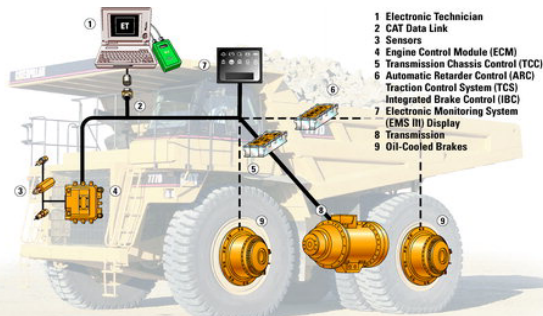
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On-Board Computing System

- Power Train Integration
- VIMS
- TPMS
- RAC



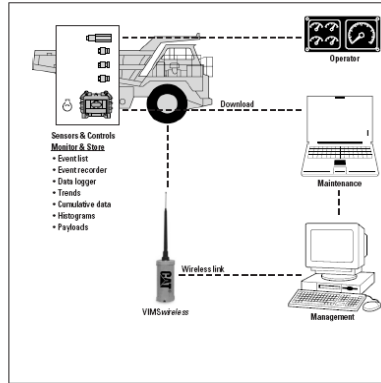
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VIMS



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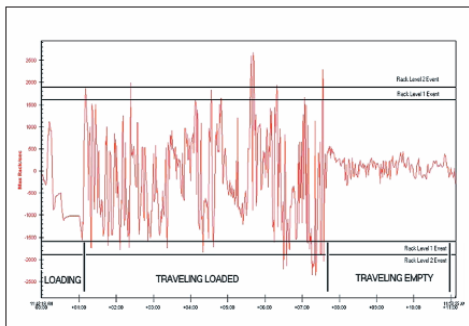
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Road Analysis Control

RAC Reading from VIMS Data Logger



-On Board IT designed to benchmark haul road quality

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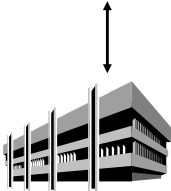
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Quarry A Office

Rollup of accrued real time data

- Fleet utilisation
- Fleet production
- Maintenance benchmarks
- Throughput of crusher
- Movement to stockpiles
- Sales to customers
- Cost and downtime to key codes
- Site severity



Rollup of site KPI's

- Benchmarking of all sites
- True understanding of cost and efficiency opportunities
- Faster and more educated decision making



Rollup of accrued real time data

- Machine health
- Machine location & tracking
- Machine production
- Interface with crusher
- Real time material blending

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Partnering Into The Future

- Strong partnership & alliances with suppliers
- Systems & support to reduce risks
- Help customer set and achieve new benchmarks for safety, efficiency and profitability.



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THANK YOU !



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References

- Matthew Mcleod (2005) Back to Basics: Getting the most tonnes at the lowest cost from your earthmoving equipment
- David Keenan (2006) Information Based Quarrying
- CATERPILLAR INC. (2005) A Reference Guide to Mining Machine Applications, Caterpillar Inc., Peoria, IL.
- CATERPILLAR INC. (2002) Cat Road Analysis Control for Mining Trucks, Media # TELQ4461, Caterpillar Inc, Peoria, IL.
- CATERPILLAR INC. (1998) Cat VIM*Wireless* (Vital Information Management system), Caterpillar Inc, Peoria, IL.
- CATERPILLAR INC. (2004) Equipment Manager/ Product Link Media # PEHP0027-02, PEHP9548-05, Caterpillar Inc, IL.

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