The Sustainable Way
Paving and Compaction Systems from Dynapac

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Agenda

- Dynapac‘s Sustainable Way
- Asphalt paving – CO_2 emissions during the process chain
- Paving the Sustainable Way: Compactasphalt® & Advanced Systems
- Rolling the Sustainable Way: Low emissions and compaction control
- Conclusion

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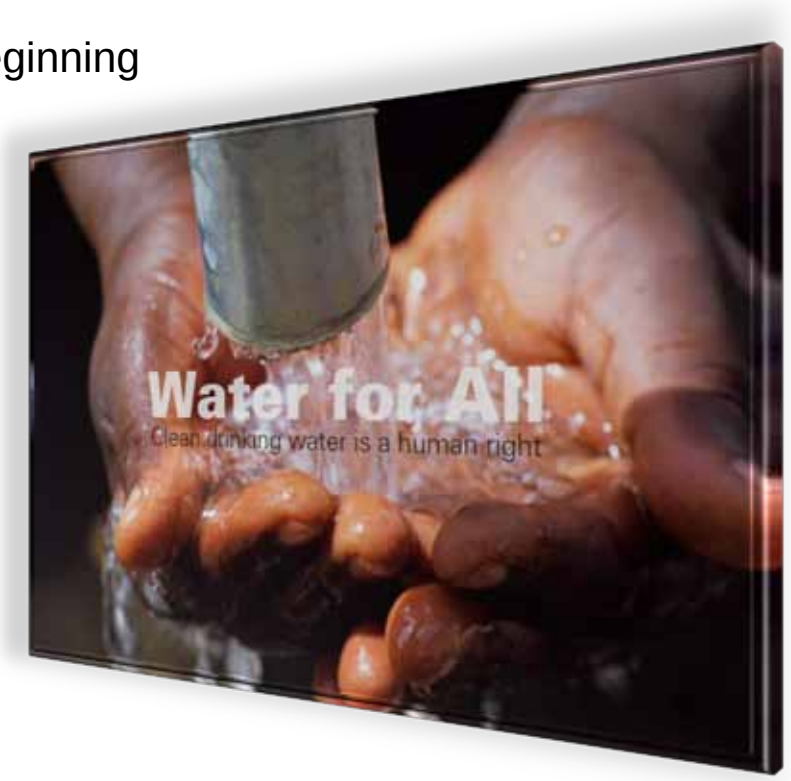
Sustainability – A holistic approach

- Create long term Value
  - For all stakeholders
- Focus on Quality
  - Do things right from the beginning
  - Do the right things
- Take Responsibility
  - Social
  - Environmental
  - Ethical
  - Economic



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Main areas to address

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Asphalt paving and CO_2 emissions – The process chain

1) **Mixed good production**
   a) Indirect emissions: production of bitumen, aggregates and electricity
   b) Direct emissions discharged by the asphalt mixing plant

2) **Machine usage**
   a) Planer(s)
   b) Paver(s)
   c) Roller(s)
   d) Material transport (trucks)

3) **Road closures**
   a) Road closures result in traffic jams
      à higher CO_2 emissions by cars
   a) Channelization of traffic causes more damage to the traffic lane where the traffic is running
   a) Standing traffic also creates a high vertical load

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Asphalt paving: Energy consumption in the process chain

- **Energy consumption in the process chain**
  - Approx. 90 to 95% of the primary energy consumption as well as CO_2 emissions are generated during the quarrying and mixing process
  - The remaining 5% to 10% is shared between transportation, paving and compaction

- **Resulting requirements for the paving process**
  - Higher quality through optimized paving processes
  - Further reduction of the energy consumption and emissions for each stage of the process
  - Reduced paving times for reduced burden on the user and residents

- **Which requirements are to be expected in the future?**
  - Higher quality standards for the paving result
  - Possible limiting values for energy consumption and emissions per ton pavement

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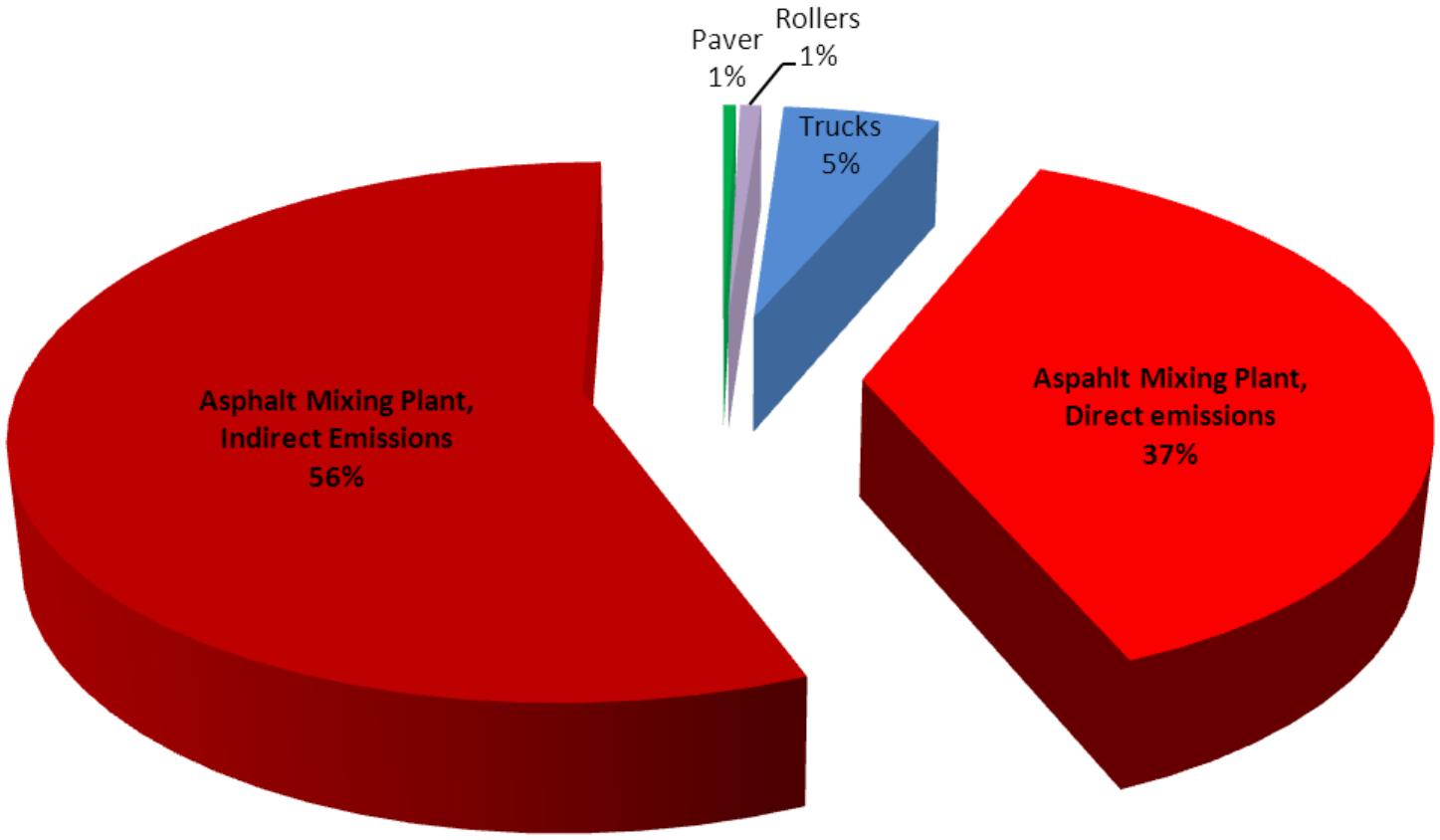
Asphalt paving: CO_2 emissions throughout the process chain



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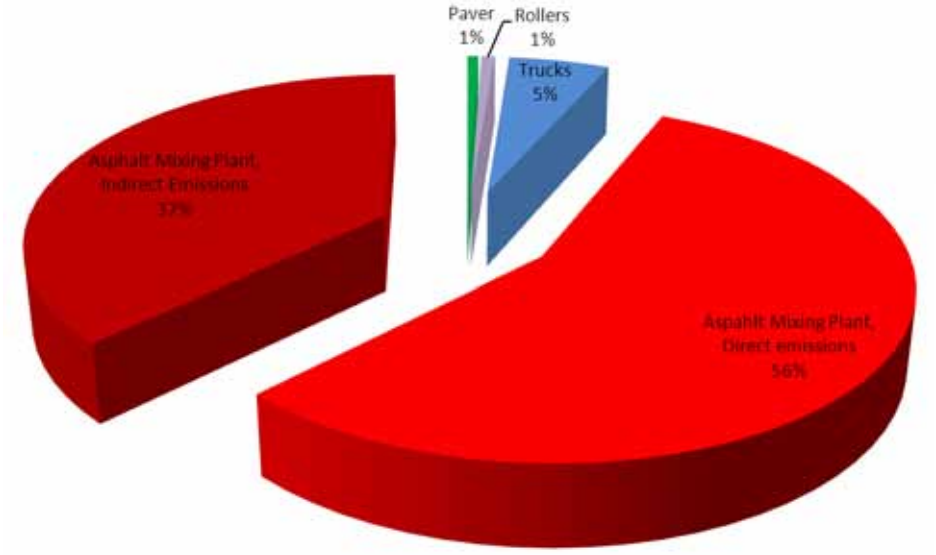
How to affect the major part of the cake as a machine producer?



How can DYNAPAC reduce CO_2 emissions in the upstream process chain?

By increasing the quality (durability) of the asphalt pavement!

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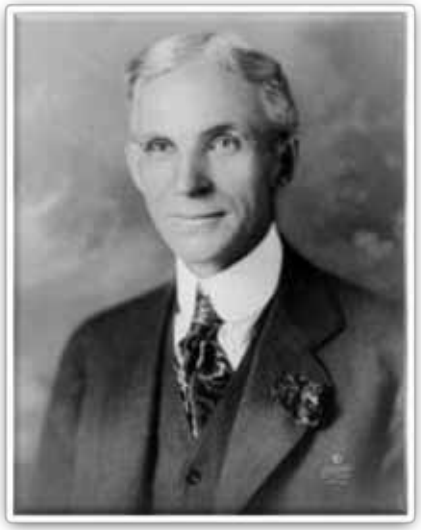
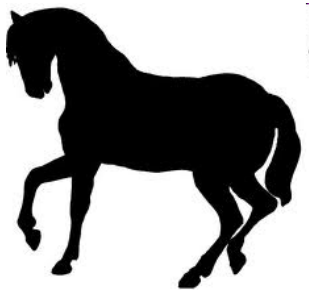
Revolutionary new concepts



Henry Ford (1863-1947)

"If I had asked people what they wanted, they would have said faster horses."



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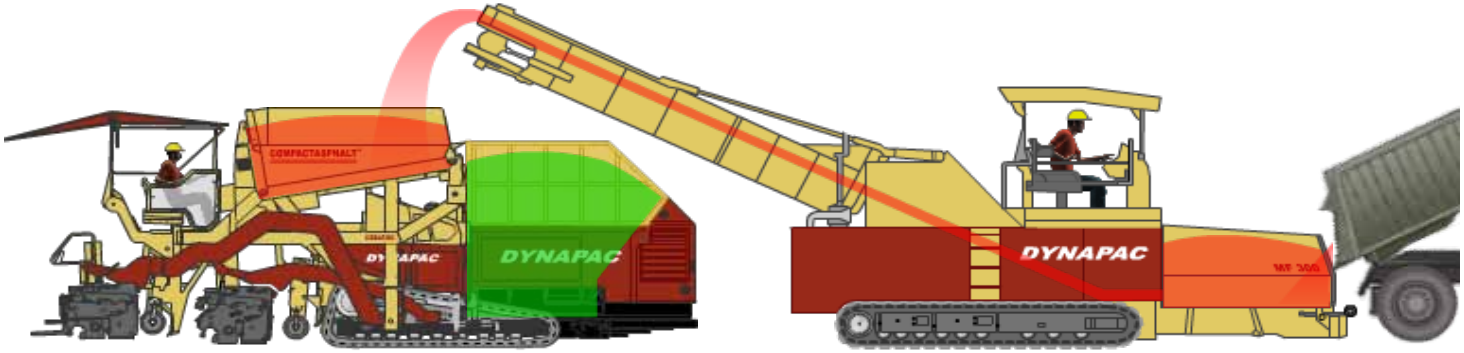
Dynapac's breakthrough innovation: Compactasphalt® Revolutionary Sustainable!

- **Two layers in one process**
  - Better interlocking of the courses
  - Paving time up to 50% less
  - One paving crew for two layers
- **Significantly increased quality**
- **Lower life cycle cost**
  - **Material savings during paving (Direct saving)**
  - **Significantly increased durability (Indirect saving)**



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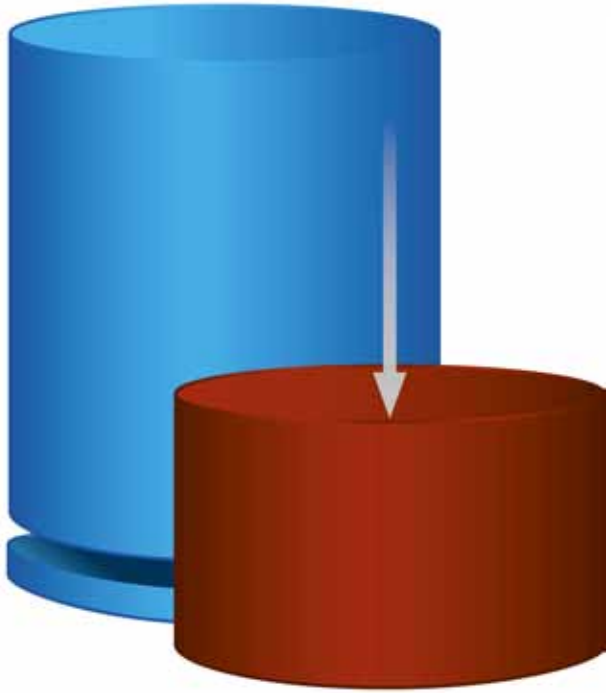
Compactasphalt® – Material savings during the paving process



- Halving the costly wearing course material
- No bitumen emulsion is needed between the courses

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Compactasphalt® – Example for material saving

Area	mass	unit	material spezification / layer	density	thickness	total material	costs material	costs calculation	calculation costs	real costs
				to/m³	cm	to	€/to	€/to	€	€
BAB A 14	290.000	m²	Binder 0/22 S	2,331	8	54.079	58	58	3.136.594	3.136.594
									3.136.594	3.136.594
BAB A 14	290.000	m²	SMA 0/8 S	2,304	4	26.726	88	88	2.351.923	2.351.923
						80.806			2.351.923	2.351.923
BAB A 14	290.000	m²	emulsion spray				0	0	43.500	43.500
						total material costs standard paving			5.532.017	5.532.017
BAB A 14	290.000	m²	Binder 0/22 S	2,331	10	67.599	58	58	3.920.742	3.920.742
	290.000	m²	SMA 0/8 S	2,304	2	13.363	88	88	1.175.962	1.175.962
						80.962			5.096.704	**5.096.704**
						total material costs compactasphalt				5.096.704
						material profit compactasphalt				435.313

Reference: Johann Bunte GmbH, Papenburg, Germany, 2007; Highway Project calculation A14

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Material savings: Your decision!

§ 43,500 € for tack coat, 290,000 m^2

§ 43,500 € for a Hybrid sports car

§ 435,000 € for more costly mixed good

§ 435,000 €……

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Compactasphalt® – Revolutionary Sustainable!

- **Bitumen savings by:**
  - **Elimination of tack coat** as no tack coat between binder & top layer is needed
    Conv. pavement needs 0.3 kg/m² x 290,000 m² = **87 tons bitumen was saved!**
  - Halving the top layer, which has a higher bitumen content compared with the subjacent layers

- **Economic effects not considered in the calculation:**
  - Up to 50% reduced paving time = Less working hours

- **PPP project savings** due to drastically reduced life cycle cost
  Assumption: No repaving once during the conventional life cycle

290,000 m² x 11 € = **3,190,000 €**

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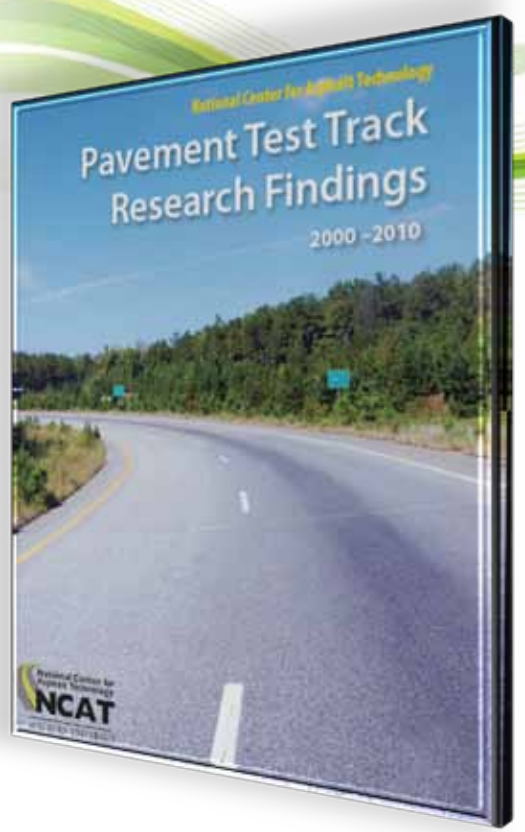
Compactasphalt® – Proven over time!

One of the most interesting test sections on the track has been the twin-layer OGFC placed in 2006. This section has a 9.5 mm nominal maximum aggregate size (NMAS) OGFC surface layer on top of a 12.5 mm NMAS OGFC layer. Both OGFC layers were placed with a special (and very large) paver built specifically to simultaneously place two HMA layers (see Fig. 4). After four years the twin-layer OGFC surface continues to be the smoothest, quietest and most effective section at eliminating water spray on the track.



- Study by the University of Darmstadt on a 12 years old Compactasphalt Highway, A7
- NCAT study also proved the high quality of Compactasphalt (Test 2006-2010)

The studies prove high quality of the Compactasphalt pavement

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Compactasphalt jobsites world wide

- **Germany:** **~ 3.500.000 m²**
- **Netherlands:** ~ 495.550 m²
- **Poland:** ~ 410.000 m²
- **Russia:** ~ 330.905 m²
- **Sweden:** ~ 54.000 m²
- **Hungary:** ~ 17.000 m²
- **China:** **~ 2.205.000 m²**

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Compactasphalt jobsite impressions

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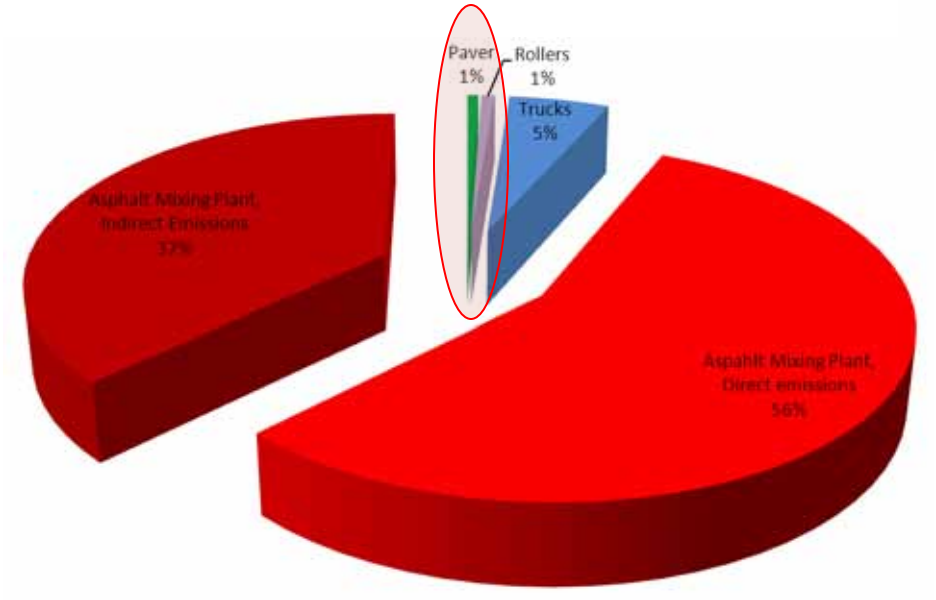
Lowering CO_2 emissions during the paving process



- Affecting the small part of the cake by reduced fuel consumption
- Affecting the largest part by increased paving quality

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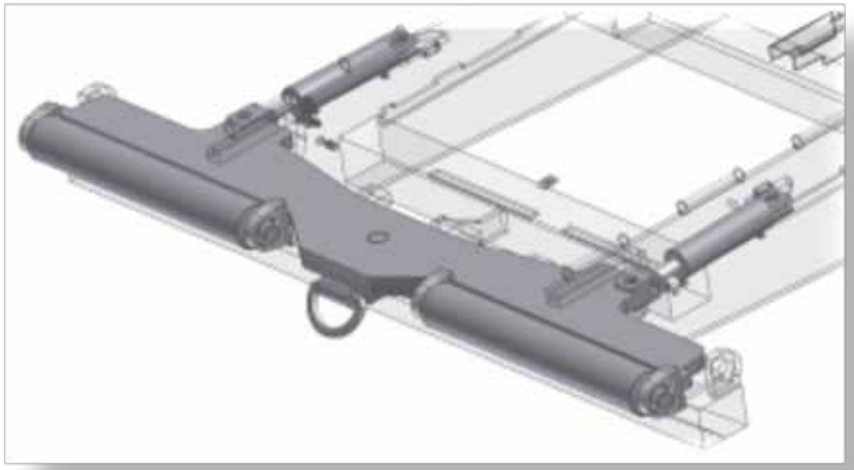
Focus on quality: Safe Impact System

Patented,hydraulically extendable push rollers



NEW SAFE IMPACT SYSTEM ensures even surfaces even in case of heavy shock from the lorry!

This hydraulical anti shock system:

1) Reduces the impacts from material trucks

2) No screed marks in the mat

3) Extended dumping length (adjustments in docking, no damage to paver by long trucks

§**UNIQUE FEATURE IN THE MARKET!**

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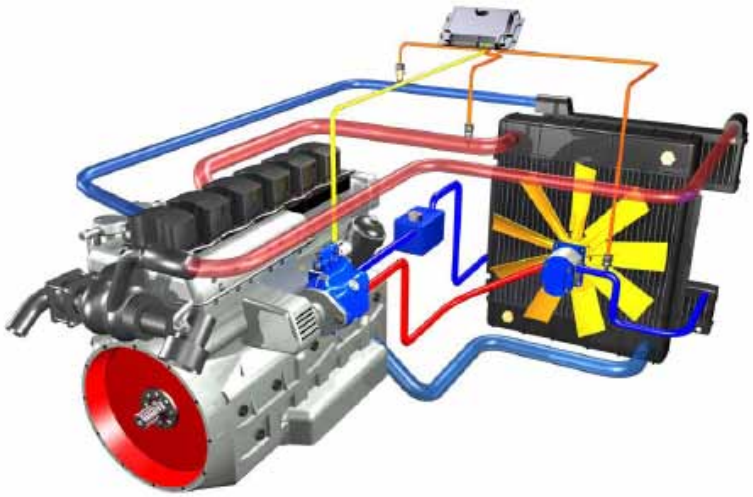
Performance: Efficient cooling system



Modified fan installation

§ Separated from diesel engine à Less noise, less vibrations

Thermostatically controlled fan

§ Electronic motor management activates fan only when required

§ Fan-free rest period

§ **Less fuel consumption**

§ **Noise reduction**

§ **Lower-noise cold starting**

§ **More rated output**

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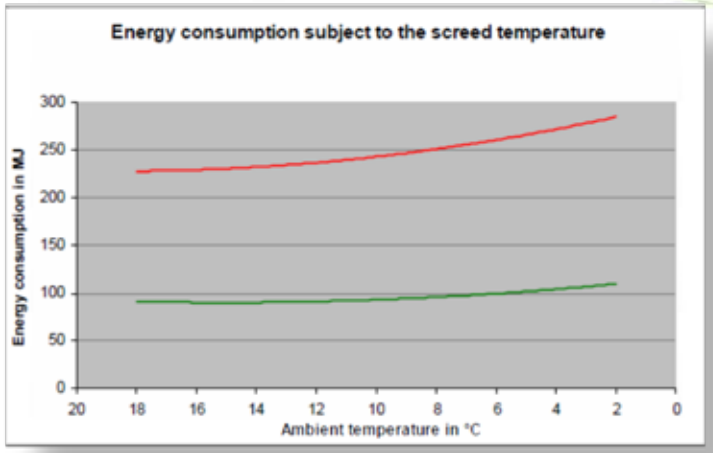
Sustainable Heating Systems: Gas heated screeds



Energy consumption of both heating systems subject to ambient temperatures

- Gas heated screed
- Electric heated screed

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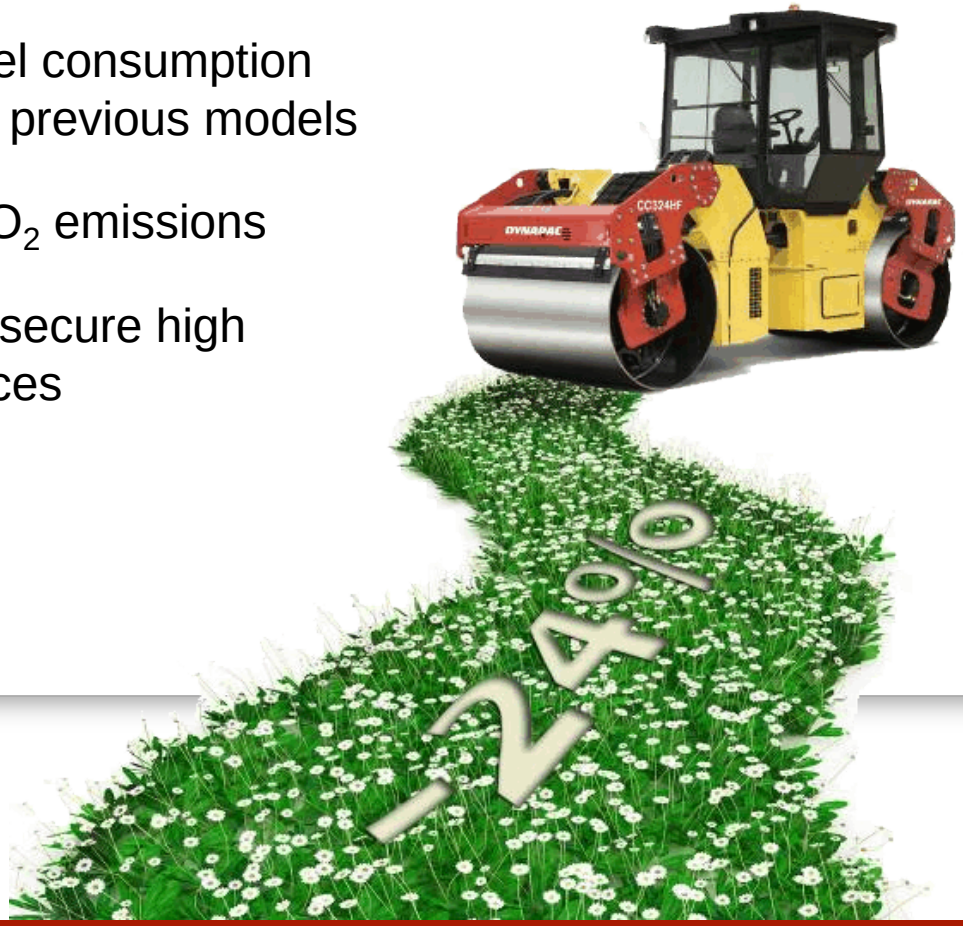
Low emissions
CC224HF-CC324HF Tandem Rollers

- 24 % less fuel consumption compared to previous models
- 24 % less CO_2 emissions
- Designed to secure high quality surfaces



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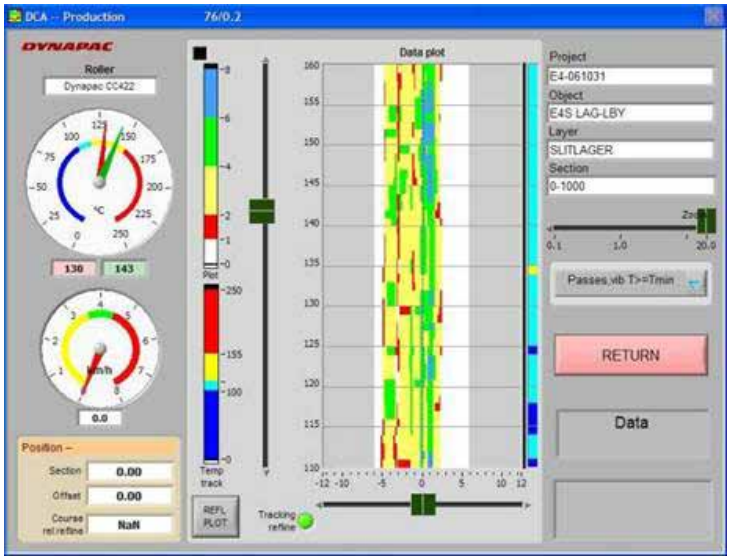
Compaction Control – DCA

Dynapac **C**ompaction **A**nalyzer - (**A**sphalt / **S**oil)



- Quality assurance of compaction process
- Secures optimum number of passes to keep the fuel consumption as low as possible
- Result is longer lasting roads

Accurate number of passes keep fuel consumption as low as possible

Dynapac CompLogger for soil compaction

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Low emissions

Aiming for the 1st zero diesel/gasoline fume emission roller concept

- Overnight charging time
- Recharged from a three-phase 400 V

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Sustainable development

”Sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs”

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Driven by innovation –
committed to customer performance

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