



Comparative
Biomechanical study

High Traffic GTI[®] tiles

Improve ergonomics for employees in Industry

Gerflor[®]

Protection and well-being of employees

Ergonomics is a key concern for manufacturers



30%

in the US manufacturing industry 30% of days away from work are due to injuries and illnesses involving musculoskeletal disorders (Bureau of Labor & Statistics USA, 2018)



50%

of employees say that ergonomic workspaces would help them to be more productive. (Staples Business Resource, USA)



9

occupational diseases out of 10 are due to musculoskeletal injury (INRS, France)



17%

of work-related accidents are related to slips, trips and falls (Works Accident Fund, Belgium)



Comparative Biomechanical study GTI® Tiles vs “Hard Floors”

Framework of the study

PARTICIPATING INSTITUTES



The Interuniversity Laboratory of Motor Biology (LIBM), located on several sites in France, associates researchers in the field of physiology, biomechanics and neurosciences applied to physical and sports activities and health.



With IGR initiatives and projects, they actively support companies in achieving their health goals. The Institut für Gesundheit und Ergonomie e.V. is an association of experts in the fields of ergonomics and back health.

OBJECTIVE OF THE STUDY

To evaluate the contribution of GTI® tiles in reducing shocks and vibrations when walking in humans compared to a «hard» floor, such as tiles, concrete or resin.

For this purpose, shock and vibration were measured in conjunction with the evaluation of muscular effort, energy expenditure and perceived comfort, in individuals performing tasks such as empty walking and load-bearing walking.

Measurements were added during more complex tasks such as handling loads, requiring a knee on the ground (LIBM).

Study to clarify to what extent GERFLOR floor coverings protect the human musculoskeletal system with its joints, bones and muscles thanks to their shock absorption effect when walking and standing (IGR).



THE STUDY EQUIPMENT

Surface EMG electrodes, thigh, calf, lumbar

- Measurement of muscular activations

Triaxial accelerometer on the heel

- Shock and vibration measurement

Heart rate measurement

- Heart rate monitor, Polar® VANTAGE V2

Perception measurement

- Borg questionnaire (validated in medicine and sports)

Measurement of skin pressures

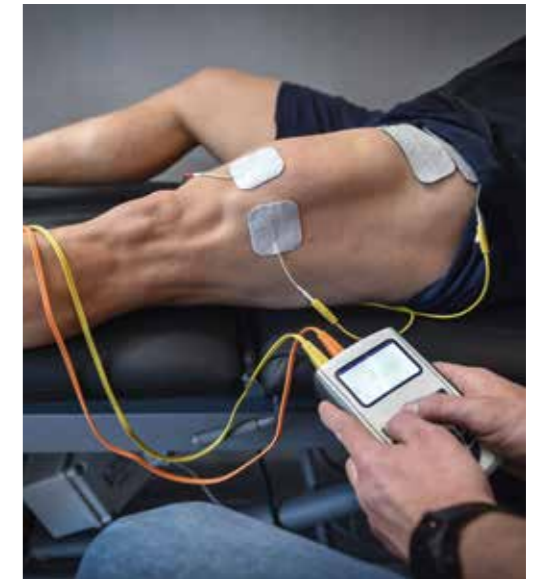
- Pressure sensors type W-INSHOE glued on the knee and the heel

Estimation of perceived comfort

- Evaluated with a visual analog scale

Walking analysis

- Medilogic system



OBSERVED POPULATION

Population

- Men and Women

Average age

- 39 years (+/- 10 years)

Average height

- 5,6 feet (+/-0,3)

Average weight

- 150 lbs (+/-22)

OBSERVED IMPACTS WITH FLOORS



Muscular efforts,
(Loaded and unloaded)



Perceived comfort
(Loaded and unloaded)



Shocks and vibrations
(Loaded and unloaded)



Pressure on the knee
when kneel down

Comparative Biomechanical study GTI® Tiles vs “Hard Floors”

The benefits of GTI® tiles for employees



The muscular efforts

10%

Reduction of muscle load*

3%

Reduction of the steps frequency*



Shocks and vibrations

15%

Reduction of shocks and vibrations on the body when walking*



Perceived comfort

7,5%

Reduction of stress when walking (pressure and muscle activation)

15%

Reduction of perceived fatigue when walking*

20%

Improvement in perceived comfort when walking*



Reduction of pressure on the knee when kneel down

38%

Reduction of pressure knees on the ground

* Average observed value



Décerné par l'institut IGR (Institut für Gesundheit und Ergonomie)



Detailed results of the study

Reduction in walking effort		Unloaded	Loaded (19,8 lbs)
Reduction of the step frequency over a given distance	Regular shoes	-6,3%	-
	Safety shoes	-0,6%	-
Reduced muscle activation during walking	Regular shoes	-12,9%	-7,6%
	Safety shoes	-11,9%	-10,5%

IMPROVEMENT OF propulsive EFFICIENCY
by better grip of the foot on the ground. Decrease of the muscular efforts to provide.

Improved perceived comfort and fatigue when walking		Gain
Walking comfort	Perceived Fatigue (Borg Questionnaire)	-15,6%
	Perceived comfort	+21,1%
	Walking stress	-7,5%

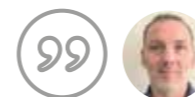
IMPROVING PERCEIVED COMFORT
Decrease in perceived fatigue.

Reduction of shocks and vibrations on the body		Unloaded	Loaded (19,8 lbs)
Reduction of the impact of shocks and vibrations on humans when walking	Regular shoes	-10 à 25%	-10 à -30%
	Safety shoes	-10 à -20%	-10 à -25%

REDUCTION OF UP TO 30% of the shock and vibration stress and vibration over a wide frequency range.

Improvement of the comfort on the floor		Gain
Comfort on the floor	Unipodal stability	+18%
	Globale pressure	-38%
		Infra-patellar bursa
	Anterior tibial tuberosity	-50%
	Perceived	+200%

DECREASE OF 38% in the the sum of the pressures on the knees. A better distribution of pressure.



« Our study has shown that GTI® High Traffic Tiles reduce shock and muscular effort while reducing perceived fatigue and improving user comfort, compared to a concrete surface. A significant reduction in the level of muscular activation for the same performance was observed, as well as a limitation of the vibratory behaviour of the muscle at low frequencies, which correspond to the resonance frequencies of human tissue. Thus, GTI® High Traffic Tiles allow for a significant reduction in mechanical stress and should therefore reduce the risk of injury to users.»

Christophe HAUTIER,
Director of the Research Unit of the Interuniversity Laboratory of Biology and Motricity at the Lyon site.

GAIN IN COMFORT BY REDUCING RISKS FOR WELL-BEING AND PRODUCTIVITY:

- Reduction of fatigue
- Improved comfort
- Reduction of shocks
- Improved productivity



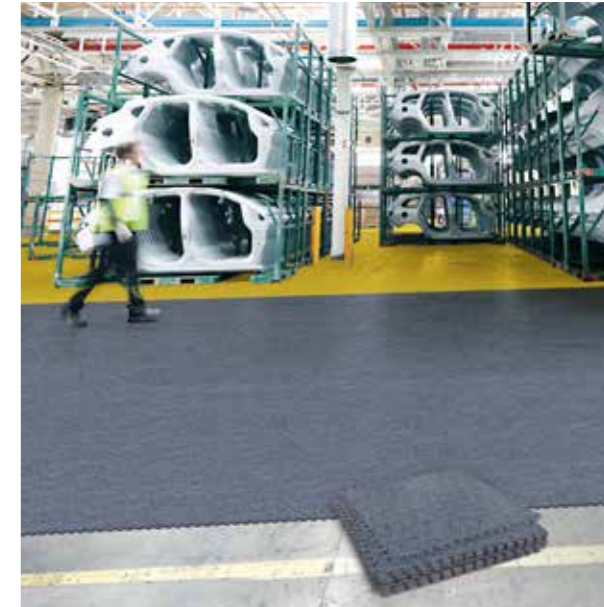
Range GTI®... acoustic comfort

Noise reduction compare to "hard floor":

	Gain
Noise of cart rollers (vs. tiles)	-8dB
Impact on noise pollution	
Impact on the ground	-4dB
Noise of footsteps	-17dB

9 dB ** average reduction in footfall, falling objects and rolling noise:

- **Improve the well-being of employees**
Reducing noise pollution contributes to limiting stress, irritability... as well as improving productivity.
- **Protecting employees**
Reducing noise pollution helps to limit the risk of accidents and hearing problems in the short and long term.



**Comparative study of GTI® tiles vs. ceramic carried out by the GERFLOR technical department, testing protocol available on demand.

Safety by floor zoning

Facilitate the organization of spaces

- **Wide choice of colors**
contribute and facilitate the implementation of a security induced by the marking.
- **Customized security logo**
Allows you to integrate your security protocols.
- **Integrated marking**
Increased resistance over time and adjustable with your organizations.

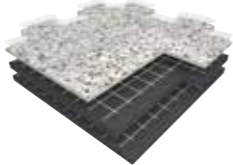


High Traffic GTI® by Gerflor

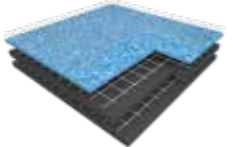
A complete range of solutions

- **Connect version: "plug and play" assembly**
Allows for quick implementation.
- **Free standing**
Allows installations in occupied areas and localized maintenance.
- **Cleantech versions (hot welded joints)**
Compatible with controlled environments.
- **Patented surface treatment**
High resistance to chemical and mechanical aggression, improved durability.
Compatible with cleaning and decontamination protocols.

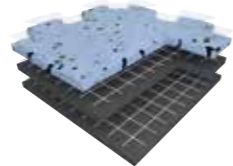
AVAILABLE VERSIONS



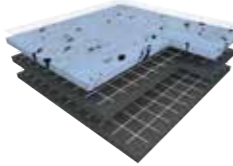
GTI® Max Connect



GTI® Max Cleantech Watertight solution

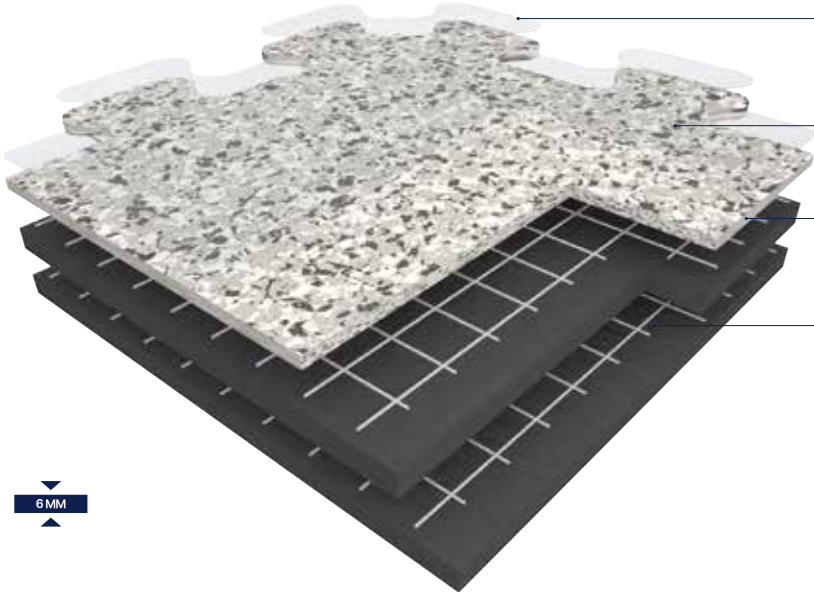


GTI® EL5 Connect ESD solution



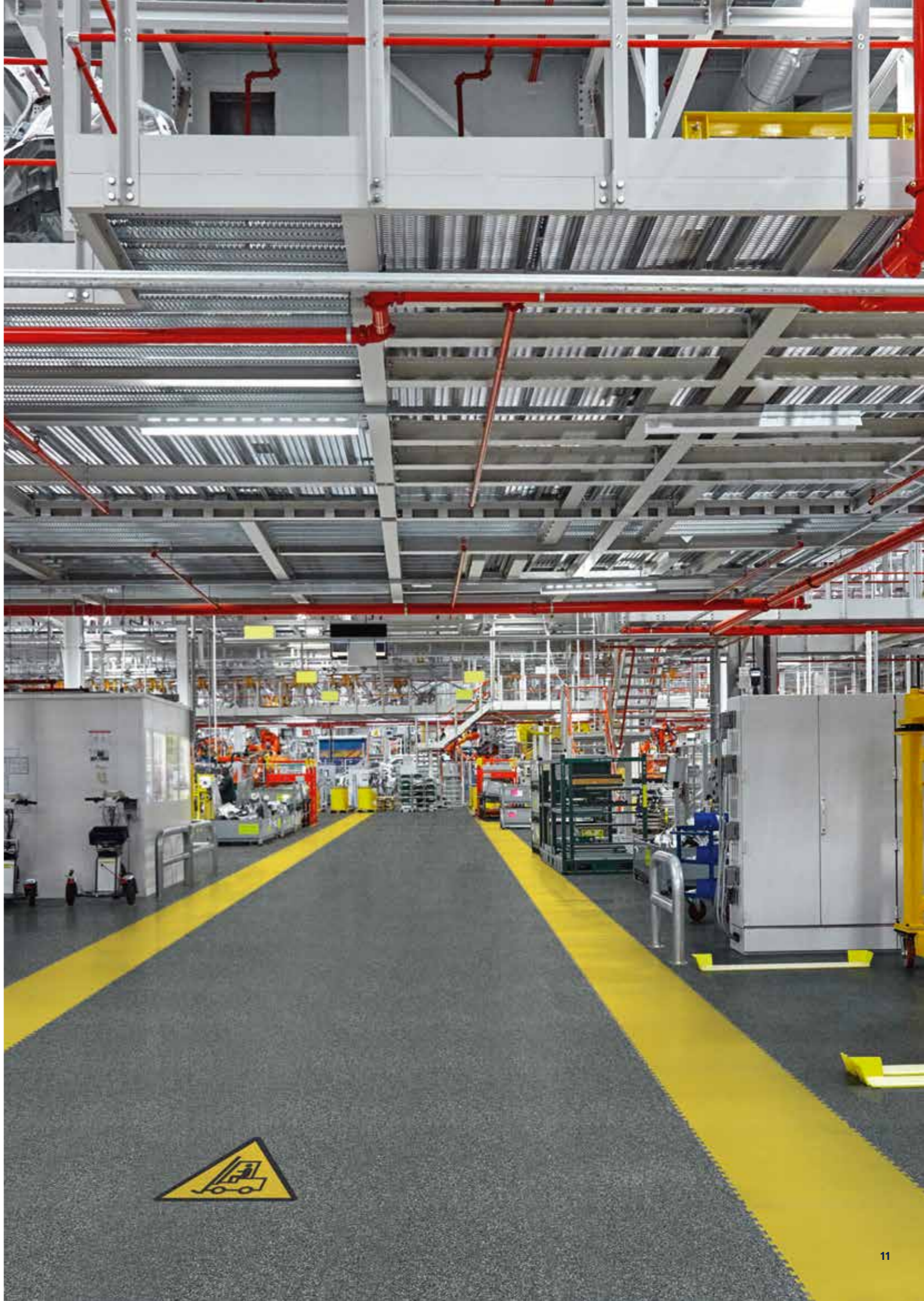
GTI® EL5 Cleantech Watertight and ESD solutions

GTI® MAX CONNECT



- Dovetail assembly
- Patented surface treatment
- 2mm wear layer
- Double reinforced fiberglass

6 MM





we care / we act Our commitments for a sustainable future


CARBON FOOTPRINT*
-20 % kg
CO₂ equivalent/m²
between 2020 and 2025


BIOSOURCED CONTENT**
10 % by 2025


RECYCLED CONTENT
30 % by 2025


ADHESIVE FREE***
35 % by 2025


ANNUAL VOLUME RECYCLED
60 000 t by 2025



* Scopes 1 and 2 defined in the GHG protocol ** % of activity with biosourced materials *** % of activity - adhesive free solution