HOW BRIDGESTONE INNOVATIVE TYRE TECHNOLOGY SUPPORTS FUTURE MOBILITY

ÖAMTC Symposium Vienna, 10 October 2017

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THE AUTOMOTIVE INDUSTRY:

CHALLENGED BY FAST TRANSFORMATIONS & BOUND BY NEW REGULATIONS!

FUTURE VEHICLE CONCEPTS

- EVs-FCVs
- Autonomous Driving
- Connectivity

SHARING & MOBILITY ON DEMAND

- Fleet ownership
- “Coach on wheels” vs “Driving dynamic”

ADVANCED MOBILITY SOLUTIONS

- Robot taxi
- Freight / Person rapid transit

FUTURE SOLUTIONS DRIVEN BY **NEW DEMANDS IN SOCIETY**

TRADITIONAL VEHICLES

- SUV / CUV
- Platform vehicles
- Global vehicles

PRODUCT LIFE TIME

- Customization
- Reduced Development cycle
- Model expansion

EU & WW REGULATIONS

- Environment
- Noise

TODAYS CHALLENGES

MULTIPLE TRENDS HAPPEN ALL AT THE SAME TIME. THE AUTOMOTIVE INDUSTRY NEEDS TO MANAGE

PARTNERSHIPS WILL REINFORCE THE APPROACH AND CAN MAKE THE DIFFERENCE!

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THE TRENDS IN THE AUTO INDUSTRY

PRODUCT LIFE TIME
- Customization
- Reduced Development Cycle

TRADITIONAL VEHICLES
- SUV / CUV
- Platform vehicles
- Global vehicles

FUTURE VEHICLE CONCEPTS
- Electrified
- Autonomous
- Connected

SHARING & MOBILITY ON DEMAND
- Fleet ownership
- “Coach on wheels” vs “Driving dynamics

ADVANCED MOBILITY SOLUTIONS
- Robot taxi
- Freight/Grp Person rapid transit

EU & WW REGULATIONS
- Environment
- Noise

… ARE DRIVING FOCUS ON…

- CO_2
- WEIGHT
- SAFETY
- COMFORT/NOISE
- BIG DATA
- DRIVING RANGE
- TCO

… WHICH IMPACTS DIRECTLY TYRE REQUIREMENTS

WHICH TYRE TRENDS ?	→	WHY ?
LOWER RRC		EMISSIONS & RANGE
LIGHTER TYRES		EMISSION & DRIVING DYNAMIC
LESS NOISE (INSIDE & PBN)		THE RISING TREND!
MINIMUM DRY AND WET GRIP		NO COMPROMISE!
CONFLICTING WEAR TRENDS		ACCEPTABLE LEVELS & TCO
BIGGER TYRES		CAR DESIGN & TECH BENEFITS
COMFORT & DRIVING DYNAMICS		AN EVOLVING BALANCE
TYRE IDENTIFICATION & SENSORS		AN ENABLER TO BIG DATA
MOBILITY SOLUTIONS		A RENEWED INTEREST THANKS TO EV & AUTONOMOUS VEHICLE
LOWER TYRE & DVPT COSTS		GLOBAL, PROLIFERATION, & SHORTER LIFE

THE TYRE IS A KEY ELEMENT FOR THE CAR, TODAY AND IN THE FUTURE

SUSTAINABILITY, THE BRIDGESTONE R&D WAY

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ILWT
INNOVATIVE LIGHT WEIGHT TECHNOLOGY

RFT
RUN FLAT TYRES

VALUE NATURAL RESOURCES

CUSTOMER VALUES
SAFETY
PEACE OF MIND

SOCIAL VALUES
BETTER USE OF RESOURCES

ECOPIA ologiC

REDUCE CO_2 EMISSIONS

CUSTOMER VALUES
ECONOMY
SAFE AND SECURE

SOCIAL VALUES
REDUCE CO_2 EMISSIONS

	MID-TERM TARGET **2020**	LONG-TERM VISION **2050 and beyond**
IN HARMONIE WITH NATURE	Promote ecological conservation and restoration[1)]	In balance with nature (contribution > footprint)
VALUE NATURAL RESOURCES	Resource productivity improvement	Towards 100% sustainable materials
REDUCE CO_2 EMISSIONS	Reduce emissions across products life cycle[2)]	Contribute to globally agreed target (over 50% reduction)

→ **SUSTAINABLE SOCIETY**

Bridgestone Group's Environmental Mission

To help ensure a healthy environment for current and future generations.

[1)] **Water intake reduction target** (baseline: 2005)
35% reduction per unit at manufacturing sites

[2)] **CO_2 Reduction Target** (baseline: 2005)
- 35% reduction in CO2 per sales from the company's total operations and its products "after-use"
- improving tyre rolling efficiency by 25% (the potential improvement in the customers fuel efficiency exceeds all other emissions in the products life cycle.)

BRIDGESTONE INNOVATIONS CREATE COMMON SOCIAL AND CUSTOMER VALUE

→ REDUCTION OF CO_2 EMISSIONS / INCREASE OF EVS RANGE / BEST VALUE OF NATURAL RESOURCES

VEHICLES	AUTOMOTIVE NEEDS	SOLUTION BRIDGESTONE CAN OFFER	BRIDGESTONE TECHNOLOGY			
			Innovative light weight technology	Ologic	RFT	Acoustic Sponge
Conventional & EV vehicles Autonomous vehicles	CO_2 emissions Driving range	Low Rolling Resistance	✓	✓	No spare tyre ✓	
	Sustainable Program	Contribution on sustainability	Weight reduction CO_2 reduction ✓	CO_2 reduction ✓	No spare tyre CO_2 reduction ✓	
	Space for battery	Space Saving			✓	
	Operation Excellence	Puncture Solution			✓	
	Acoustic	Sponge				✓

BRIDGESTONE KEEPS INVESTING IN INNOVATIVE CORE TECHNOLOGIES FOR FUTURE VEHICLE PROGRAMS

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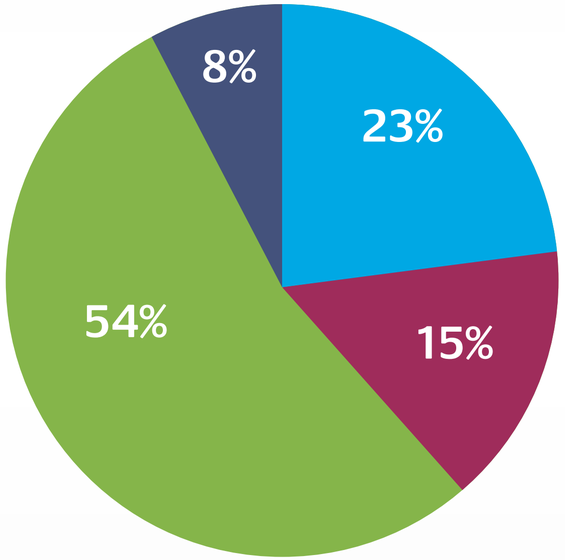
FUEL CONSUMPTION FACTORS

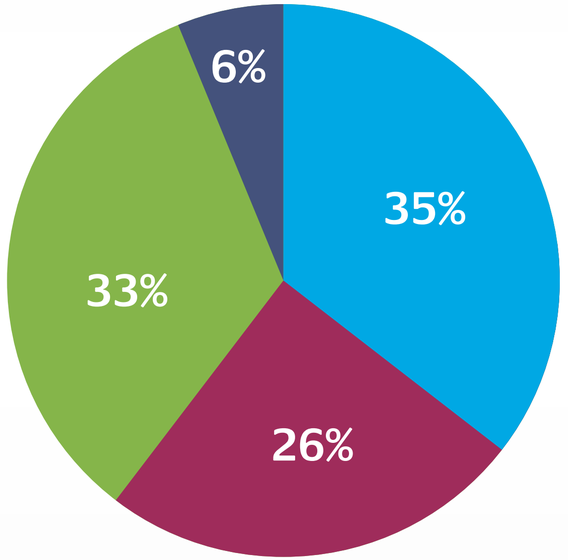
DESPITE SOME DIFFERENCE BETWEEN THE TWO MODES (DUE TO THE NATURE OF THEIR TESTING), ROLLING AIR RESISTANCES ARE COMPARATIVELY LARGE IN TOTAL.

- OTHERS
- TYRE ROLLING RESISTANCE
- VEHICLE AIR RESISTANCE
- VEHICLE ECCELERATION RESISTANCE

JC08 MODE [1)]



NEDC MODE [2)]



[1)] JC08: Measuring method in Japan
[2)] NEDC: Measuring method in EU

WHERE CONVENTIONAL APPROACHES FOCUSED MAINLY ON THE REDUCTION OF ROLLING RESISTANCE, THE “OLOGIC TECHNOLOGY” SUPPORTS DECREASE IN VEHICLE AIR RESISTANCE WHILE SUBSTANTIALLY REDUCING ROLLING RESISTANCE AT THE SAME TIME.

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NEXT GENERATION TYRE WITH ECOLOGY IN MIND AND OPTIMAL LOGIC IN DESIGN

SUPER-LOW ROLLING RESISTANCE | **DECREASED AIR RESISTANCE**

Ecology in mind eco

Optimal Logic in design logic

ecologic

Next generation tyre with ecology in mind and optimal logic in design

OLOGIC TYRE VS. CONVENTIONAL TYRE STRUCTURE

- Narrower in width
- Large in diameter
- Higher in pressure

UNIQUENESS OF OLOGIC TECHNOLOGY

Uniqueness of Ologic technology	
Unique Structure	• Lighter weight • Less rolling resistance
Unique Tread Pattern	• Improved hydroplaning performance • Optimal stiffness
Unique Tread Rubber	• Improved WET grip performance

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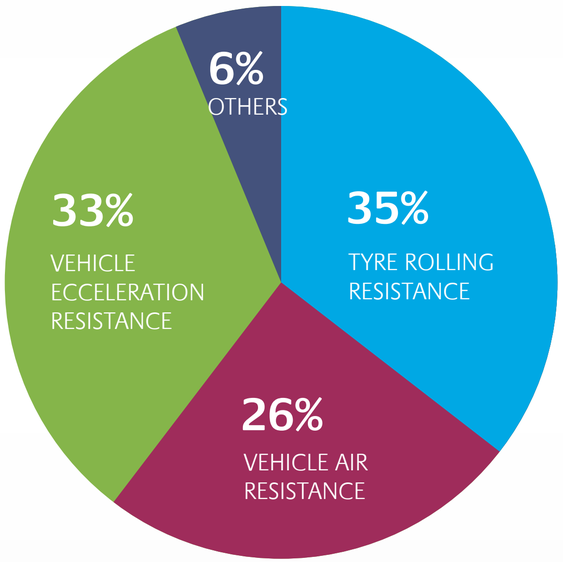
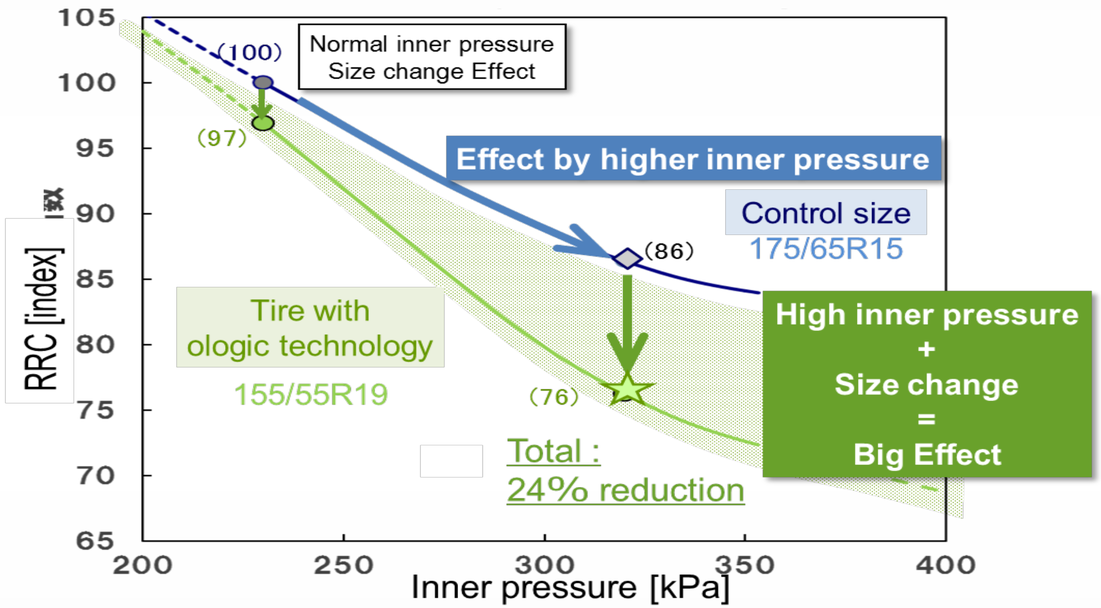
FUEL CONSUMPTION FACTORS

NEDC MODE [2)]



RRC REDUCTION EFFECT BY SIZE AND IP CHANGE



OLOGIC TECHNOLOGY ACHIEVES **ULTRA-LOW RRC** BY **SYNERGY OF HIGH IP AND TYRE SIZE CHANGE.**
(IF APPLYING HIGHER IP, ROLLING RESISTANCE COEFFICIENT REDUCTION THROUGH TYRE SIZE CHANGE IS MUCH BIGGER THAN WITH NORMAL IP CONDITION)

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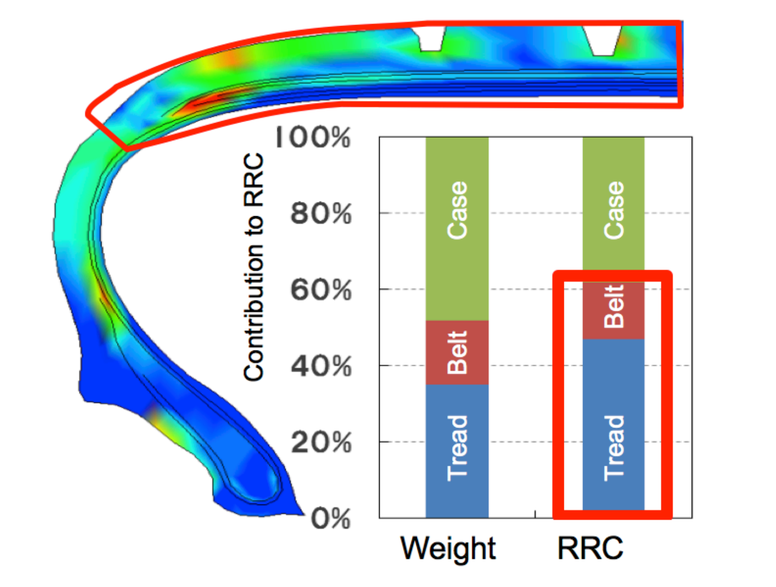
RRC CONTRIBUTION ANALYSIS BY TYRE PART

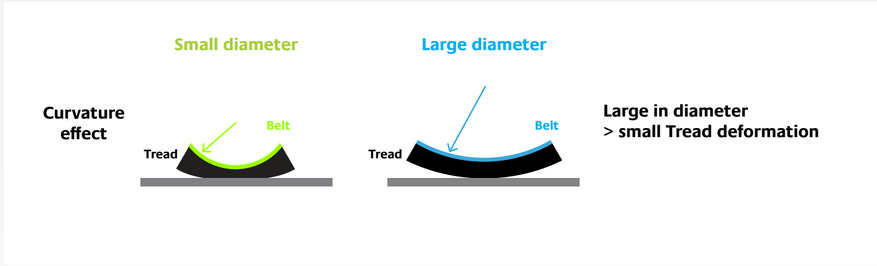
(FEA analysis)

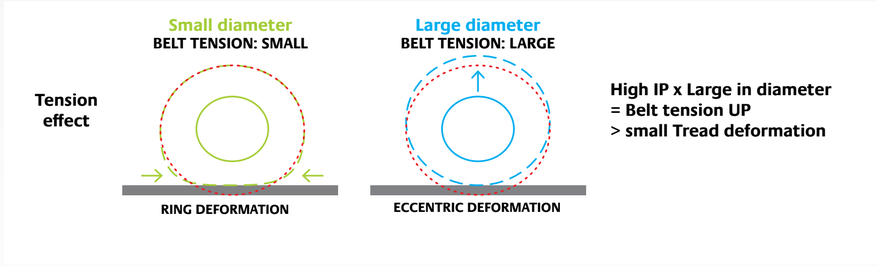


Tread area (incl. Belt) strongly contributes to RRC

MECHANISM OF RRC REDUCTION FOR OLOGIC

RCC = Material Loss x Volume x deformation





LOW RRC ACHIEVED THROUGH COMBINED EFFECT OF **LARGE DIAMETER AND HIGH IP** BY CONTROLLING TREAD DEFORMATION.

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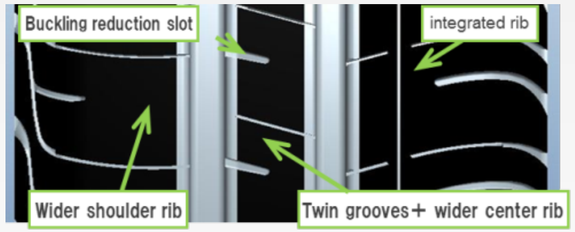
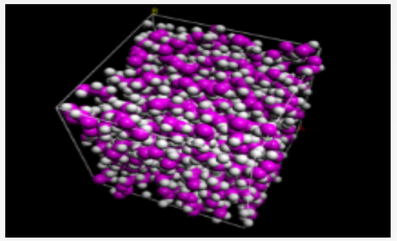
UNIQUE PATTERN OF OLOGIC TECHNOLOGY



Making full use of LNC's contact patch dynamics

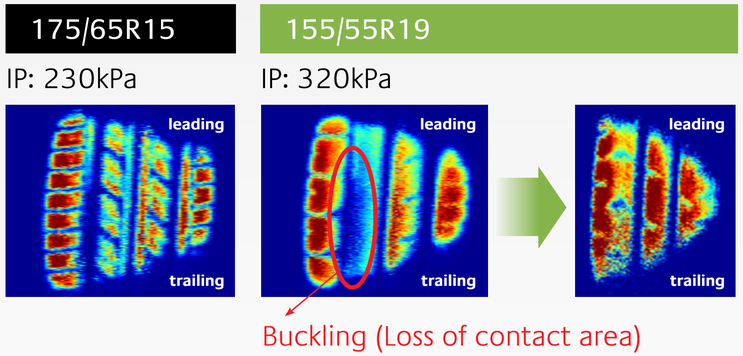
- Effective drainage
- High stiffness pattern

UNIQUE TREAD COMPOUND OF OLOGIC TECHNOLOGY



Optimized rubber material properties maximizing LNC's RRC-m supremacy (Polymer molecular distribution control tech.)

FOOTPRINT OPTIMIZATION



HIGHER WET GRIP IS SECURED WHILE FIRMLY KEEPING THE ULTRA-LOW RRC CHARACTERISTICS
BY USING **UNIQUE TREAD COMPOUND**
IMPROVED CORNERING POWER BY DEVELOPING A **DEDICATED PATTERN** FOR THE NARROW WIDTH

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RFT

RUN-FLAT TYRE FEATURES

- After a puncture, a RFT tyre allows to continue driving thanks to **reinforced rubber on the inside of the sidewall**
- A RFT tyre allows you to drive at **zero pressure** at a speed of **max. 80km/h for a distance of 80km**

BASIC PRINCIPLE OF A RUN-FLAT TYRE

RFT CONTRIBUTION TO "MOBILITY"

SAFETY DRIVING & SAFETY STOP

Even with a flat tyre, you can **drive safely** up to 80 km at a speed up to 80 km/h and **stop safely**

UNNECESSARY TO STOP & RESPOND ON A ROAD

You can continue to **drive** a safe location (e.g. tyre dealer) **without changing** your tyre on the road

ENVIRONMENTAL

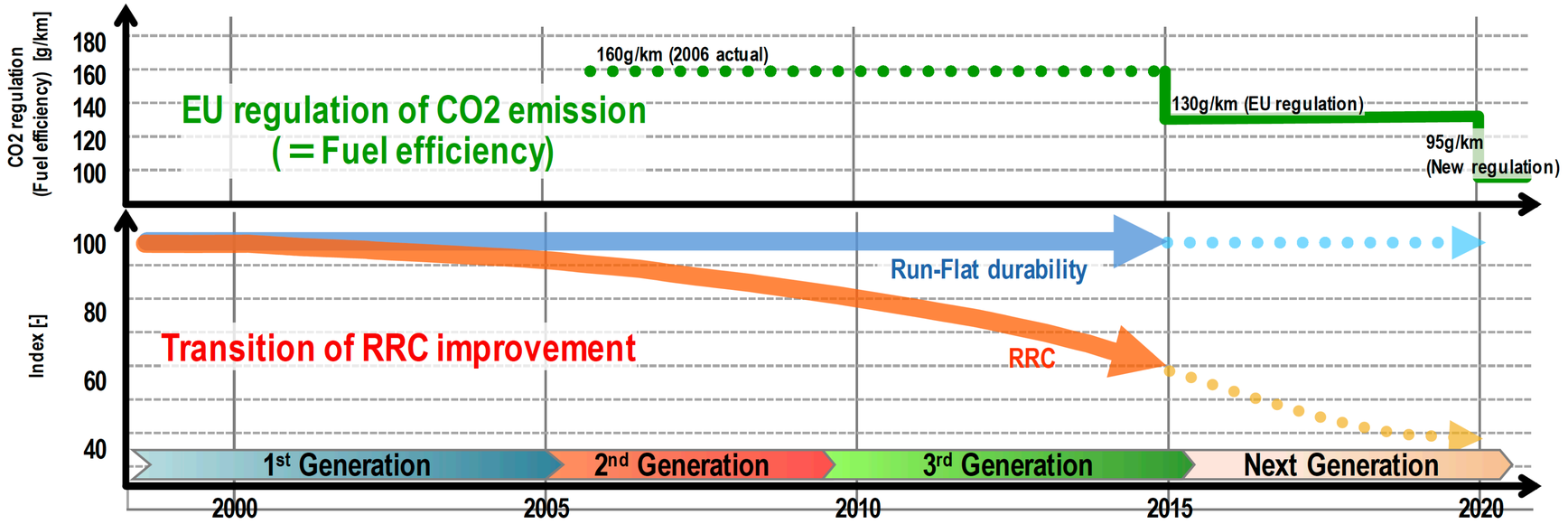
You no longer need a spare tyre/wheel. This saves a big amount of materials

CAR DESIGN FLEXIBILITY

RFT offers more flexibility in car design: **wider trunk space, e.g. for batteries**

FUTURE MOBILITY: RFT CAN BE A BIG ASSET FOR AUTONOMOUS DRIVING, SUPPORTING IN AN AIR LOSS EMERGENCY SITUATION

ROADMAP (CO_2 REGULATION / RRC / RUN-FLAT DURABILITY)



Evolution of Run-Flat technology					
	1st Generation	2nd Generation	3rd Generation	Next Generation	
New carcass material				NEW	In development
Sidewall reinforcement rubber	Reduction of heat generation Focus on stiffness	Reduction of heat generation	Softening / Low heat generation	NEW	

BRIDGESTONE ACHIEVED RRC IMPROVEMENT KEEPING RUN-FLAT DURABILITY
WITH NEW SPECIFIC TECHNOLOGIES

RFT

TREAD COMPOUND

Cap and Base:

- Mixing technology
- Raw materials

BELT PACKAGE

Tread Ply material:

- Fabric (thinner / lighter)
- Skim (lower hysteresis)

Cap Ply material:

- Fabric (thinner / lighter)
- Skim (lower hysteresis)

COMMON FOR STD AND RFT

DEDICATE TO RFT

CARCASS CONSTRUCTION

Body Ply material:

- Fabric (stiffer)
- Skim (lower hysteresis)

Body Ply layout (simplified)

Bead reinforcement:

- Material (lower hysteresis)
- Volume (lower)

Innerliner:

- Layout

Sidewall gauge (lower)

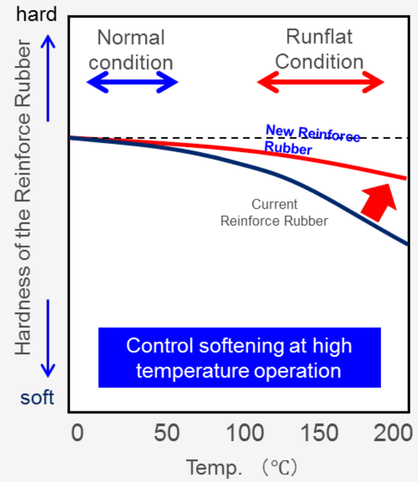
MOLD DESIGN

Cavity profile:

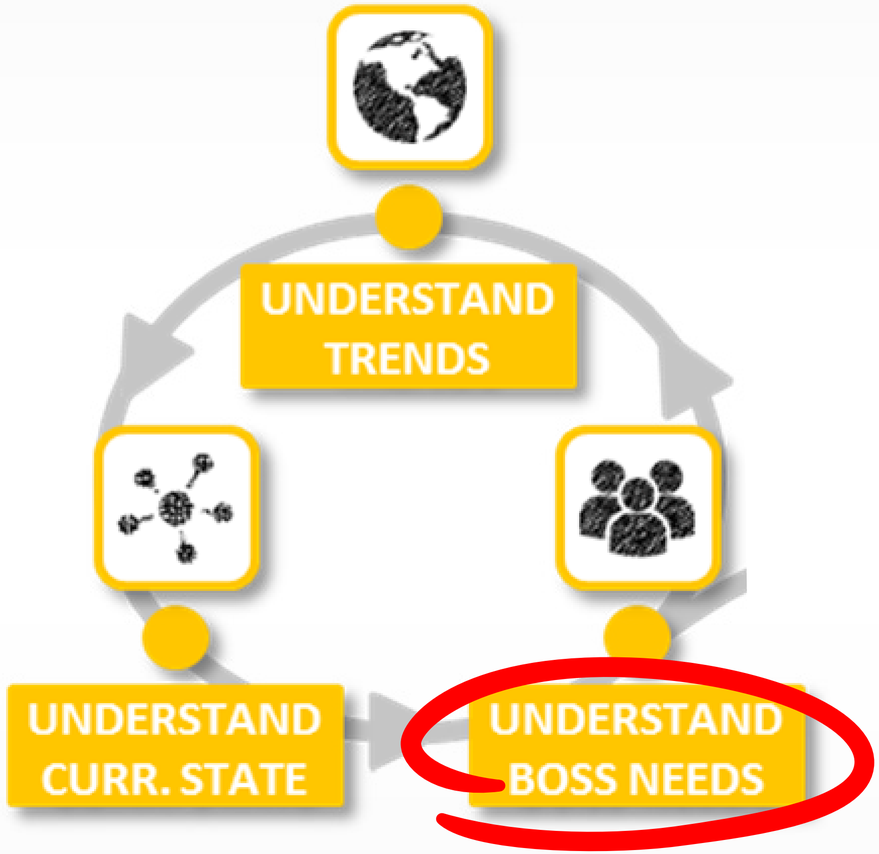
- Optimized strain control through FEM simulation

REINFORCE RUBBER

New generation



DRIVEGUARD | INNOVATION FOR THE "BOSS"



«BOSS» IS ASKING FOR "SAFETY" AND "MOBILITY" WHEN GETTING A PUNCTURE
BRIDGESTONE IS PROVIDING INNOVATIVE SOLUTION

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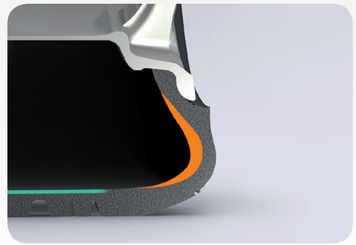
WET CONTROL
due to

+

COMFORT
due to



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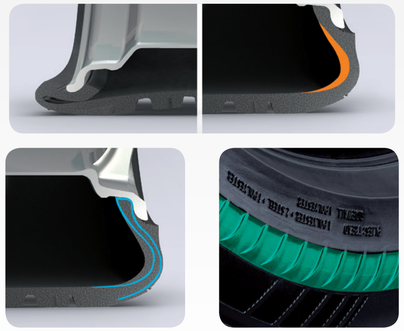
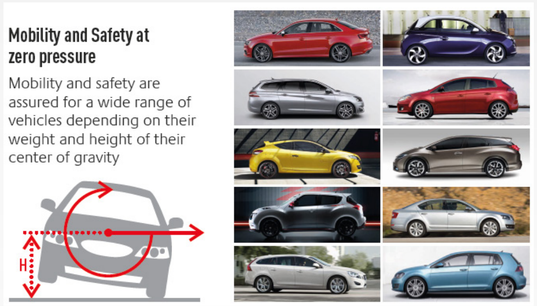
MOBILITY
due to



FOR ALL CARS



THANKS TO

1) SPECIAL POLYESTER PLY [Comfort, Weight, Durability]
2) TUNED PATTERN DESIGN [Wet/Wear performance balance]
3) NEW CAP COMPOUND [Wet performance]

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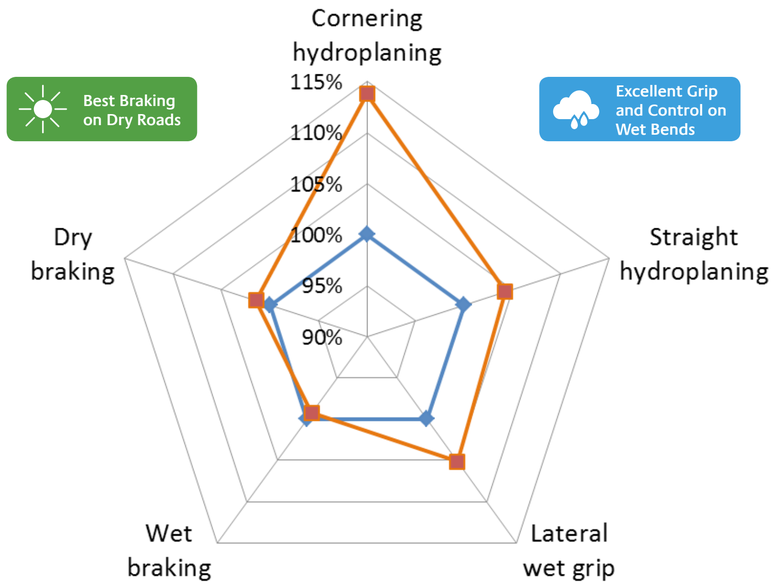
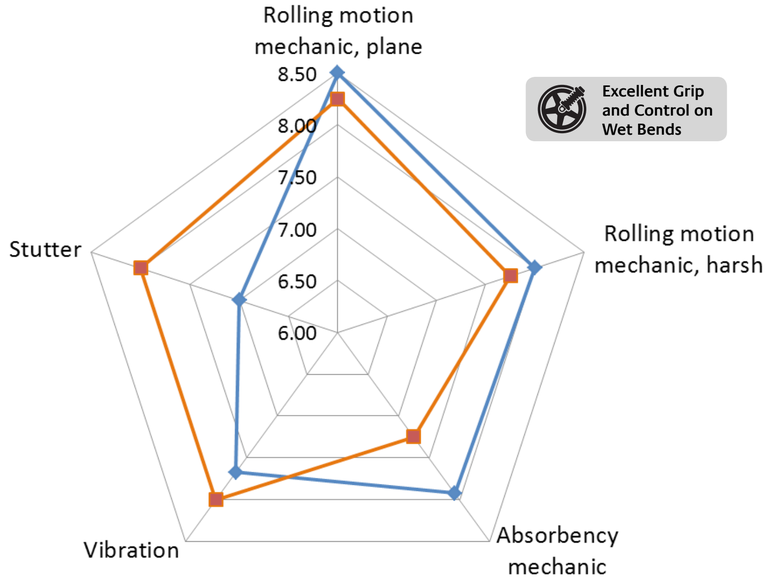
EVALUATED TÜV SÜD, DRIVEGUARD DEMONSTRATES THAT IT RANKS HIGHLY IN PERFORMANCE CATERGORIES THAT ARE IMPORTANT





AVG premiums conventional competitors

DRIVEGUARD

CONCLUSION

- BRIDGESTONE IS CONSISTENTLY WORKING TO MEET AND EXCEED THE FUTURE AUTOMOTIVE MARKET REQUIREMENTS WITH **SUSTAINABLE PRODUCTS AND TECHNOLOGIES**
- NEW BRIDGESTONE TECHNOLOGIES OFFER **CUSTOMER VALUES** AS WELL AS **SOCIAL VALUES**
- BRIDGESTONE **OLOGIC TECHNOLOGY** COMBINES A LARGER AND NARROWER TYRE SIZE WITH HIGHER INFLATION PRESSURE TO **IMPROVE ROLLING RESISTANCE**
- RUN FLAT TECHNOLOGY DEVELOPS CONTINUOUSLY TO COMBINE SAFETY WITH ENVIRONMENTAL SUPPORT, **MATCHING TODAY'S AND FUTURE NEEDS**

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THANK YOU
FOR YOUR ATTENTION!

DO YOU HAVE
ANY QUESTIONS?