

# Potential analysis of a semi-active anti-roll bar based on MR technology

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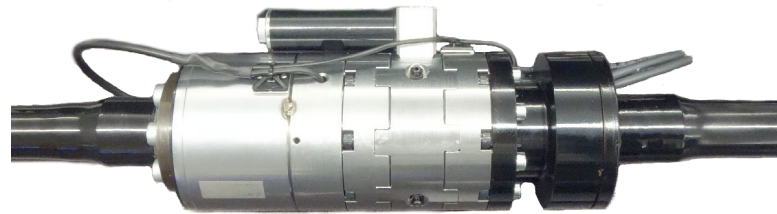
# Different technologies of anti-roll bars

There are three different solutions of implementing anti-roll bars

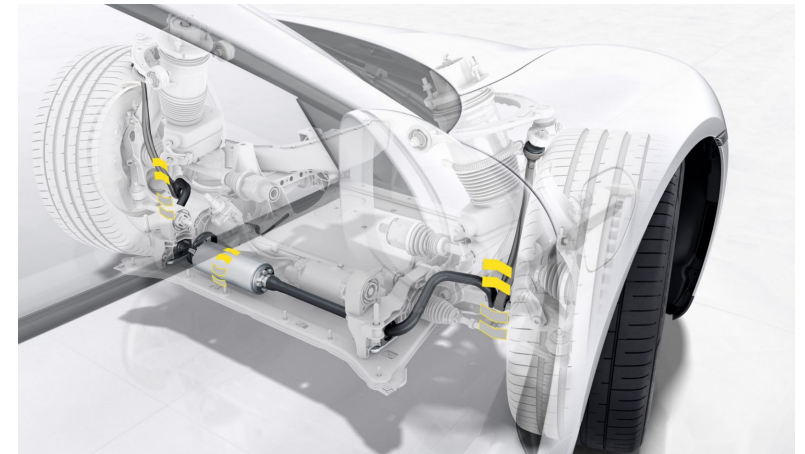


Source: <https://www.audi-mediacenter.com/de/audi-technik-lexikon-7180/fahrwerk-7185>

Passive system



Semi-active system



Source: <https://newsroom.porsche.com/de/produkte/taycan/fahrwerk-18537.html>

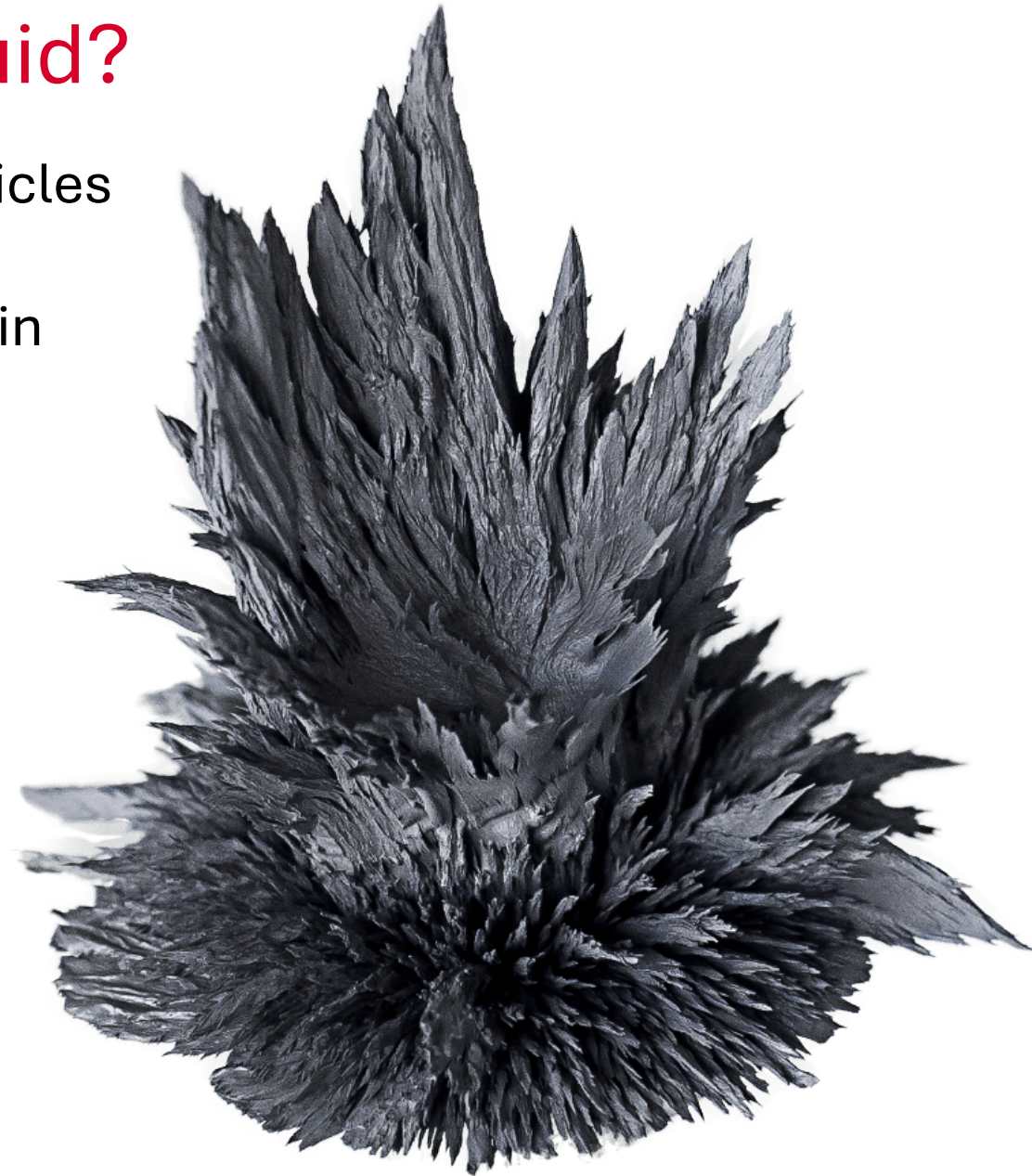
Active system

# Pros and cons of the different solutions

Passive system	Semi-active system	Active system
PROs		
<ul style="list-style-type: none"><li>• Minimal weight</li><li>• Compact design</li><li>• Low cost</li><li>• Simple design</li></ul>	<ul style="list-style-type: none"><li>• Increased driving comfort</li><li>• Improved vehicle dynamics</li><li>• Low power consumption</li><li>• Medium cost intensive</li></ul>	<ul style="list-style-type: none"><li>• Increased driving comfort</li><li>• Improved vehicle dynamics</li><li>• Advanced driving functions</li></ul>
CONs		
<ul style="list-style-type: none"><li>• Limited comfort potential</li><li>• Not adjustable</li></ul>	<ul style="list-style-type: none"><li>• No active torque</li><li>• Technology not proven</li></ul>	<ul style="list-style-type: none"><li>• Power consumption</li><li>• Design space</li><li>• Cost intensive</li></ul>

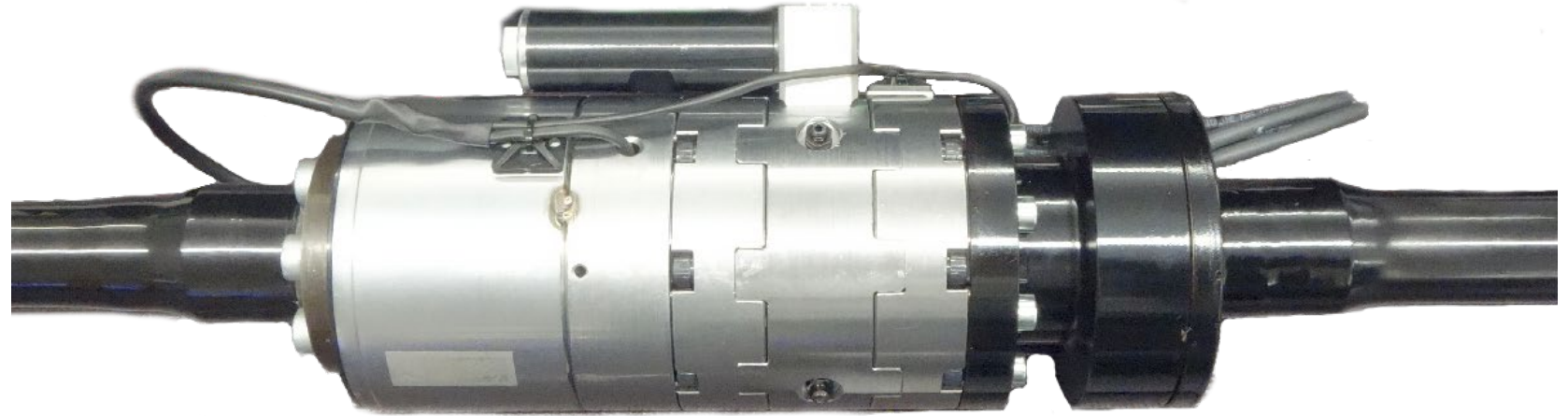
# What is a magnetorheological fluid?

- Mixture of a base oil and magnetizing iron particles
- Building a chain formation in a magnetic field
- The higher the applied field, the bigger the chain formation



# Semi-active system by Inventus

- Cut anti-roll bar
- Idle state without current applied
- Fail-safe design
- Consists of:
  - Actuator unit containing the MRF
  - Planetary gearbox
  - Rotary encoder
  - Controller unit





# Test vehicle setup

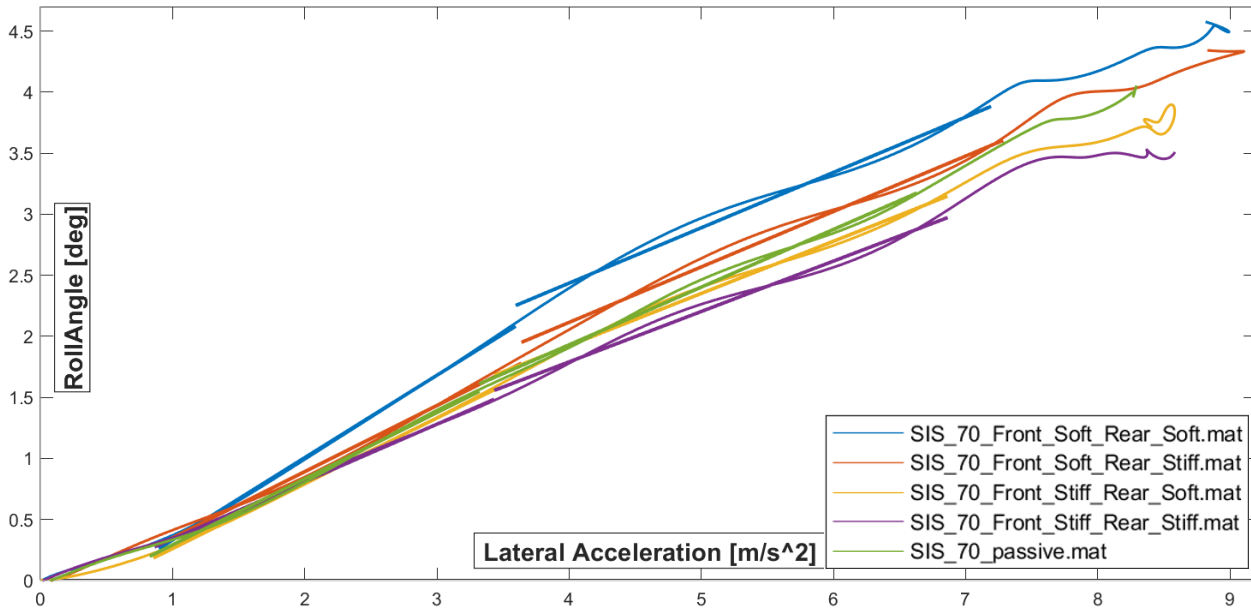




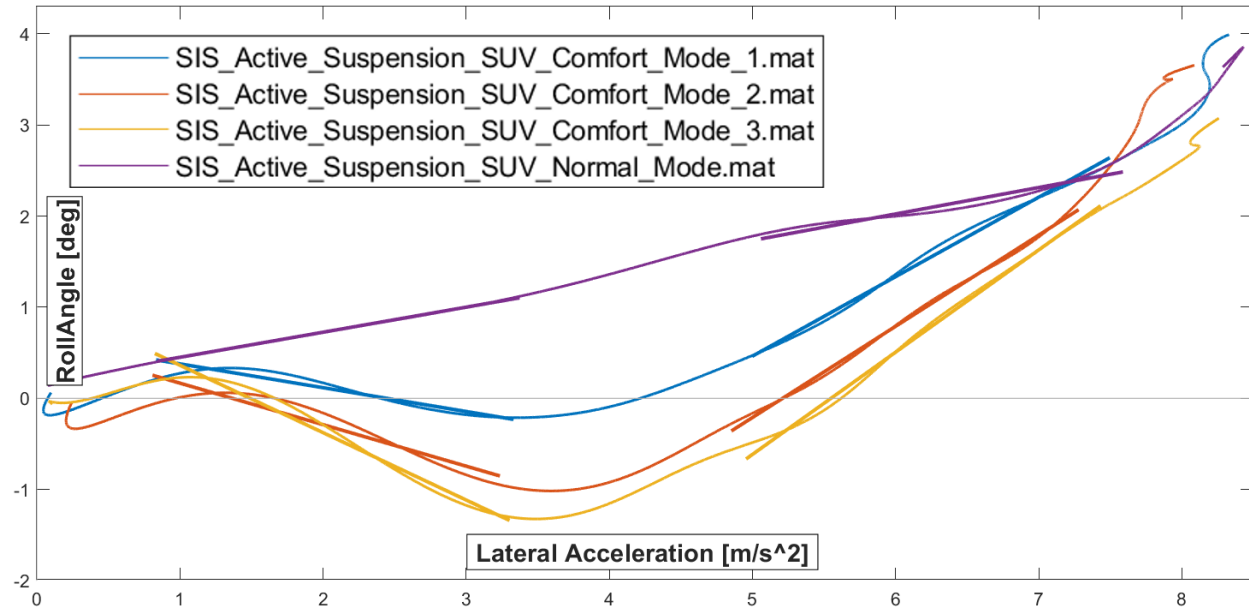
# Test vehicle setup



# Transition test - ISO 13674-2:2016



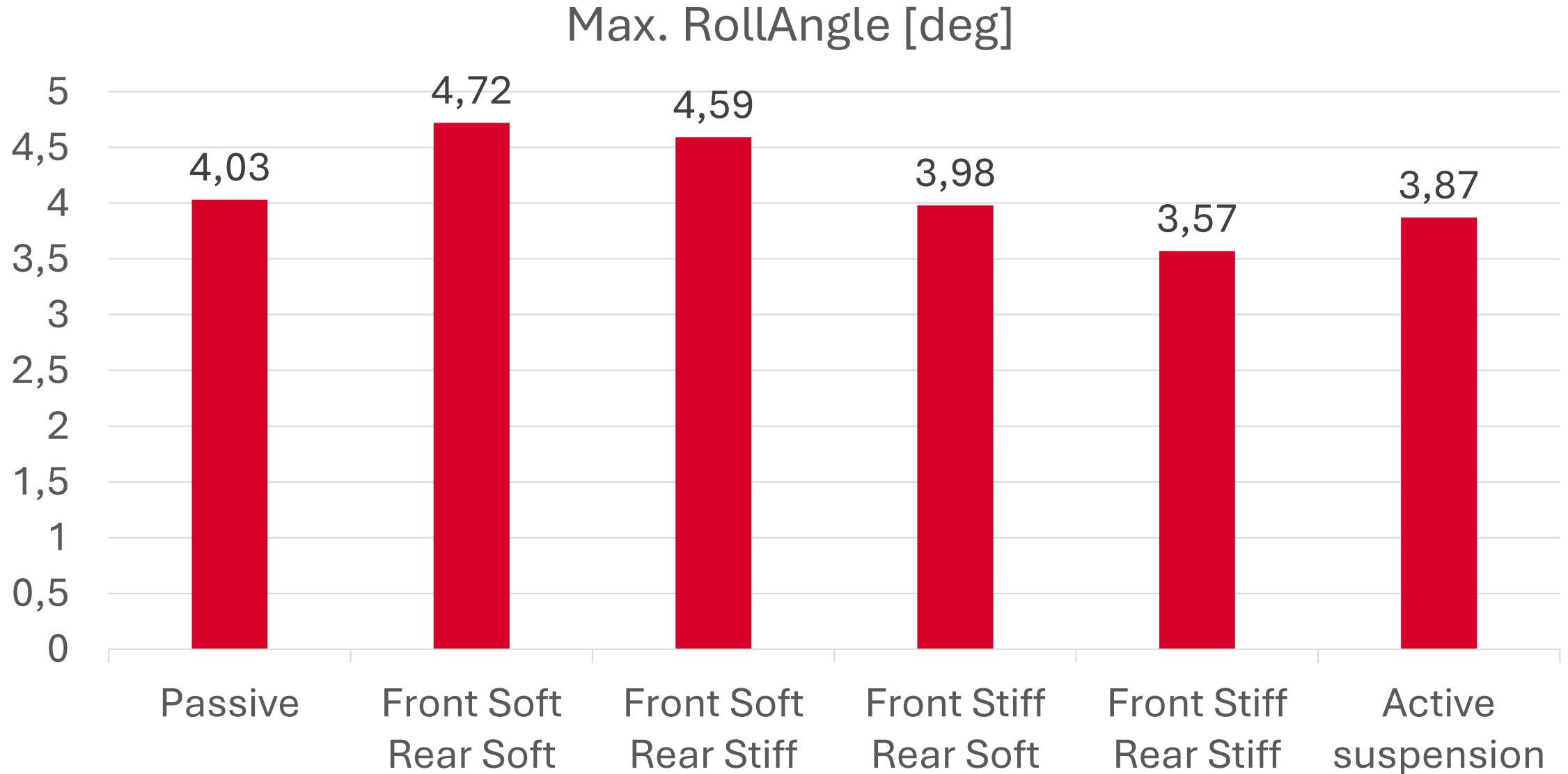
BMW X6 with passive and semi-active system



Reference SUV with active suspension

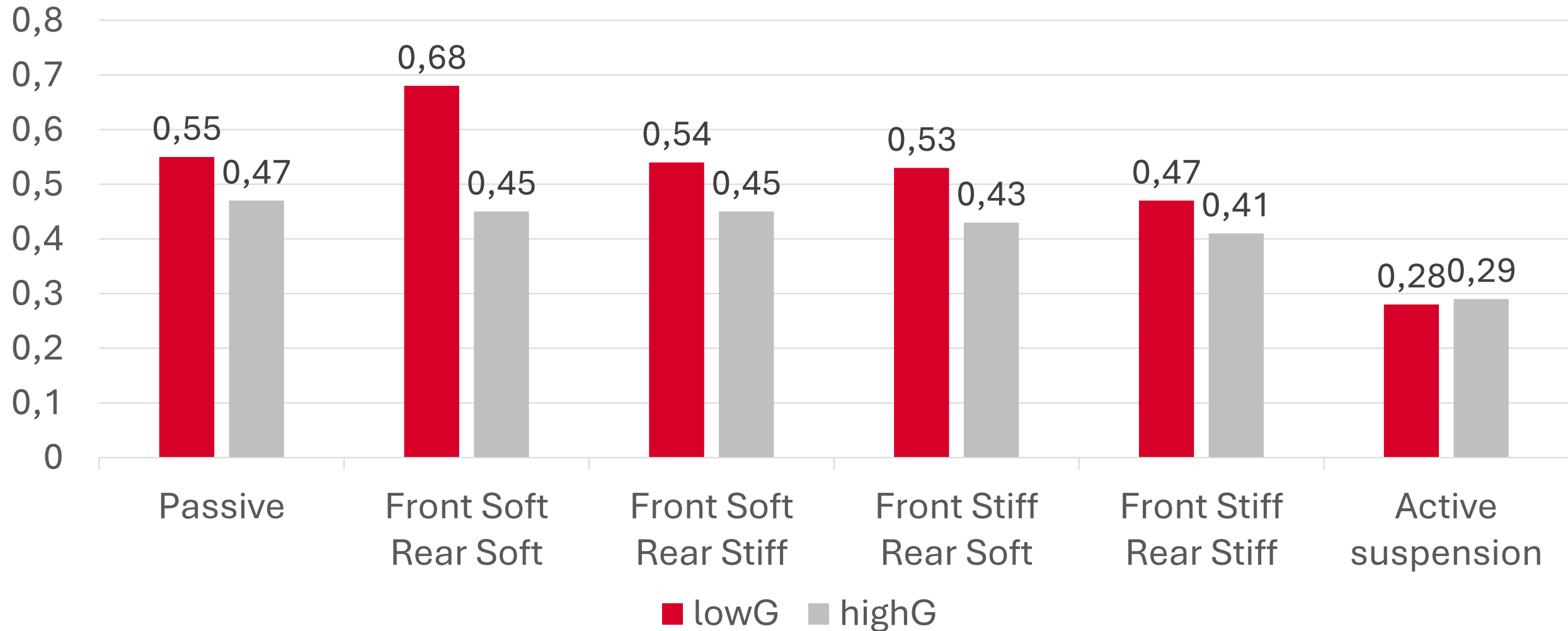


# Transition test - ISO 13674-2:2016

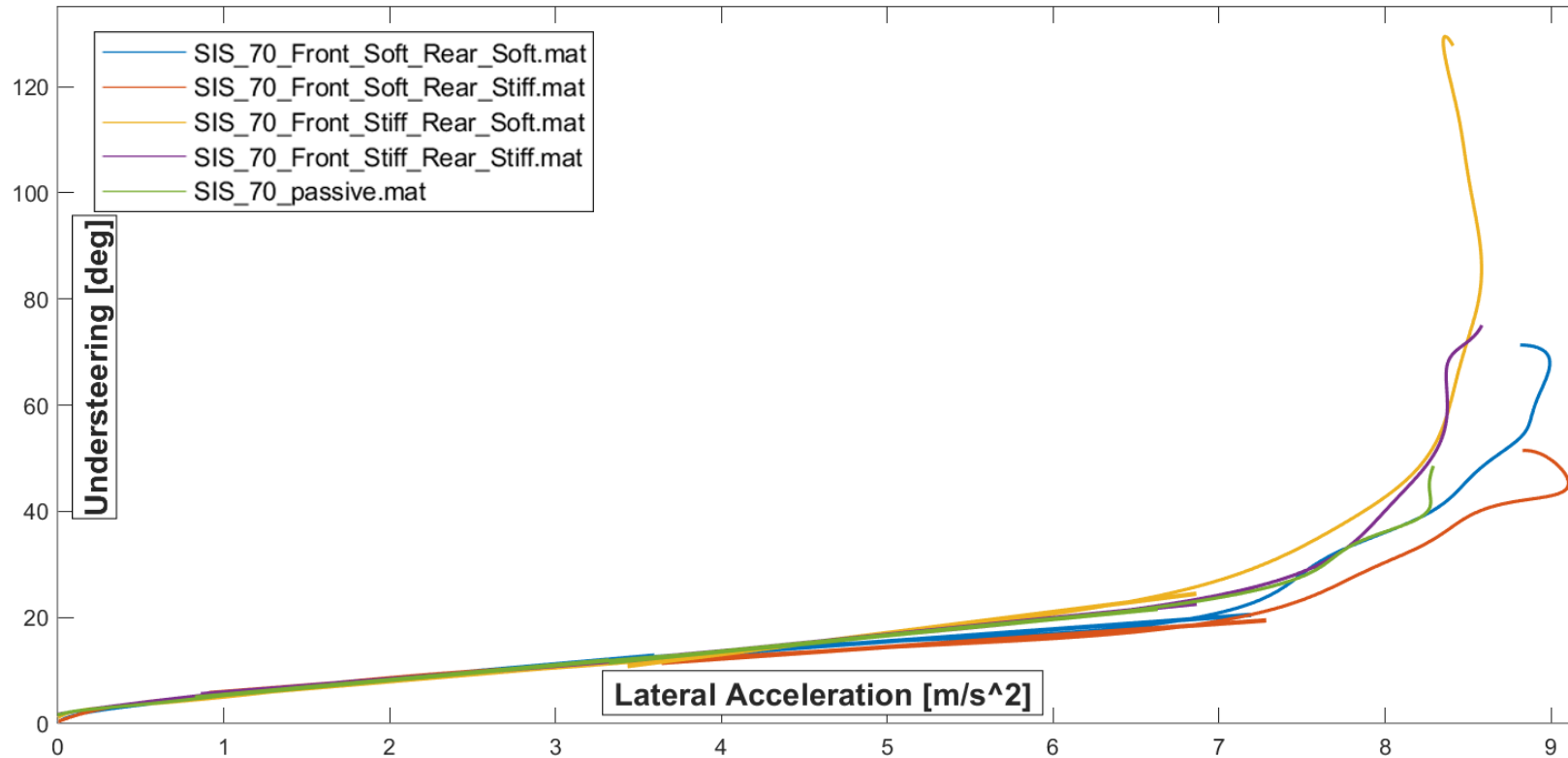


# Transition test - ISO 13674-2:2016

RollAngle Gradient [ $deg/(m/s^2)$ ]



# Transition test - ISO 13674-2:2016

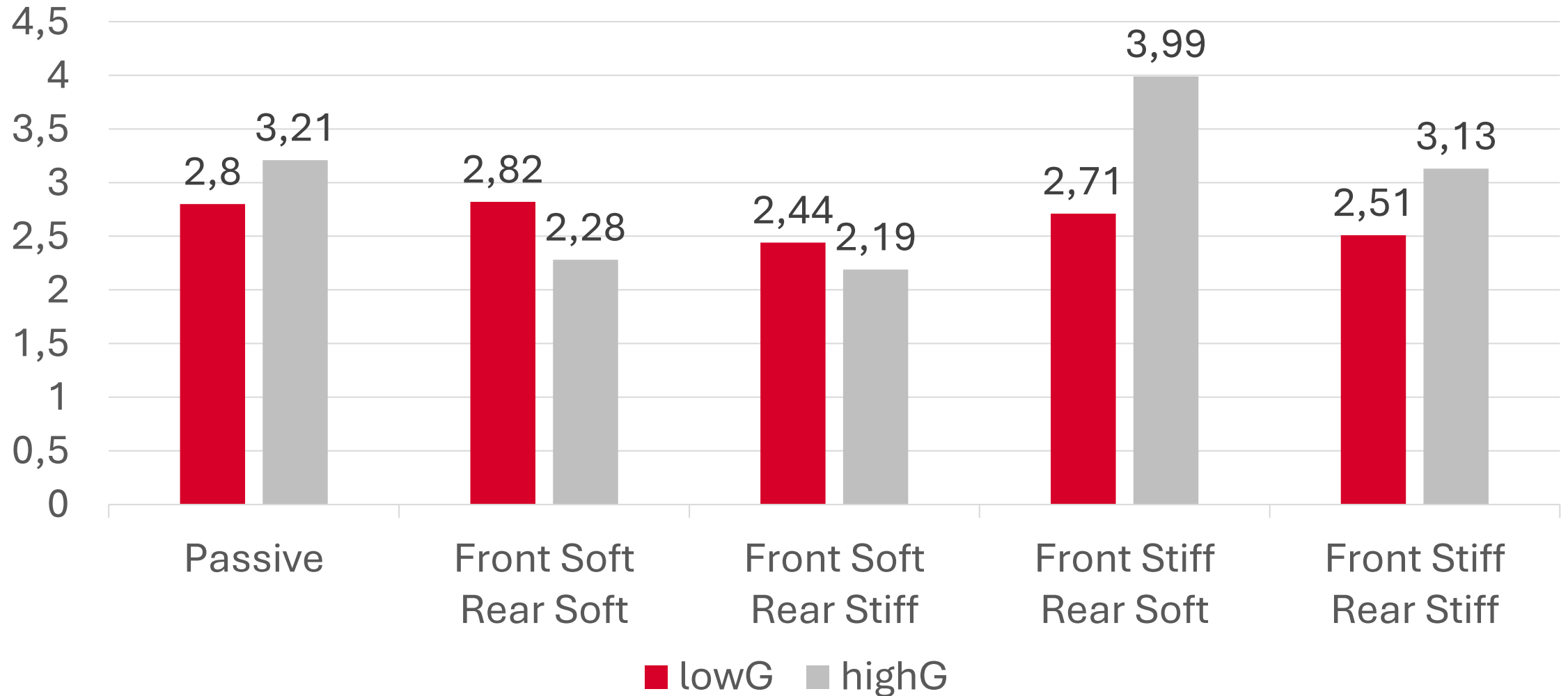


BMW X6 with passive and semi-active system

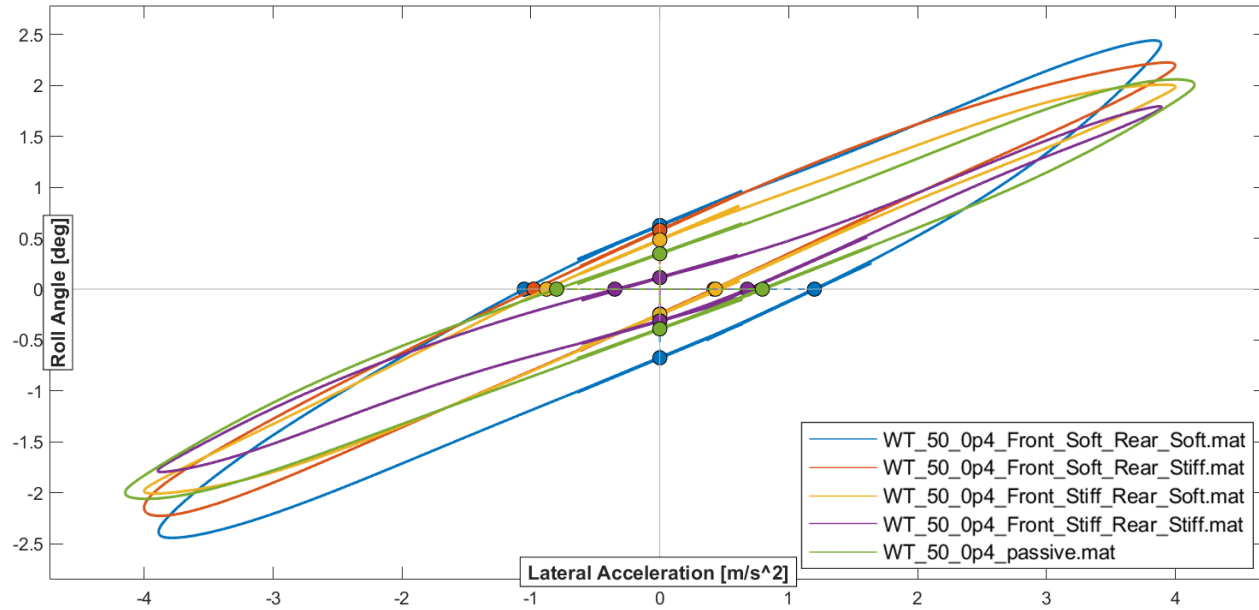


# Transition test - ISO 13674-2:2016

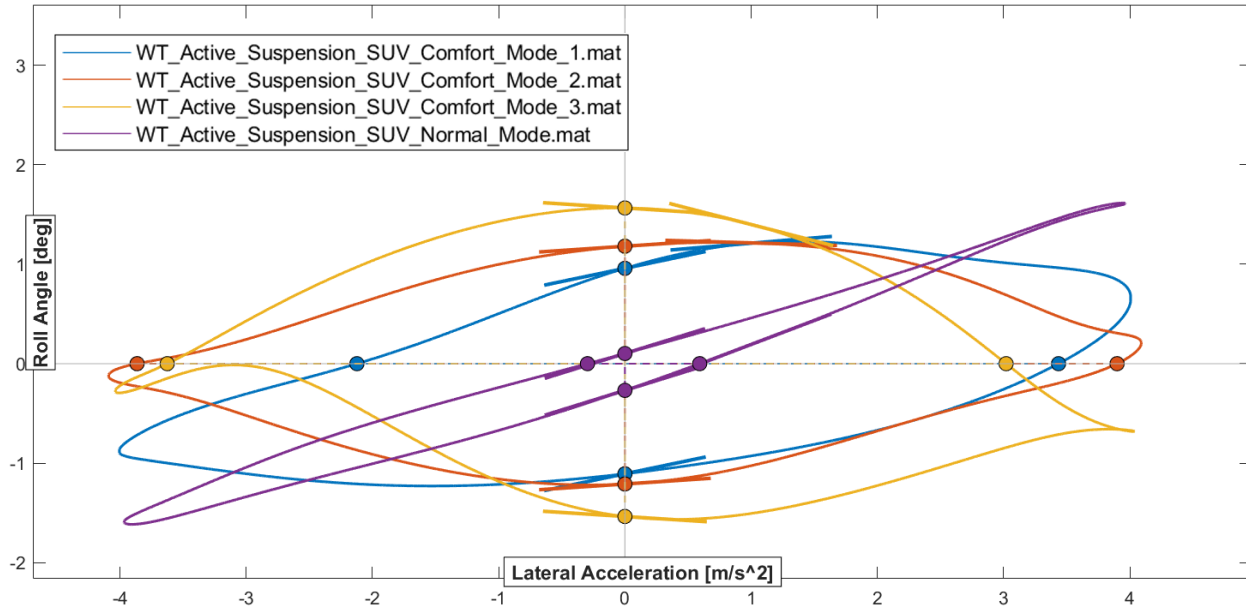
Understeer Gradient [ $deg/(m/s^2)$ ]



# Weave test – ISO 13674-1:2016



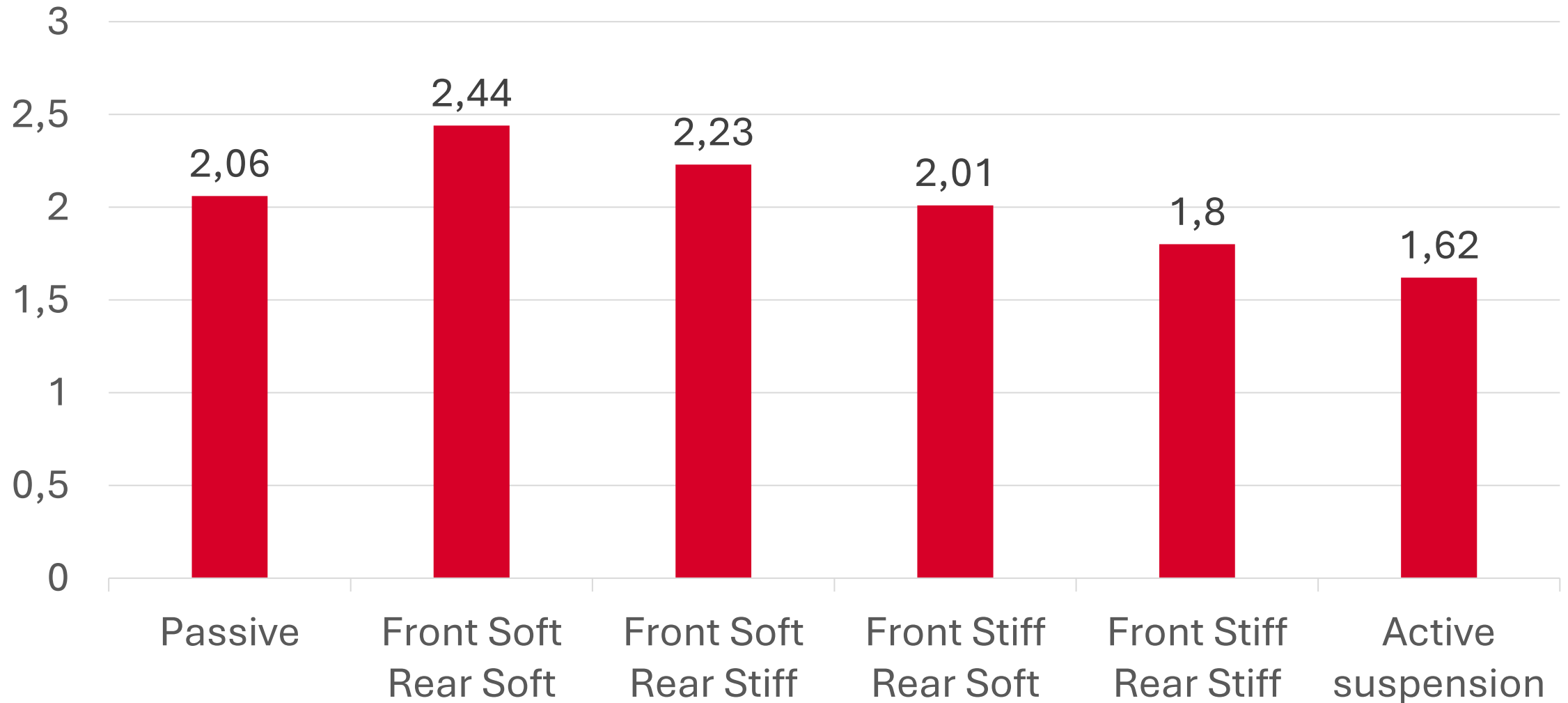
BMW X6 with passive and semi-active system



Reference SUV with active suspension

# Weave test – ISO 13674-1:2016

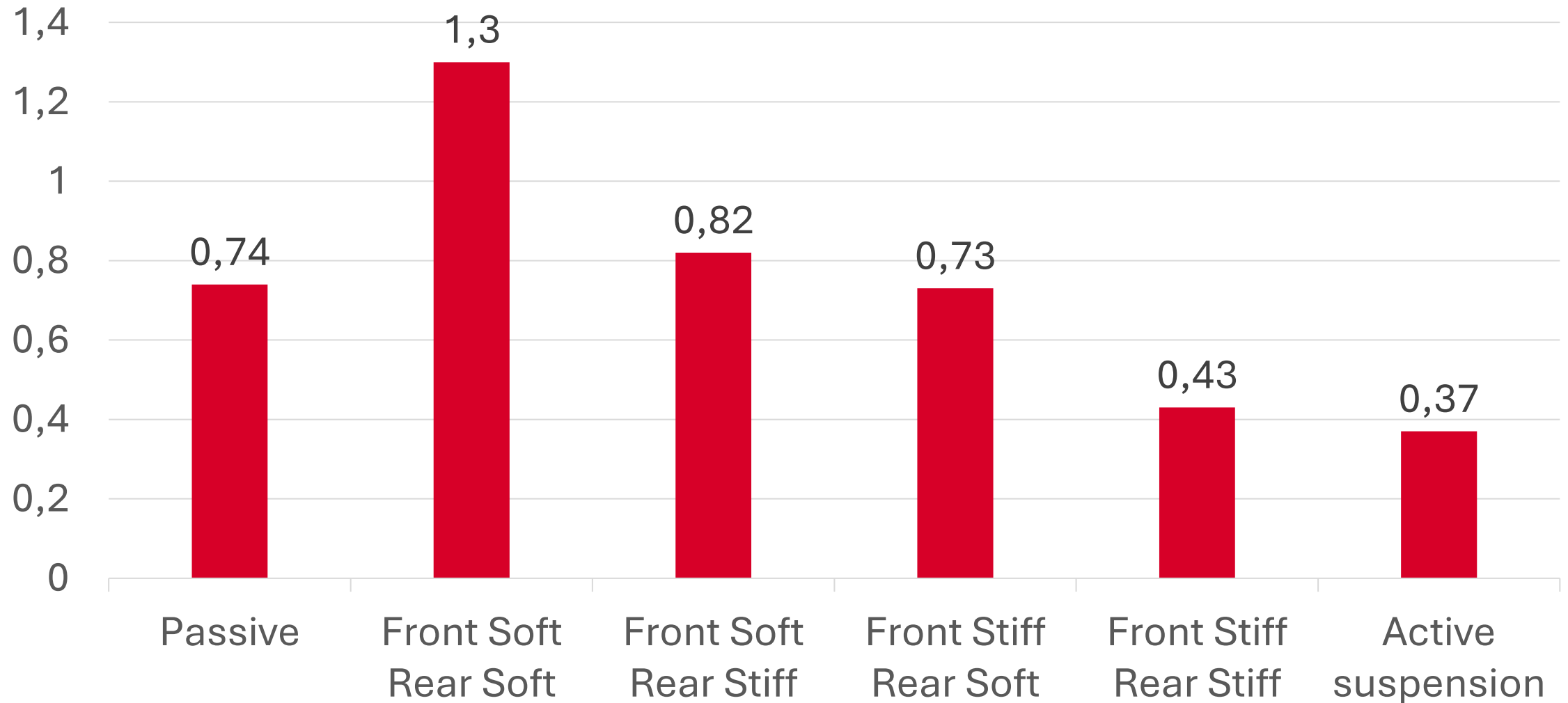
Max. RollAngle [*deg*]





# Weave test – ISO 13674-1:2016

RollAngle Hysteresis [*deg*]



# Conclusion

- Designed to match the torsional stiffness of traditional passive systems
- Additionally introduces variable stiffness and damping capabilities
- Refined balance between comfort and stability
- Outperforming the passive system
- Exhibited tendency of active systems with less power consumption
- Viable, cost-effective, bridging the gap between passive and active

M dynamix