

Composite Ride Comfort Index (CRCI)

For Heavy Commercial Vehicles
With Vehicle/Application-based Weightage

By

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Outline

- Objective and Scope
- Introduction
- Experiments
- Background
- Definition of Composite Ride Comfort Index (CRCI)
- Results
- Conclusion
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Objective and Scope

- Objective

Derive a composite ride comfort index for heavy commercial vehicles with vehicle/application-based weightage

- Scope

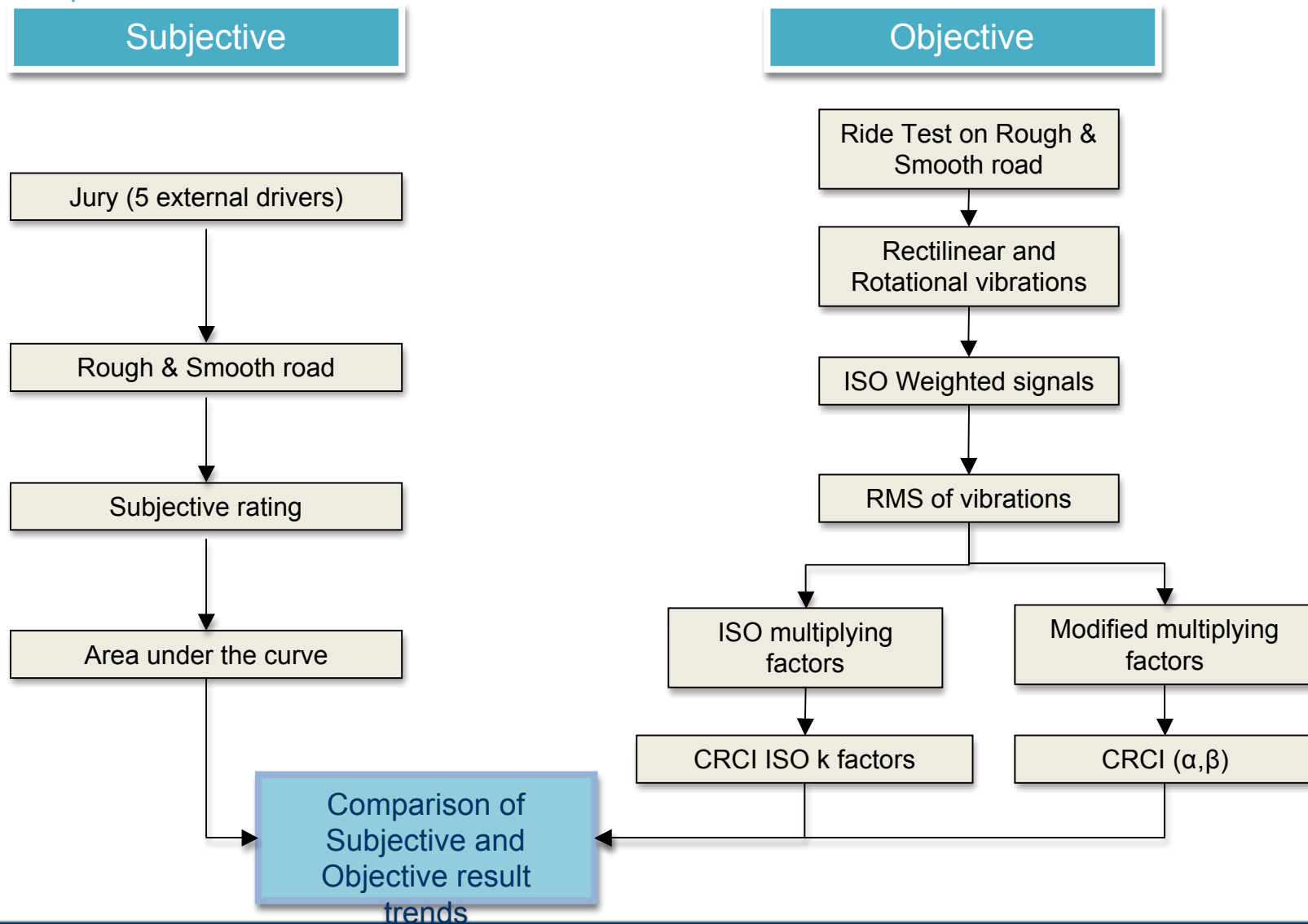
Define composite ride comfort index for heavy commercial vehicles by defining different weightage for cab rotational motions



Introduction

- ISO 2631 – Ride Index
 - ISO weighting w_d , w_d , w_k for rectilinear vibrations and w_e for rotational vibrations in x, y and z directions respectively.
 - $CRCI = \sqrt{(k_x a_x)^2 + (k_y a_y)^2 + (k_z a_z)^2 + (k_{rx} r_x)^2 + (k_{ry} r_y)^2}$
 - $k_x = 1.4$; $k_y = 1.4$; $k_z = 1$; $k_{rx} = 0.63$; $k_{ry} = 0.4$
- Poor correlation seen in subjective to objective results.

Methodology

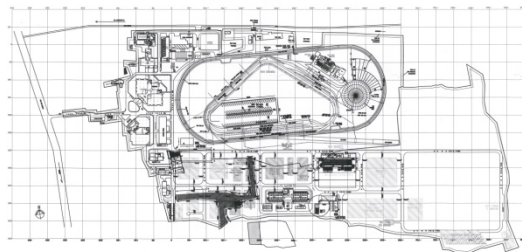


Experimental Details

Typical Questionnaire

Surface	Question	Driver 1	Driver 2	Driver 3	Driver 4
Smooth Road	Primary ride comfort				
	Secondary ride comfort				
	Cut/No				
Rough Road	Primary ride comfort				
	Secondary ride comfort				
	Following in Pul follow				
	Overall rating: extremely poor to good				
	Adaptation				
	Cut/No				
	Reaction on change, etc.				

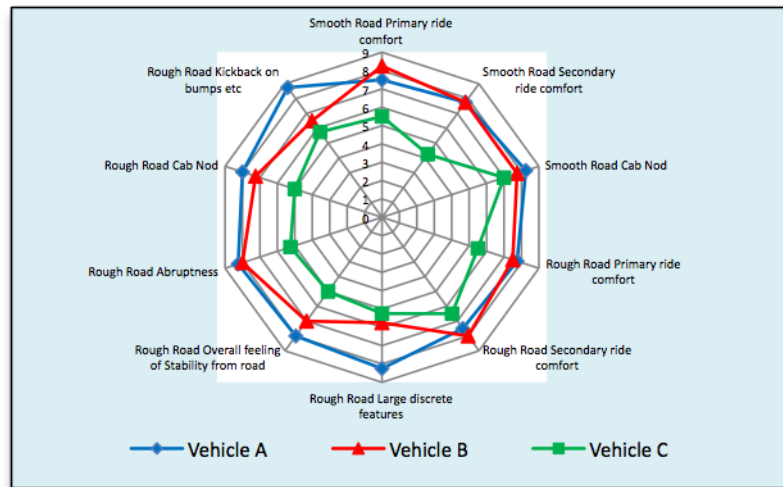
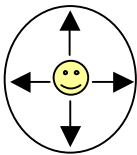
Utilized Track



- Surfaces
 - Rough Road
 - Smooth Road
- Jury
 - Five external on-road drivers
- Questionnaire
- Three tractors with trailers loaded to GVW considered for analysis
- Rating scale: 1 to 10 (higher the better)

Experimental Details

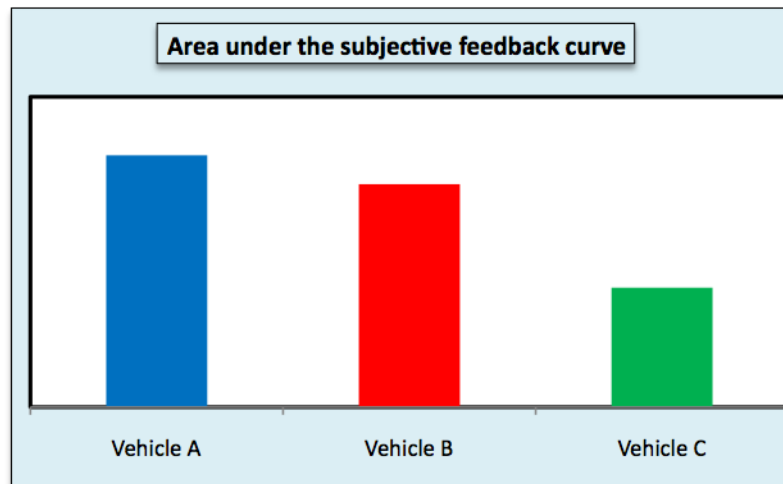
Higher the
Better



- Area under the radar chart is considered as the overall rating of the vehicle.

- Higher the area, better the ride.

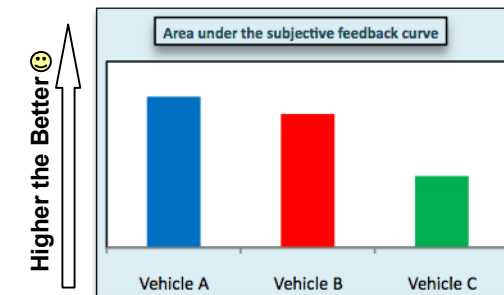
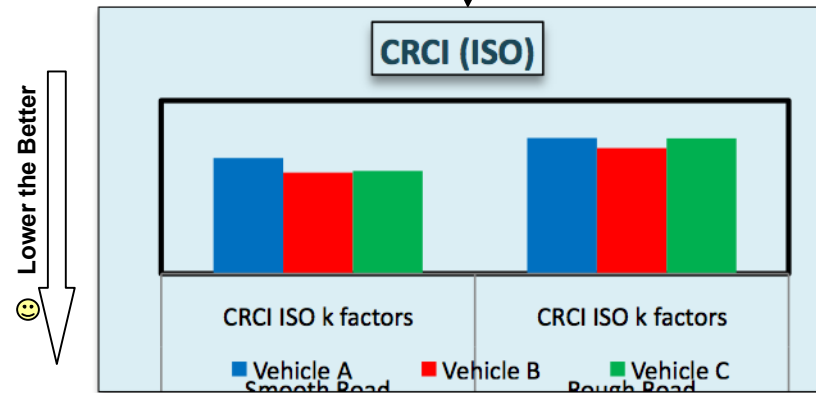
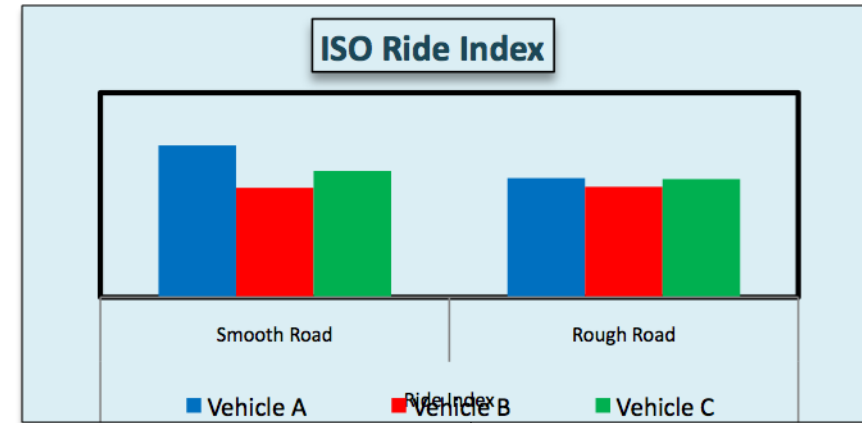
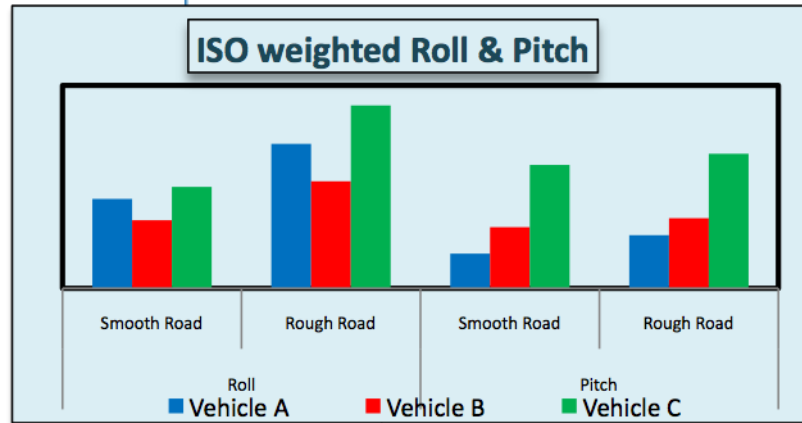
Area under the subjective feedback curve



- Vehicle A & B were rated better than vehicle C in subjective trials.

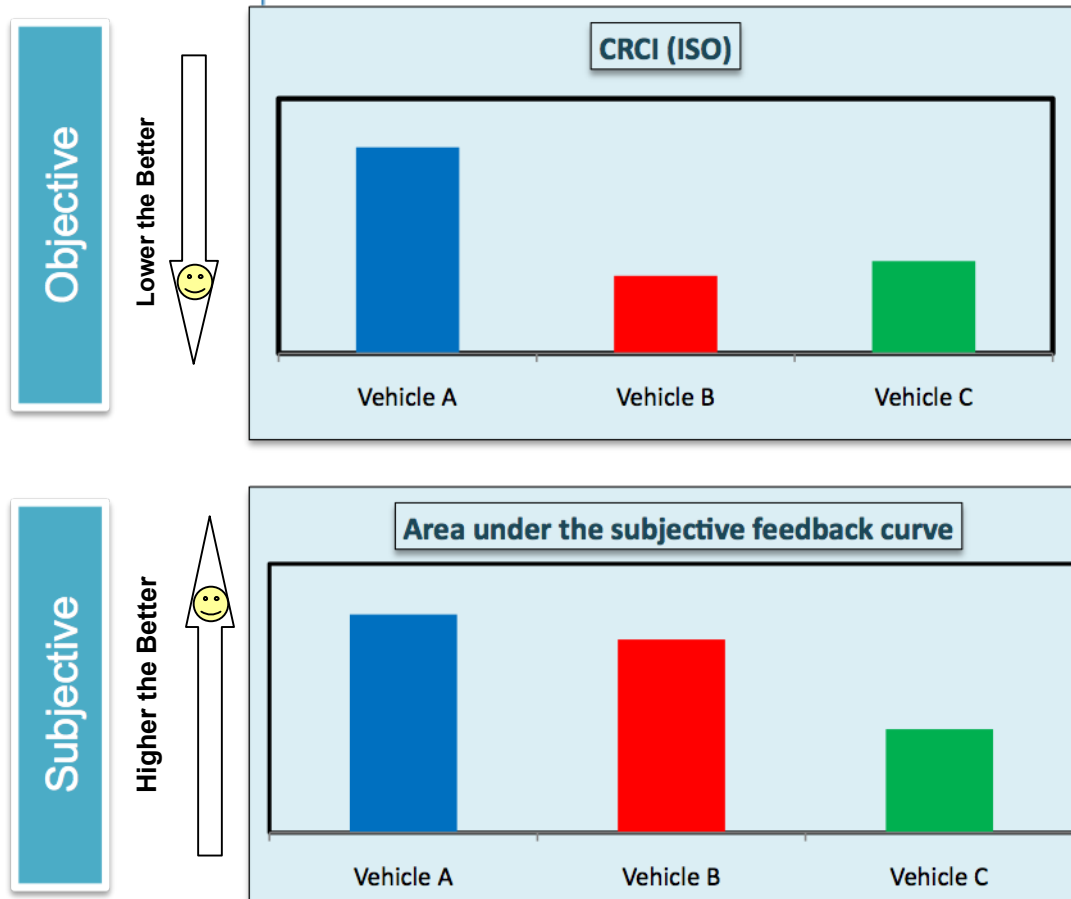


Issue



Vehicle C should have highest Comfort Index to correlate with subjective feedback

Experimental Details



- Rectilinear vibrations captured at seat-base of driver seat
- Rotational vibrations were evaluated from cab mounting points
- ISO 2631 weighting and multiplying factors are used to compute CRCI
- Trends are not correlating for subjective and objective results



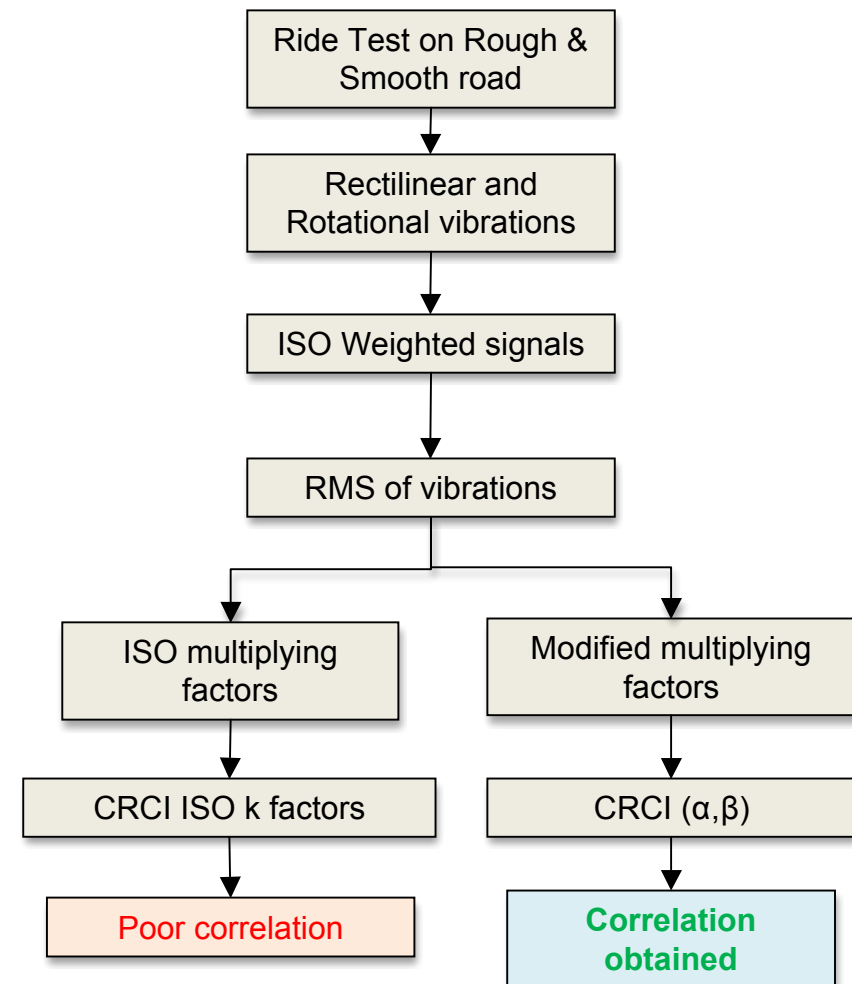
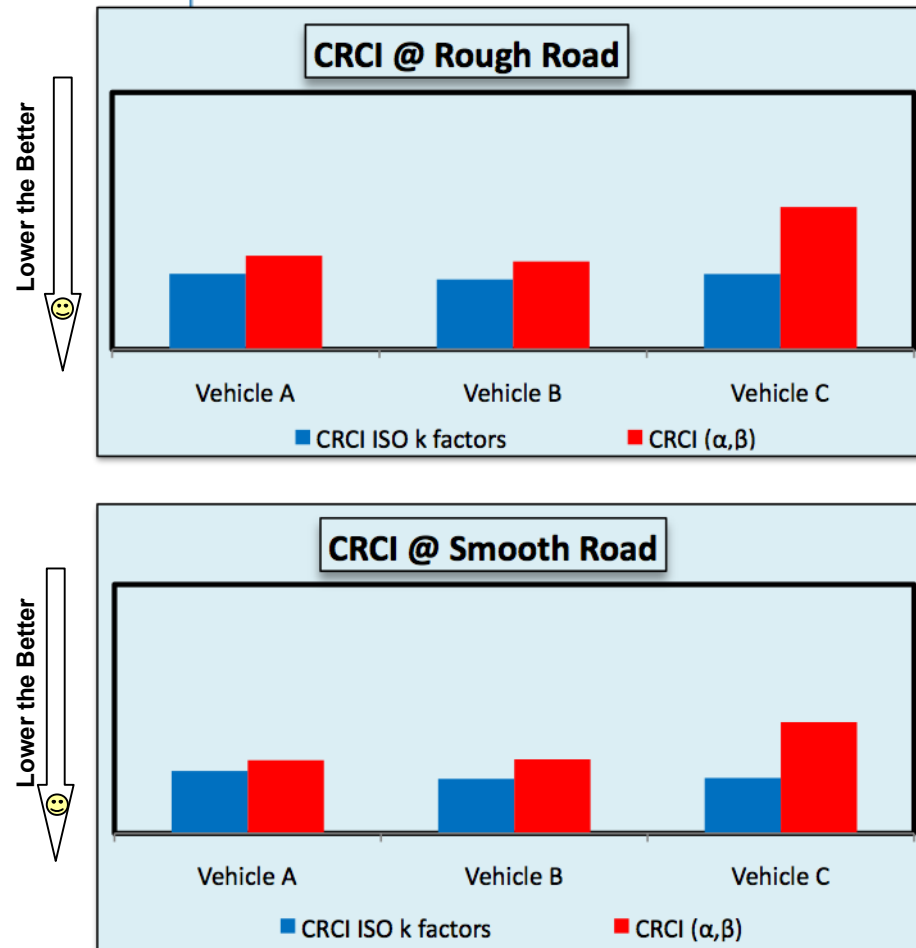
Definition of CRCI (Proposed)

- Changes introduced in rotational signals and their multiplying factors
 - r_x - RMS of ISO weighted / raw signal
 - r_y - RMS of ISO weighted / raw signal
 - k_{rx} and k_{ry} multiplication factors

- $$CRCI = \sqrt{(k_x a_x)^2 + (k_y a_y)^2 + (k_z a_z)^2 + (k_{rx} r_x)^2 + (k_{ry} r_y)^2}$$

Objective Comparison

– ISO v/s Proposed





Conclusion

- Poor correlation of subjective feedback and objective results using conventional ISO 2631 multiplying factors.
- Modified multiplying factors results in correlation of subjective feedback and objective results.



Scope for future work

- Collect more data in the same type of vehicles and validate the concept.
- Conduct tests in other segments of commercial vehicles and validate the proposed multiplying factors.

References

- ISO 2631 – 1



Questions ?