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The Importance of Pole Side Impact Alignment Accuracy

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Introduction

- FMVSS 214 and ENCAP pole side impact protocol specify an impact alignment tolerance of $\pm 38\text{mm}$.
- Draft GTR text includes option (in brackets) for $\pm 20\text{mm}$ impact alignment tolerance.
- OICA comments on draft GTR suggested $\pm 25\text{mm}$ tolerance.



Statements on the Importance of Impact Alignment

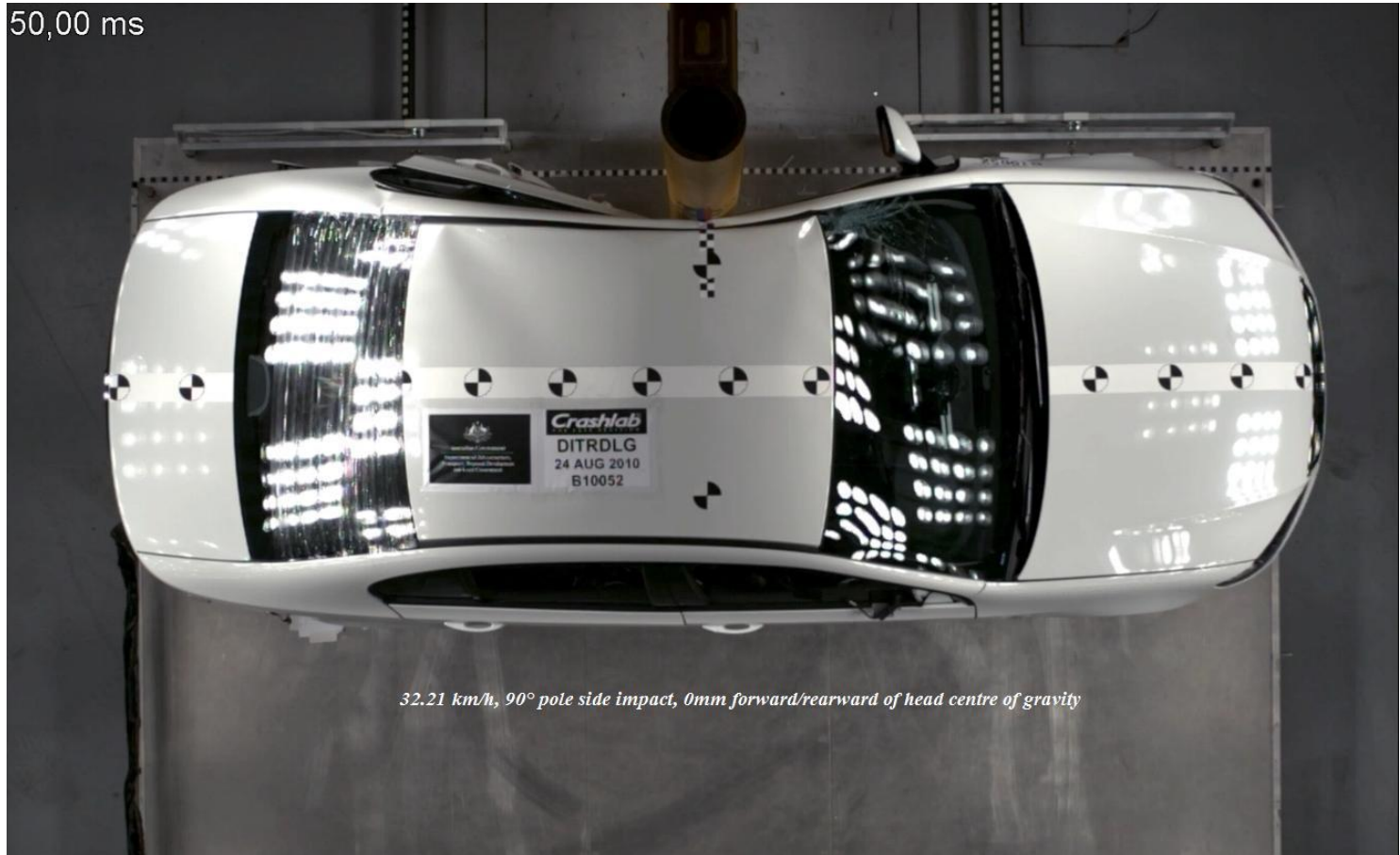
- ISO/TC 22/SC 10 have previously recommended care should be taken in the interpretation of results from pole tests where alignments are offset by more than 10 mm.
- APROSYS (AP-SP11-0086) found “the major influencing factor in changing the impact angle is in fact the change in the geometrical alignment of the pole with the dummy”.



Vehicle-to-Pole Test

32.21 km/h, 90° pole side impact, 0 mm from head centre of gravity

50,00 ms



32.21 km/h, 90° pole side impact, 0mm forward/rearward of head centre of gravity



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Vehicle-to-Pole Test

32.23 km/h, 90° pole side impact, 97 mm forward of head centre of gravity

50,00 ms



32.23 km/h, 90° pole side impact, 97 mm forward of head c.o.g.

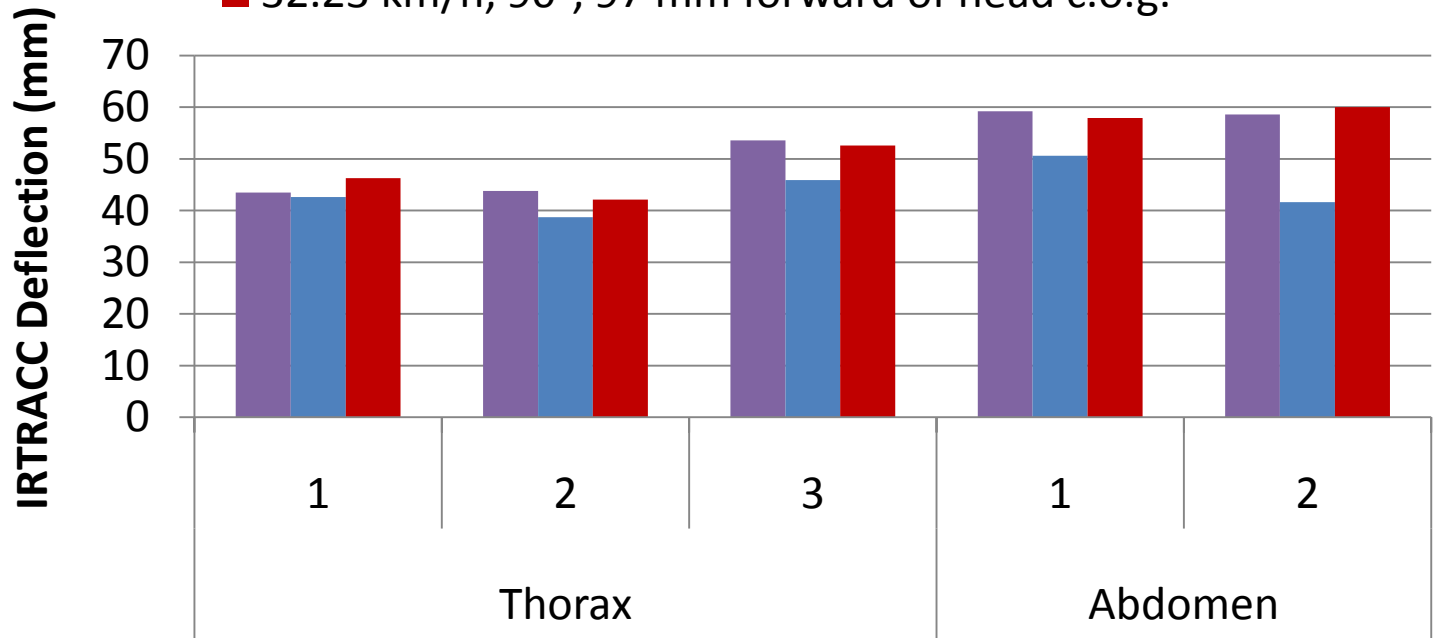


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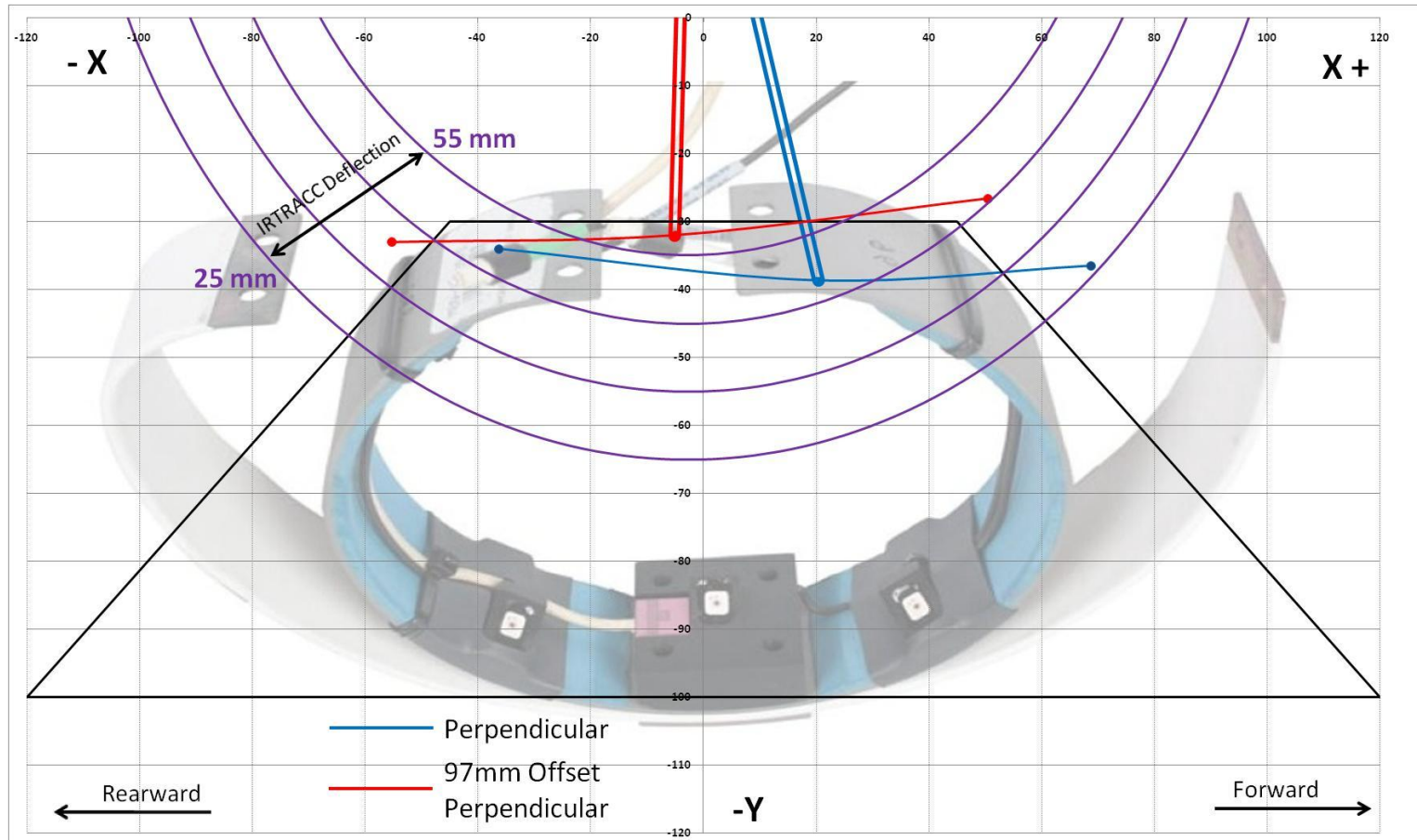
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Influence of Impact Alignment on WS50M Rib Responses

- 32.17 km/h, 75°, 5 mm rearward of head c.o.g.
- 32.21 km/h, 90°, 0 mm forward/rearward of head c.o.g.
- 32.23 km/h, 90°, 97 mm forward of head c.o.g.



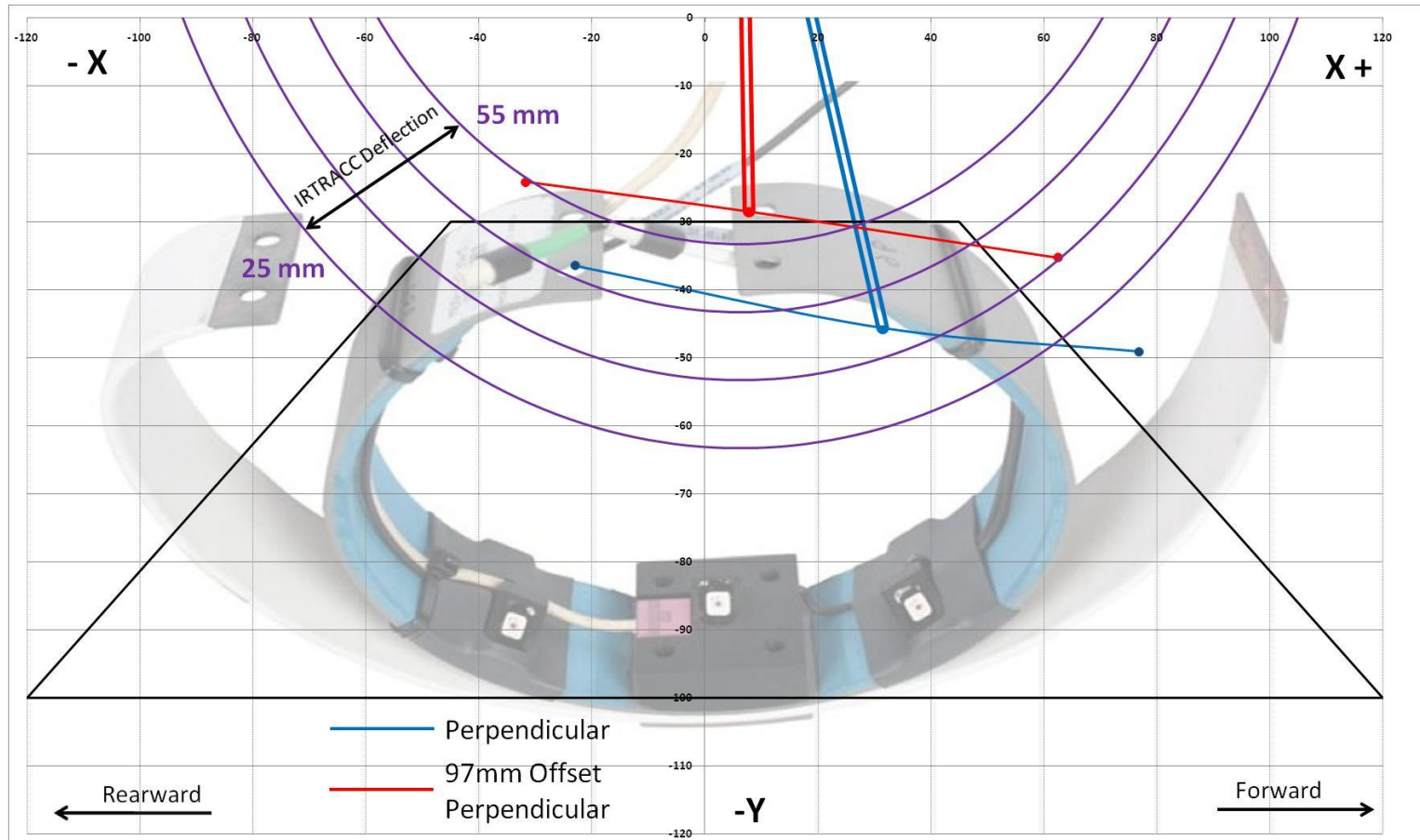
X-Y Response (0-100ms): Abdominal Rib 1



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X-Y Response (0-100ms): Abdominal Rib 2



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Summary of WS50M Responses

- Approximately 100 mm difference in impact alignment can have a similar influence on thorax and abdomen rib responses as a 15° change of impact angle.
- The alignment of the pole relative to the dummy can directly influence the direction in which the WorldSID 50th adult male dummy ribs deflect.
- Changing the direction of the rib loading will influence the maximum thorax and abdomen rib deflection values.
- Pure lateral rib responses are likely to produce “worst case” thorax and abdomen rib IRTRACC deflections.
- In 75° pole tests with impact alignments within ± 10 mm of head centre of gravity, thorax and abdomen rib responses have generally occurred in a predominantly lateral direction (see [PSI-01-15](#) and [PSI-04-03](#)).



US NCAP Impact Alignment Accuracy

(summary of NHTSA [PSI-03-12](#) presentation)

- Results from 59 US NCAP pole tests.
- Most tests were within ± 10 mm tolerance.
- All but 3 tests within ± 20 mm tolerance.
- All but 1 test within ± 25 mm tolerance.
- All tests were within ± 30 mm tolerance.
- Most repeatable results were produced on floating floor (carrier sled) test system.



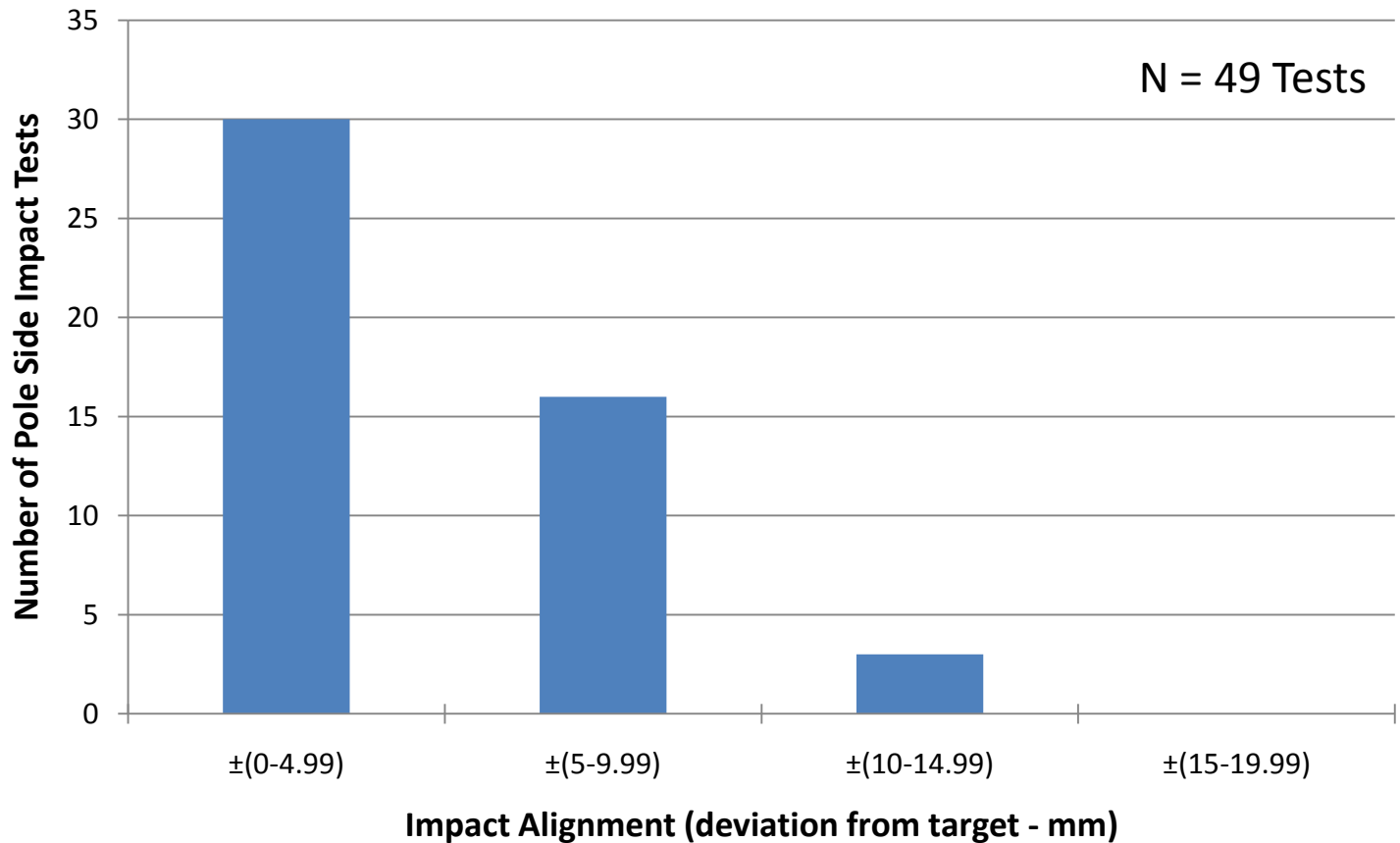
Test Analysis by Actual Impact Alignment

Analysis based on results reported from 49 pole side impact tests conducted using a carrier sled (floating/flying floor).

- 3 different facilities – RTA Crashlab, Autoliv Australia / APV Test Centre and PMG Technologies.
- 38 perpendicular impacts & 11 oblique impacts.
- 25 research tests conducted for Australian Department of Infrastructure and Transport and/or Transport Canada.
- 24 ANCAP tests (2008-2011).



Results of Impact Alignment Analysis



- Maximum deviation from target alignment was 13 mm.



Conclusions

- For WS50M, a 76 mm (± 38 mm) allowable impact alignment range could provide opportunity for unnecessarily large variation in the maximum thorax or abdomen rib IRTRACC deflection value.
- It is technically feasible to consistently produce actual impact alignments within ± 15 mm of the target alignment.
- The pole side impact GTR could therefore specify a ± 20 mm impact alignment tolerance and should certainly specify no more than a ± 25 mm impact alignment tolerance.
- Such an impact alignment tolerance is important for both regulatory and consumer rating test requirements:
 - where rib deflection in particular is used as a performance criteria, need to ensure approvals are issued / consumer ratings are based on tests of comparable stringency.



Thank you



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