

# Examine optimised Shoulder Strap Anchorages

## A Guideline

by Carl J. Schroth, July 2002

This guideline is written with the author's best knowledge at date of issue, incorporating experience from dynamic testing, driver fit trials and real world accident analysis. Some alternative data already reflect the intent use of HANS.

This document refers to the shoulder strap anchorage location and angularity to achieve optimal strap guidance. The data and results from formulas herein need to be verified for each cockpit, seat, and HANS design as well as for the individual driver and his seating position.

### 1) Shoulder strap attachment height

Strap routing behind the shoulder should be horizontal. For application w/o HANS a downward routing up to 20° is acceptable. Strap length behind the seat back should not exceed 750 mm.

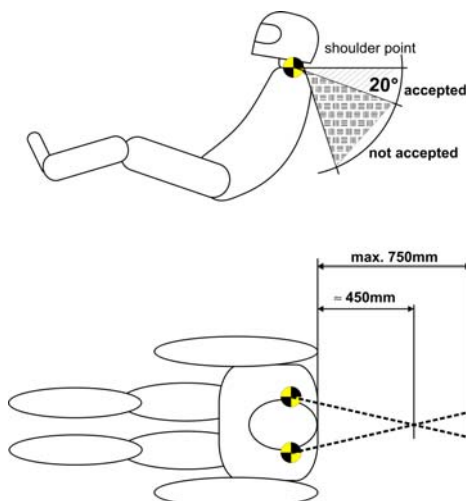
If HANS is in use, the anchorages must be raised by the thickness of HANS at shoulder points. The strap routing must be horizontal. If a downward routing can not be avoided maximum 20° are acceptable. **The strap length behind the seat should not exceed 200 mm.**

### 2) Shoulder strap attachment distance

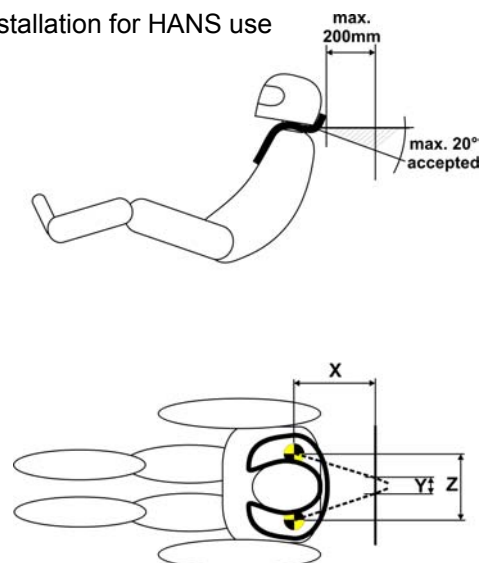
To ensure proper strap routing also during a forward crash and for better lateral stability it is recommended to narrow the shoulder strap attachment (Y) relative to the webbing distance at neck area (Z). The distance between the individual anchor points will vary as the width of the HANS does and the distance of the anchor points from the driver's shoulder points vary.

The following Figures show the limits and give references how to use the calculation formula.

Installation w/o HANS use



Installation for HANS use



**Variables:**

**X** = Distance from Shoulder Points to attachment. Take measure from the highest shoulder point (on top of the HANS warn)

**Z** = Distance mid to mid of webbing at Shoulder Point

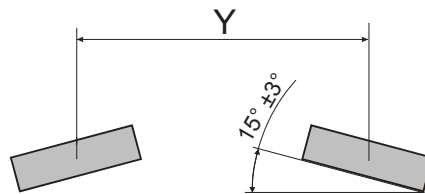
**Y** = Approximate distance between anchor points. (measured mid to mid of webbing at anchor point)

Formula:  $Y = Z - (X \cdot 0,40)$

A negative result indicates a need for shoulder belts to cross over behind driver seat.

For HANS systems SCHROTH recommends the use of 50mm webbing shoulder harnesses (accepted by FIA, NASCAR, CART to be used with HANS) since such design allows more narrow anchorage location. To get the benefits from using 50 mm webbing appropriate anchorage design is essential In particular in open wheel race cars.

**3) Angularity**



In open wheel race cars an approximate angularity of 15° ± 3° is recommended as shown in the sketch above. The optimal angle is influenced by the driver's shoulder shape or HANS shape as applicable.



**75 mm Shoulder Harness w/o HANS**  
Anchorage distance approx. 200 mm



**50 mm Shoulder Harness w/ HANS**  
Anchorage distance approx. 170 mm

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