CROSS COUNTRY CHAMPIONSHIPS

COMPETITOR INSTALLATION BEST PRACTICE

FEDERATION INTERNATIONALE DE L'AUTOMOBILE

A WORLD IN MOTION

Background

Due to the frequent cases of spinal injury reported by Cross Country competitors following a heavy vertical impact or landing, the FIA Safety Department is conducting extensive research to identify the most significant contributory factors leading to risk of this type of injury mechanism.

As part of this effort, valuable information is now available regarding the correct installation and use of existing competitor safety devices within the cockpit to mitigate the risk of such injuries. This information summarises the measures that should be adopted by competitors at all levels in Cross Country competition.

The research project has been supported by funding from the FIA Foundation.

Photographs: RallyZone, DPPI and Cross Country event organisers

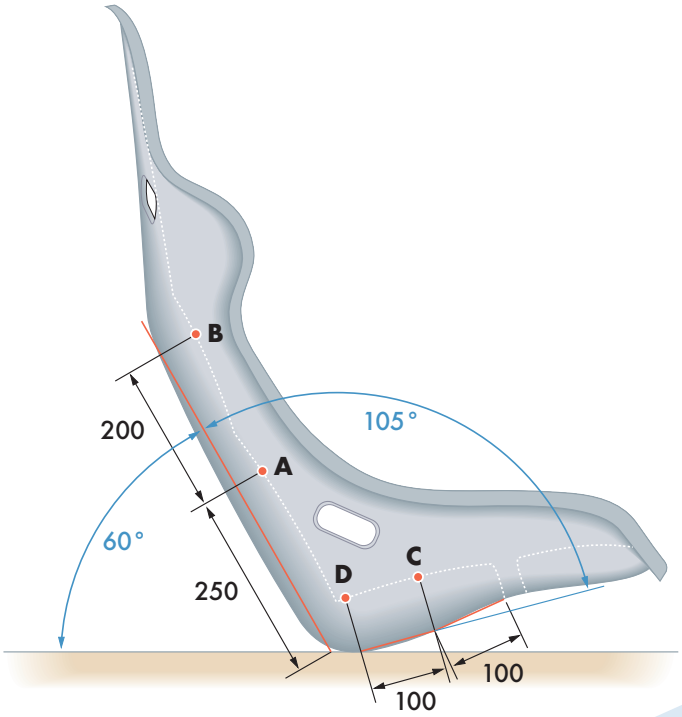
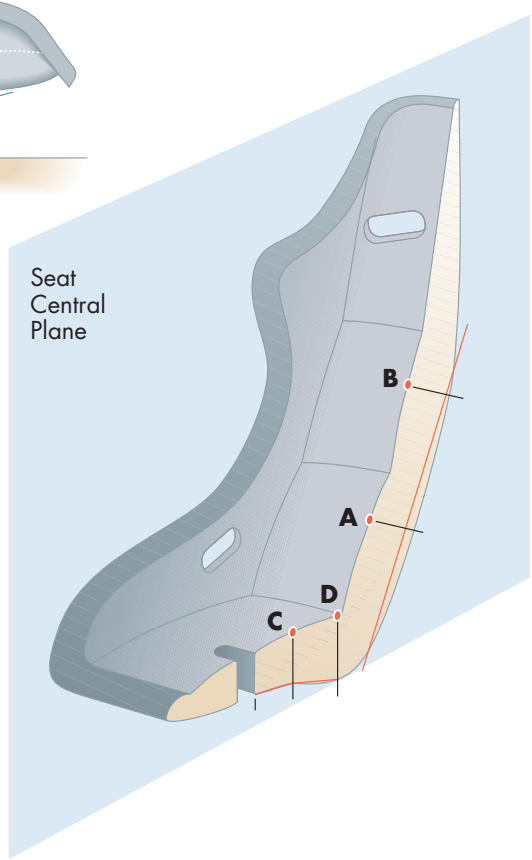


Figure 1:
Seat angle and inclination



Driver / Co-driver Installation

Seat Geometry and Installation

Select a seat with an angle between the back and the base of around 105°, with this angle being measured as follows (see **Figure 1**):

i Mark a point 'A' on the seat central plane at 250 mm from the seat base

ii Mark a point 'B' on the seat central plane at 200 mm above point 'A'

iii Mark a point 'C' on the seat central plane at 100 mm rearward from the most reward edge of the crotch slot

iv Mark a point 'D' on the seat central plane at 100 mm rearward point 'C'

v The angle between the lines connecting points 'A' and 'B' and points 'C' and 'D' should be around 105°

The seat should be installed in the most upright position possible for the competitor to still achieve a comfortable and ergonomic posture. The research found that rotating the seat from 40° to 60° equates to a 22% reduction in the forces that translate into a fracture of the spine during a heavy landing. The seat back angle should be measured as follows (see **Figure 1**):

i The line connecting points 'A' and 'B' should have an angle of around 60° from the horizontal

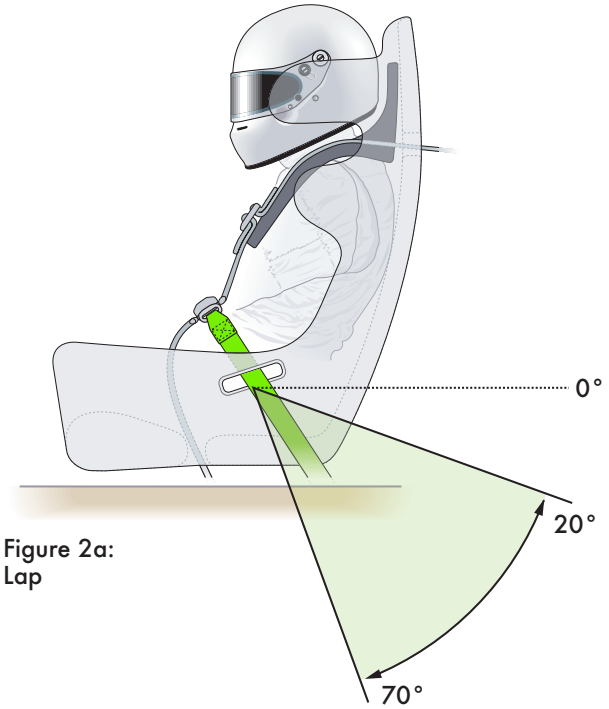


Figure 2a:
Lap

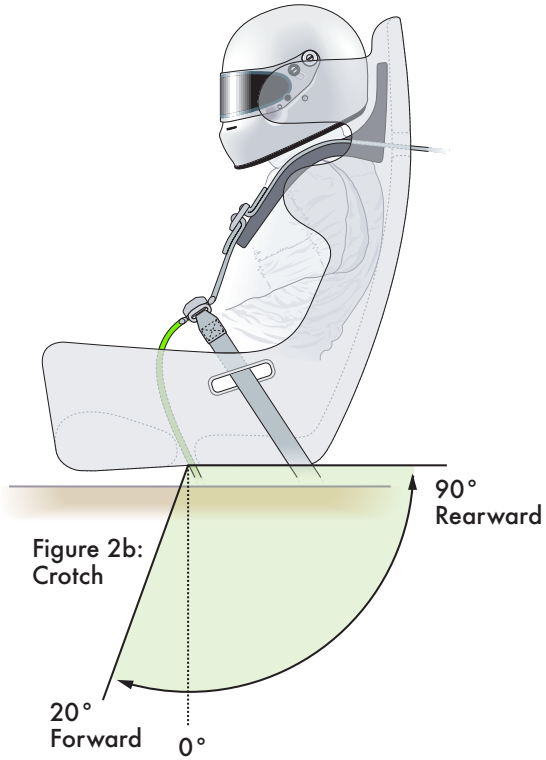


Figure 2b:
Crotch

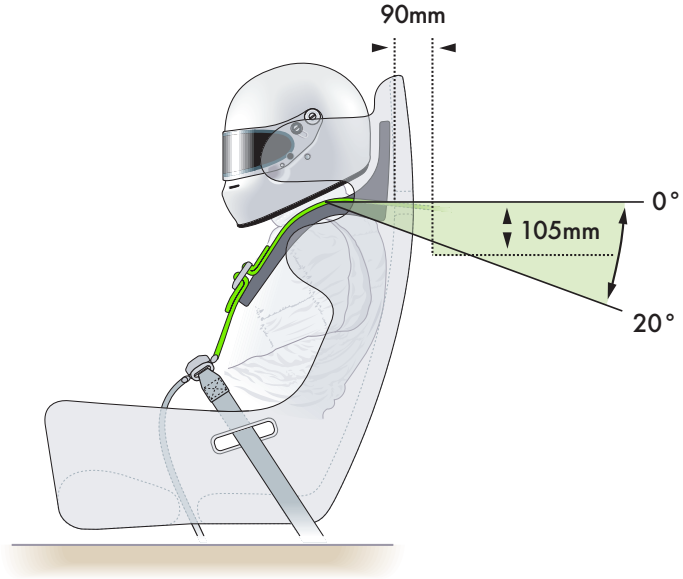


Figure 2c:
Shoulder

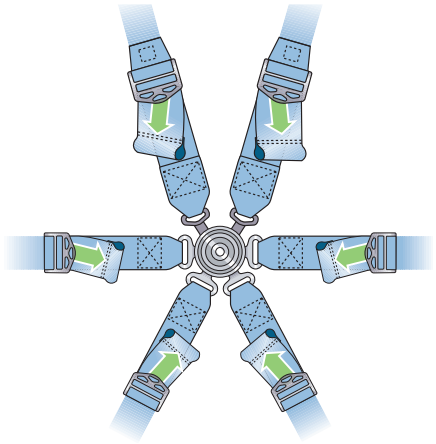
Safety Harness Installation

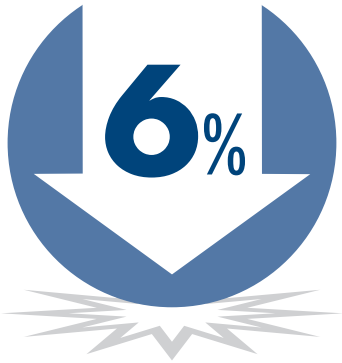
The safety harness must be installed in accordance with the FIA regulations, but whenever possible it should be as close as possible to the following requirements:

Lap strap angle shall be as horizontal as possible, as shown in **Figure 2a**. The strap can be tangential to the lap strap slot upper edge and should make a straight line between the anchorage point and buckle. The research found that changing this angle from 70° to 20° equates to an 8% reduction in the forces that translate into a fracture of the spine during a heavy landing.

Crotch strap angle should be as forward as possible, as shown in **Figure 2b**. The strap can be tangential to the crotch strap slot forward edge and should make a straight line between the anchorage point and buckle.

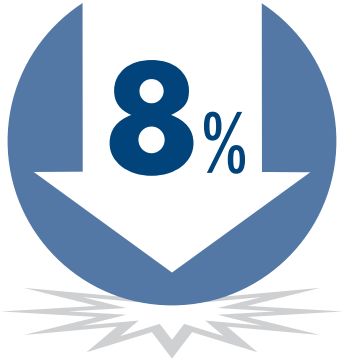
Shoulder strap angle between 0° and 20°, as shown in **Figure 2c**. Although changing this parameter between 0° and 20° downwards did not show any major improvement, it is recommended to target an angle between 0° and 10° in order to ensure the effectiveness of Frontal Head Restraint system (please refer to the Guide and installation specification for FHR devices).





Safety Harness Tension

As the safety harness may become slightly loose during competition, the consequences of an accident with a loose safety harness were studied. A heavy landing with a tight safety harness can reduce the forces that translate into a fracture of the spine by around 6%. It is therefore important that competitors always keep their safety harness properly tightened.



Competitor Weight

The research concluded that the weight of the competitor has a significant influence on the risk of spinal injury. It showed that a change in weight from 84kg to 74kg led to an 8% reduction in the forces that translate into a fracture of the spine during a heavy landing.

Study Limitations

The research utilized finite element analysis with the THUMS human body model, simulating typical Cross Country vertical impact scenarios correlated with real world cases, to study the influence of the parameters described above to mitigate spinal injury. The FIA Safety Department continues to conduct further research, simulating a wide range of Cross Country accident cases and conducting physical testing, in order to continually improve our understanding and refine the best practice for the installation of competitors in Cross Country competition vehicles.

FEDERATION INTERNATIONALE DE L'AUTOMOBILE

Chemin de Blandonnet 2
1215 Genève 15, Suisse
T +41 22 544 44 00
F +41 22 544 44 50

FIA.COM

A WORLD IN MOTION