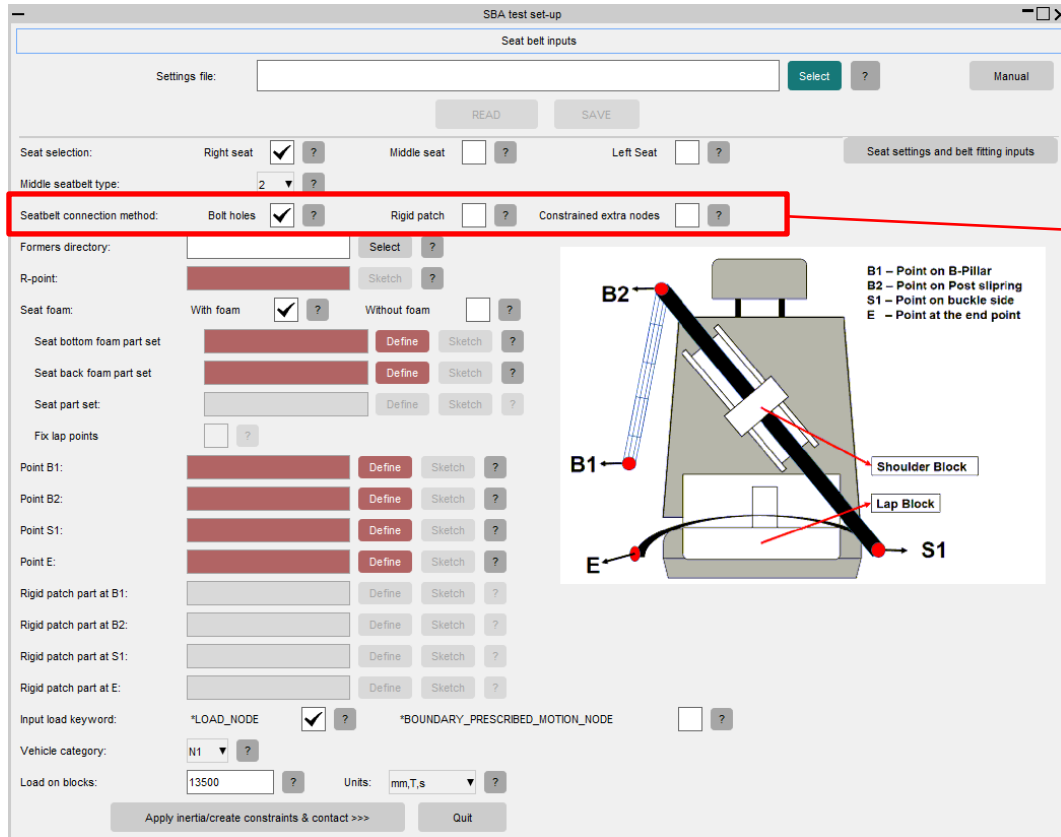


Seat Belt Anchorage



Introduction

- The SBA (Seat Belt Anchorage) script positions the loading devices (lap block and shoulder block) attached with seatbelt system at R-point in the vehicle and setup the analysis according to ECE R14 specification.
- The following figure shows "Main input" panel of SBA script:



Use one of the options to constrain the vehicle/seat belt. Use 'Bolt Holes' if vehicle structure only has bolt hole. If vehicle structure has rigid patch available for merging, select 'Rigid Patch'. Select 'Constrained extra node' to constrain end of the belt to the body or seat using *CONSTRAINED_EXTRA_NODES.

Main Inputs



The following options are available on the main input panel:

Setting file	A setting file may be read or written which may include mandatory information and other data required for seat positioning.
Seat Selection	Choose the seat being tested – Right, Middle or Left.
Middle Seatbelt Type	If middle seat has been selected in the Seat Selection Input, then choose 2 or 3 point belt system for the middle seat from the drop-down box. The default value is 2.
Seat belt connection	Bolt hole: Create bolt for each anchorage to join the end of the belt to the seat/body.
	Rigid Patch: Use rigid patches on the BIW for each anchorage to join the end of the belt to the seat/body.
	Constrained extra nodes: Create *CONSTRAINED_EXTRA_NODES for each anchorage to join the end of the belt to the seat/body.
Formers Directory	A formers directory may be selected so you can use your own impactors. If this input is left blank, the default directory in PRIMER source will be selected. Please ensure your impactors do not contain *INLCUDE.
R-point	R-point is the relative location of the seated dummy's hip point when the seat is set in the rearmost and lowermost seating position.
Seat data input	Select 'Seat with foam' or 'Seat without foam'. For seat with foam, provide part set for bottom and back foam separately. For seat without foam, provide part set comprising of all the parts that might effect positioning of the impactor.
Fix lap points	This is applicable to seat without foam. If this option is ON, seat belt points will be fixed on lap block.
Point B1	B1 is the point on B-Pillar.
Point B2	B2 is the point on B-Post.



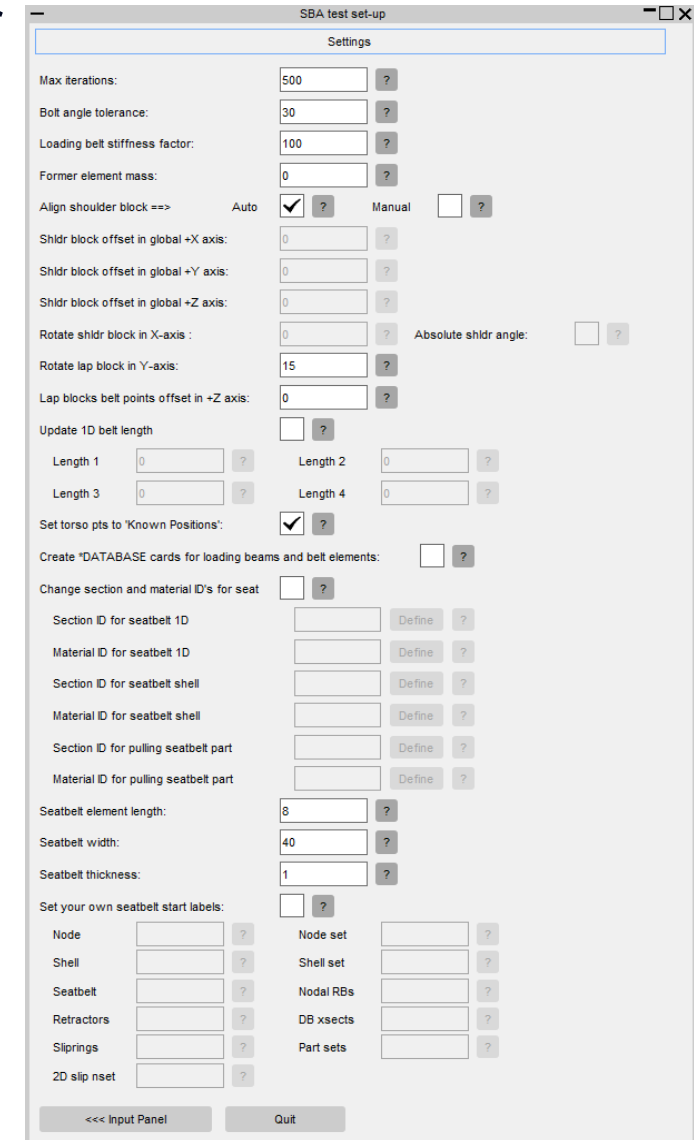
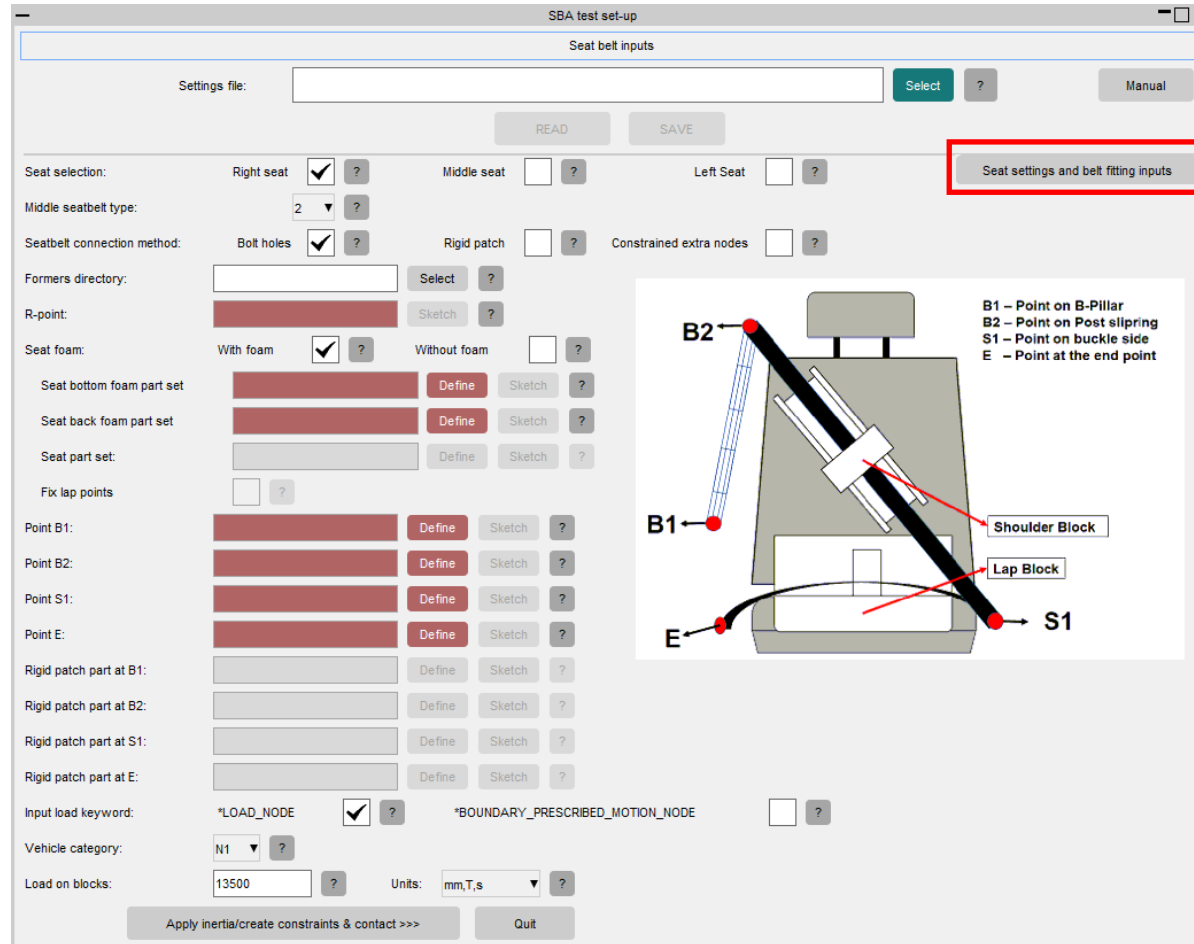
Main Inputs Continued

Point S1	S1 is the point on buckle side.
Point E	E is the point at the end.
Rigid patch/node set at B1	Either specify rigid patch part to merge (if rigid patch is selected) or node set to CONSTRAINED at B1 (if extra_node is used for connection).
Rigid patch/node set at B2	Either specify rigid patch part to merge (if rigid patch is selected) or node set to CONSTRAINED at B2 (if extra_node is used for connection).
Rigid patch/node set at S1	Either specify rigid patch part to merge (if rigid patch is selected) or node set to CONSTRAINED at S1 (if extra_node is used for connection).
Rigid patch/node set at E	Either specify rigid patch part to merge (if rigid patch is selected) or node set to CONSTRAINED at E (if extra_node is used for connection).
Input Load Keyword	Choose between *LOAD_NODE and *BOUNDARY_PRESCRIBED_MOTION_NODE (using curve smooth) for the input load keyword.
Vehicle Category	Select a Vehicle Category from the drop-down box. This will automatically update the load on blocks and inertia load as per the specification.
Load on blocks	Load input on lap and shoulder block.
Units	Specify unit system of the selected model.



Settings Panel

- Settings panel lets you select seat type and adjust lap and shoulder blocks



Settings Inputs (Iterations and Align Shoulder Block)

Set maximum iteration for the belt fitting and bolt angle tolerance

Align Shoulder Block

Auto: Shoulder block will be aligned automatically along the belt.

Manual : Adjust shoulder block manually by providing translation/rotation details.

SBA test set-up

Settings

Max iterations: 500 ?

Bolt angle tolerance: 30 ?

Loading belt stiffness factor: 100 ?

Former element mass: 0 ?

Align shoulder block ==> Auto ☒ ? Manual ☐ ?

Shldr block offset in global +X axis: 0 ?

Shldr block offset in global +Y axis: 0 ?

Shldr block offset in global +Z axis: 0 ?

Rotate shldr block in X-axis: 0 ?

Absolute shldr angle: 0 ?

Iteration and tolerance values

Select automatic or manual option to align shoulder block

Input translation and rotation values

Select if input angle is absolute

Settings Inputs (Rotate Lap Block and Z offset)

Rotate Lap Block

- Rotate lap block in Y-Axis

Rotate lap block in Y-axis:	<input type="text" value="15"/>	<input type="button" value="?"/>
Lap blocks belt points offset in +Z axis:	<input type="text" value="0"/>	<input type="button" value="?"/>

Input angle to rotate lap block in Y-axis. The default is 12

Set the distance to move lap block's belt points in +Z axis to remove any initial belt penetration between the lap block and seat. If left empty, the tool will automatically calculate suitable distance for offset

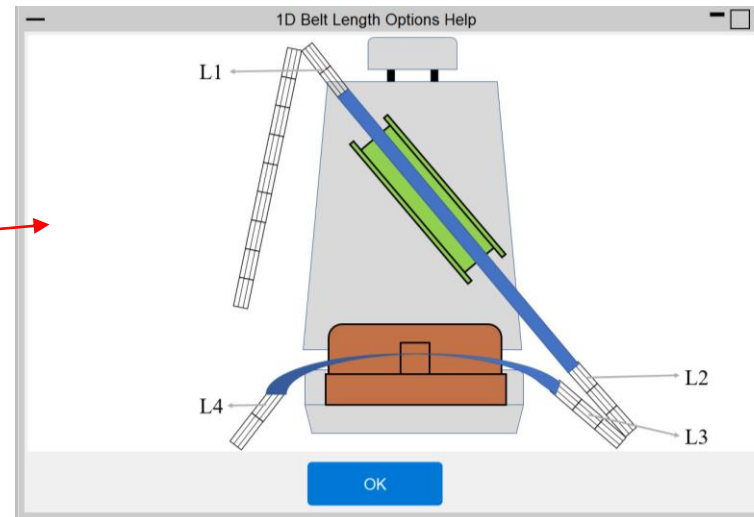
Settings Inputs (Update 1D Belt Length)

Update 1D Belt Length

- Select update 1D belt length and provide lengths to change 1D lengths in belt definition
- For 2-pt middle belt, provide length 1 and length 2

Update 1D belt length ☒ ?

Length 1	<input type="text" value="1"/>	<input type="button" value="?"/>	Length 2	<input type="text" value="2"/>	<input type="button" value="?"/>
Length 3	<input type="text" value="3"/>	<input type="button" value="?"/>	Length 4	<input type="text" value="4"/>	<input type="button" value="?"/>



Setting Inputs (Create *DATABASE cards)

Update 1D belt length ☐ ?

Length 1 ? Length 2 ?

Length 3 ? Length 4 ?

Set torso pts to "Known Positions": ☒ ?

Create *DATABASE cards for loading beams and belt elements: ☐ ?

Change section and material ID's for seat ☒ ?

Section ID for seatbelt 1D Define ?

Material ID for seatbelt 1D Define ?

Section ID for seatbelt shell Define ?

Material ID for seatbelt shell Define ?

Section ID for pulling seatbelt part Define ?

Material ID for pulling seatbelt part Define ?

Keyword: M1/DATABASE_HISTORY_BEAM (4/0 mod)

Filter by: DATABASE_HISTORY_BEAM <auto> <auto>

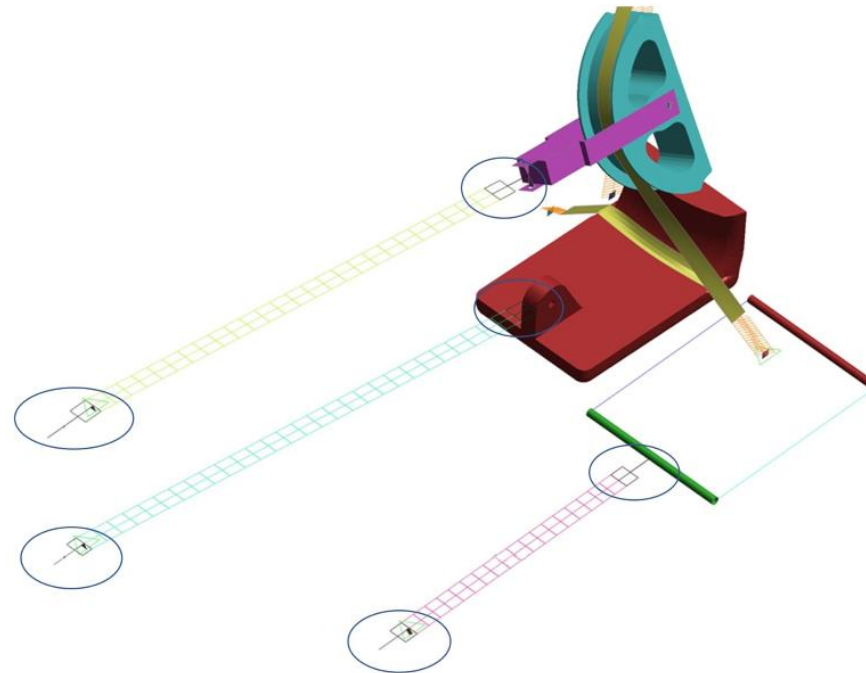
#	Options...	Incl	Suffices	ID	B	TITLE
Create	Main	<none>		0		
1	Main	ID		120011		Chain SHL Free
2	Main	ID		120012		Chain Lap Free
3	Main	ID		120013		Chain Lap
4	Main	ID		120014		Chain SHL

Keyword: M1/DATABASE_HISTORY_SEATBELT (4/0 mod)

Filter by: DATABASE_HISTORY_SEATBELT <auto>

#	Options...	Incl	Suffices	ID	SB	1
Create	Main	<none>		0		
1	Main	<none>		9794		
2	Main	<none>		9764		
3	Main	<none>		9763		
4	Main	<none>		9793		

Select this option to create *DATABASE_HISTORY cards for the SBA loading beams and the seatbelt elements connected to them. See the elements in the image to the right.



Setting Inputs (Change Section and Material ID's for Seatbelt)



Update 1D belt length

Length 1

0

?

Length 2

0

?

Length 3

0

?

Length 4

0

?

Set torso pts to 'Known Positions':

☒ ?

Create *DATABASE cards for loading beams and belt elements:

☐ ?

Change section and material ID's for seat

☒ ?

Section ID for seatbelt 1D

3000

Define

?

Material ID for seatbelt 1D

3001

Define

?

Section ID for seatbelt shell

3002

Define

?

Material ID for seatbelt shell

3003

Define

?

Section ID for pulling seatbelt part

3004

Define

?

Material ID for pulling seatbelt part

3005

Define

?

MODIFY PART M1/P5100039

+ Update

Reset All

✓ Check

✎ Sketch

Only

Sketch Master

✕ Cancel

Copy In

X-Refs

A Text Edit

Basic C of G

Adjusted C of G

Include:

(1) formers_arup.key

Modify PART 5100039 (model 1)

Part type:

*PART

Title:

seatbelt

Contents...

Part contains 28 SEATBELT(s)

Properties...

MAT_020: RIGID

Rigid attributes

Restraints, etc

Insert props

PID	SECID	MID	EOSID	HGID	GRAV	ADPOPT	TMID
5100039	3004	3005	<n/a>	<n/a>	0	0	<n/a>

+ Update

Reset All

✓ Check

✎ Sketch

Only

Sketch Master

✕ Cancel

Copy In

X-Refs

A Text Edit

Basic C of G

Adjusted C of G

Include:

(1) formers_arup.key

Modify PART 5100036 (model 1)

Part type:

*PART

Title:

belt_part_1

Contents...

Part contains 1008 SHELL(s)

Properties...

MAT_024: PIECEWISE_LINEAR_PLASTICITY

Rigid attributes

Restraints, etc

Insert props

PID	SECID	MID	EOSID	HGID	GRAV	ADPOPT	TMID
5100036	3002	3003	<n/a>	<n/a>	0	0	0

_option1

<no option>

_option2

<no option>

_option3

<no option>

_option4

<no option>

_option5

<no option>

☐ _INERTIA

☐ _CONTACT

☐ _PRINT

☐ _ATT_NODES

☐ _AVERAGED

☐ _REPOSITION

Switch to PART_COMPOSITE

Report _INERTIA modifiers

MODIFY PART M1/P5100040

+ Update

Reset All

✓ Check

✎ Sketch

Only

Sketch Master

✕ Cancel

Copy In

X-Refs

A Text Edit

Basic C of G

Adjusted C of G

Include:

(1) formers_arup.key

Modify PART 5100040 (model 1)

Part type:

*PART

Title:

seatbelt_2

Contents...

Part contains 30 SEATBELT(s)

Properties...

MAT_020: RIGID

Rigid attributes

Restraints, etc

Insert props

PID	SECID	MID	EOSID	HGID	GRAV	ADPOPT	TMID
5100040	3004	3005	<n/a>	<n/a>	0	0	<n/a>

+ Update

Reset All

✓ Check

✎ Sketch

Only

Sketch Master

✕ Cancel

Copy In

X-Refs

A Text Edit

Basic C of G

Adjusted C of G

Include:

(1) formers_arup.key

Modify PART 5100032 (model 1)

Part type:

*PART

Title:

seatbelt

Contents...

Part contains 102 SEATBELT(s)

Properties...

MAT_024: PIECEWISE_LINEAR_PLASTICITY

Rigid attributes

Restraints, etc

Insert props

PID	SECID	MID	EOSID	HGID	GRAV	ADPOPT	TMID
5100032	3000	3001	<n/a>	<n/a>	0	0	<n/a>

_option1

<no option>

_option2

<no option>

_option3

<no option>

_option4

<no option>

_option5

<no option>

☐ _INERTIA

☐ _CONTACT

☐ _PRINT

☐ _ATT_NODES

☐ _AVERAGED

☐ _REPOSITION

Switch to PART_COMPOSITE

Report _INERTIA modifiers



Setting Inputs (Belt width, length and thickness)

Seatbelt element length:

15

?

Seatbelt width:

50

?

Seatbelt thickness:

2

?

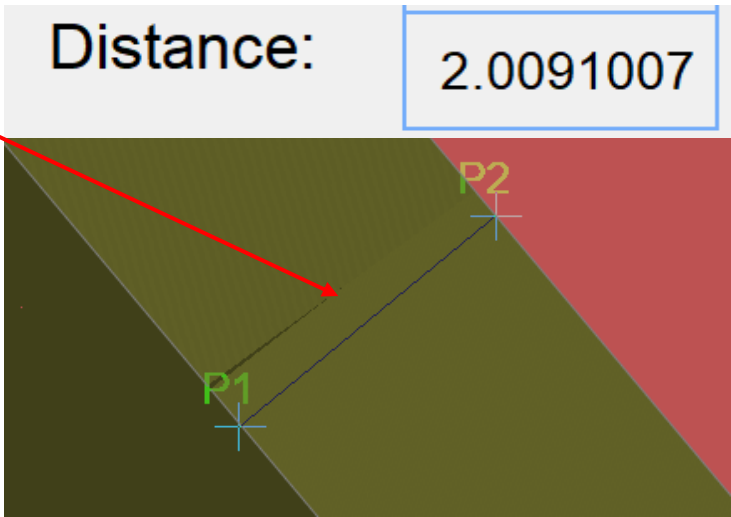
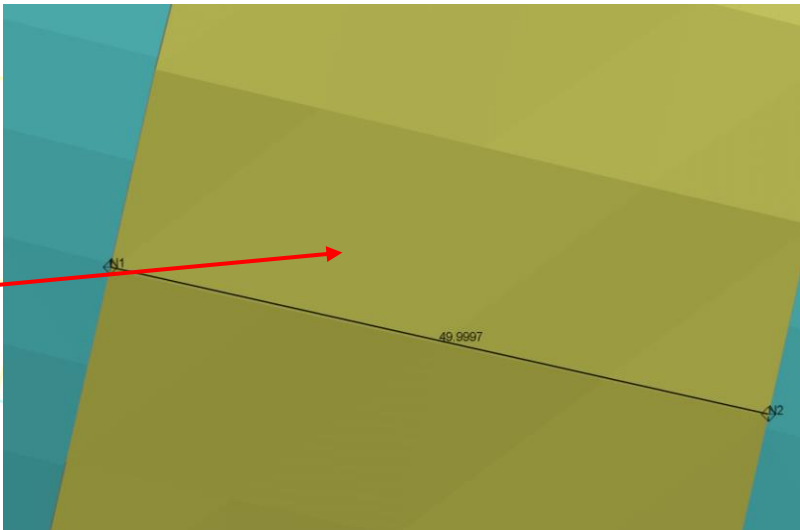
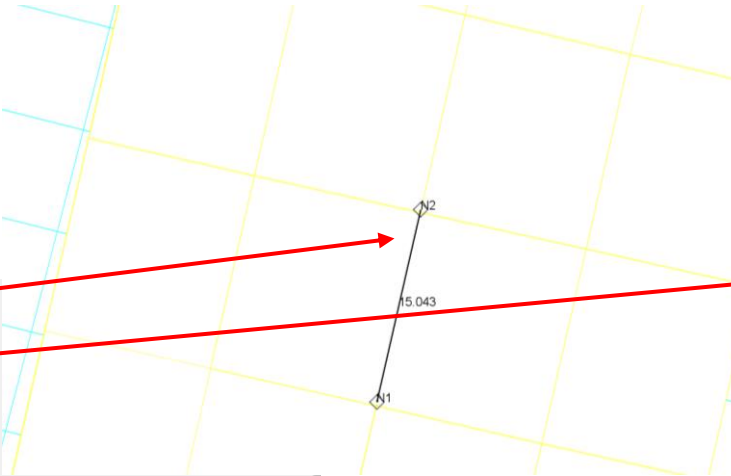
Set your own seatbelt start labels:

?

Node	<div></div> <div>?</div>	Node set	<div></div> <div>?</div>
Shell	<div></div> <div>?</div>	Shell set	<div></div> <div>?</div>
Seatbelt	<div></div> <div>?</div>	Nodal RBs	<div></div> <div>?</div>
Retractors	<div></div> <div>?</div>	DB xsects	<div></div> <div>?</div>
Sliprings	<div></div> <div>?</div>	Part sets	<div></div> <div>?</div>
2D slip nset	<div></div> <div>?</div>		

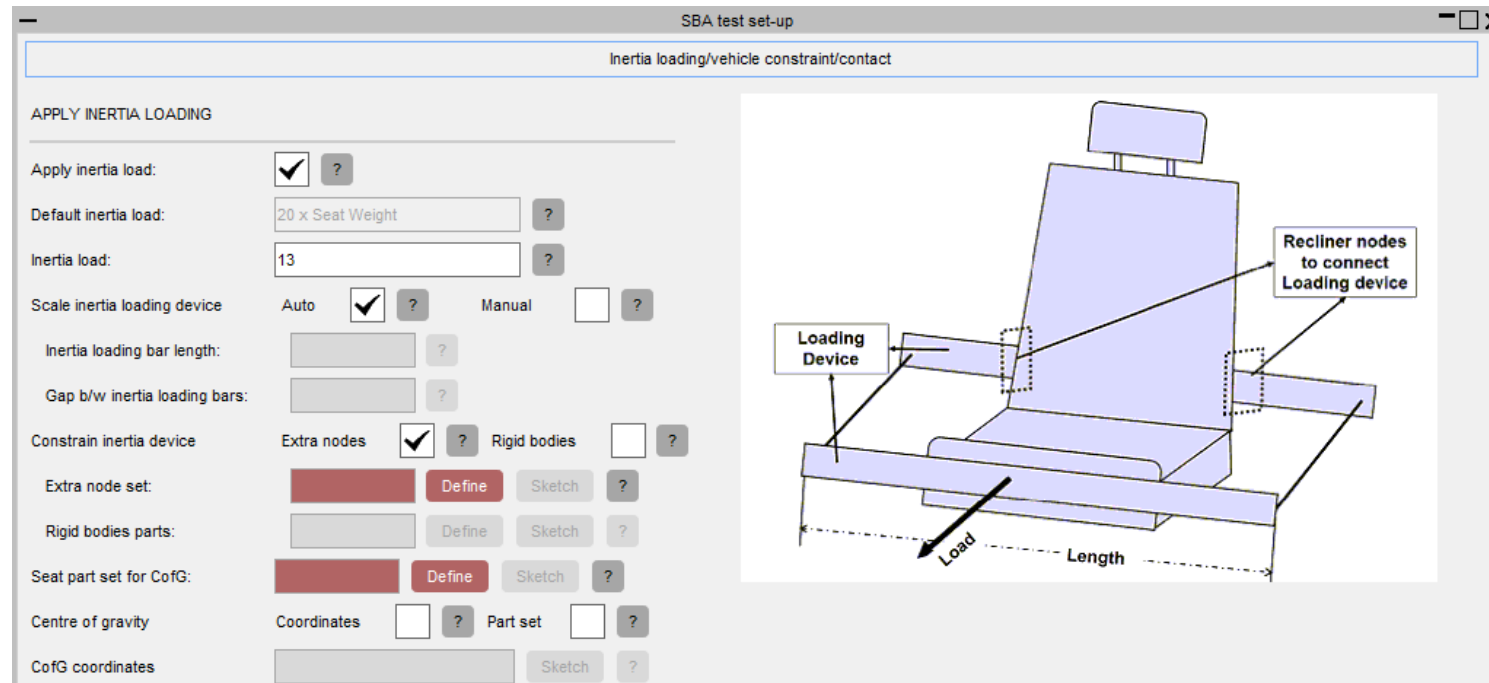
<<< Input Panel

Quit



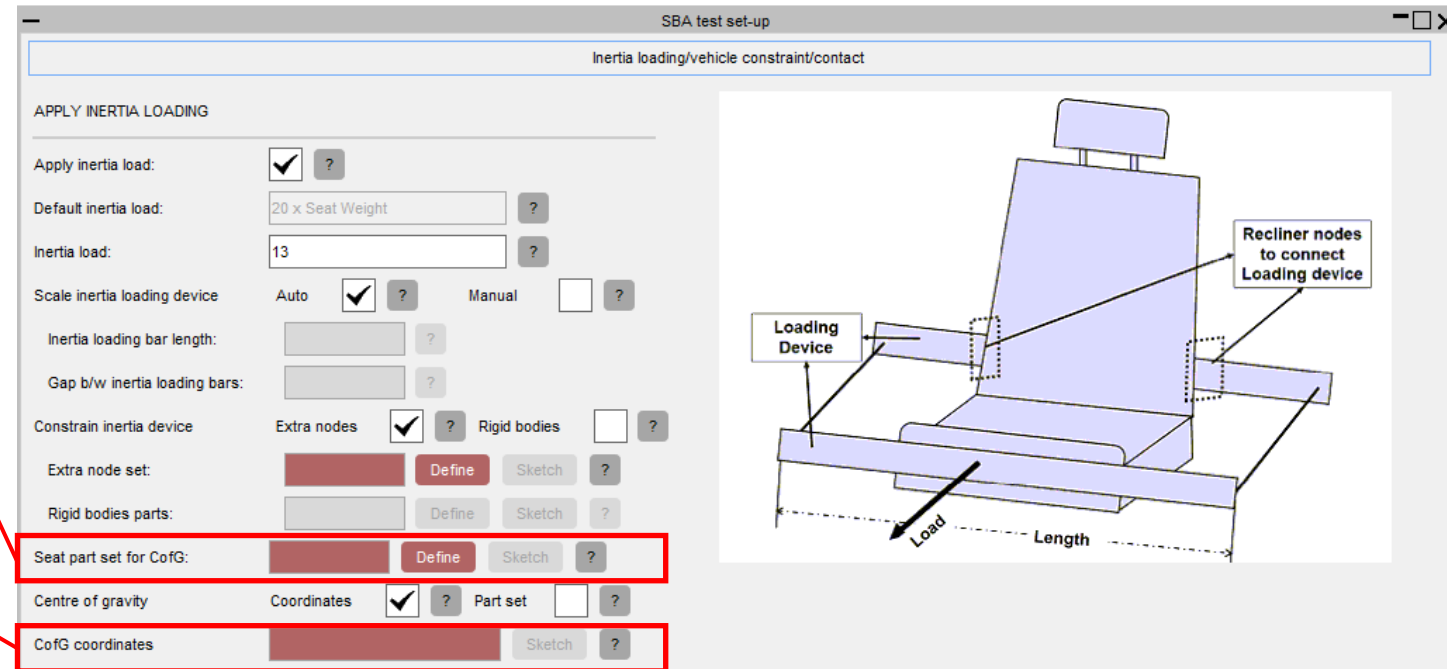
Install Inertia Bar

- Select “Apply inertia load” to install a bar for applying inertia load.
- Select “Auto” to scale inertia device automatically or “Manual” to provide inertia bar length and gap
- Provide value of inertia load or let it calculate as per the specification using seat part set and vehicle category options
- To attach the inertia bar to the seat, you can either use the "Extra node set" option to apply constraints using *CONSTRAINED_EXTRA_NODES, or select "Rigid bodies parts" to constrain it using *CONSTRAINED_RIGID_BODIES.



Inertia Centre of Gravity

- Centre of Gravity can be calculated on the fly using the seat structure part set selected in 'Seat Part Set'.
- Or Centre of Gravity can now be specified by inputting your own coordinates.



Create Vehicle Constraint

- Once main inputs have been defined click “**Create *BOUNDARY_SPC card**” to create vehicle constraint and contact. All the options available on "Vehicle constraint/contact" input panel are optional. It will allow you to constrain the vehicle using *BOUNDARY_SPC card.
- To create *BOUNDARY_SPC card, select "create *BOUNDARY_SPC card" option as shown below. Use "Node set for SPC" text box to provide set id for *BOUNDARY_SPC card.

SBA test set-up

Inertia loading/vehicle constraint/contact

APPLY INERTIA LOADING

Apply inertia load: ☐ ?

Default inertia load: 20 x Seat Weight ?

Inertia load: 13 ?

Scale inertia loading device: Auto ☒ ? Manual ☐ ?

Inertia loading bar length: ?

Gap b/w inertia loading bars: ?

Constrain inertia device: Extra nodes ☒ ? Rigid bodies ☐ ?

Extra node set: ? Define Sketch ?

Rigid bodies parts: ? Define Sketch ?

Seat part set for CoG: ? Define Sketch ?

Centre of gravity: Coordinates ☐ ? Part set ☐ ?

CoG coordinates: ? Sketch ?

CONSTRRAIN THE VEHICLE

Create *BOUNDARY_SPC card: ☒ ?

Node set for SPC: 81040, 4081039 Define Sketch ?

MISCELLANEOUS

Create *AUTO_SINGLE_SURFACE contact: ☒ ?

Exempted part set: 1028 Define Sketch ?

Create *SET_PART_COLLECT_TITLE: ☐ ?

Set part id: ? Define Sketch ?

Change *PART to *PART_INERTIA for body blocks ☐ ?

Load Length

Recliner nodes to connect Loading device

Loading Device

<<< Seat belt input Calculate Quit

Create Contact

- Select "create *AUTO_SINGLE_SURFACE contact" option as shown below to create a *CONTACT_AUTOMATIC_SINGLE_SURFACE with exempted part set in slave side. Impactor parts will get added automatically to the exempted part set.
- Use "Exempted part set" option to add any other part sets in the exempted set.

CONSTRAIN THE VEHICLE

Create *BOUNDARY_SPC card: ☒ ?

Node set for SPC: Define Sketch ?

MISCELLANEOUS

Create *AUTO_SINGLE_SURFACE contact: ☒ ?

Exempted part set: Define Sketch ?

Create *SET_PART_COLLECT_TITLE: ☐ ?

Set part id: Define Sketch ?

Change *PART to *PART_INERTIA for body blocks ☐ ?

<<< Seat belt input Calculate Quit

Items created by script to *SET_PART_COLLECT_TITLE

CONSTRAIN THE VEHICLE

Create *BOUNDARY_SPC card: ☒ ?

Node set for SPC: Define Sketch ?

MISCELLANEOUS

Create *AUTO_SINGLE_SURFACE contact: ☒ ?

Exempted part set: Define Sketch ?

Create *SET_PART_COLLECT_TITLE: ☒ ?

Set part id: Define Sketch ?

Change *PART to *PART_INERTIA for body blocks ☐ ?

MODIFY SET_PART M1/S_PT1999

+ Update Reset All Check Sketch Only

Cancel Copy In X-Refs Text Edit

Include: M1 <Master file>

Modify SET_PART 1999 (model 1)

Label: 1999 17 PARTs

Title: All COLLECTed sets

Edit child

This is a special 'parent' set acting as a collector for the 1 SET_PART_COLLECT definitions that use this label.

This set is for Primer usage only, giving a way of referencing all the collected sets under a single definition, and it will NOT be written out to the keyword output file.

The only editing operation you can perform is to change its label, which will automatically change the labels of all of its 'child' SET_XXX_COLLECT definitions. You can also change the title if you wish, but this will only affect the name of this set inside PRIMER.

MERGE_COLLECT will copy the contents of all child sets into this parent definition, then removes its _COLLECT suffix, converting it an ordinary _LIST set definition. If child sets are retained they too have _COLLECT removed and are given new (unique) labels.

SPLIT_COLLECT simply removes the _COLLECT suffix from parent and child sets, relabelling all children and leaving the parent empty.

Merge_COLLECT Explain this

Split_COLLECT Explain this

MODIFY SET_PART M1/S_PT1999

+ Update Reset All Check Sketch Only

Cancel Copy In X-Refs Text Edit

Include: M1 <Master file>

Modify SET_PART 1999 (model 1)

Label: 1999 17 PARTs

Title: Default set part collect

Contents Lock contents against deletion

Add... Add PART Automatic Explain this

Remove... Rem PART Unlocked

Empty... View / Edit... Locked

Convert to

LIST COLLECT ?

COLUMN

GENERATE

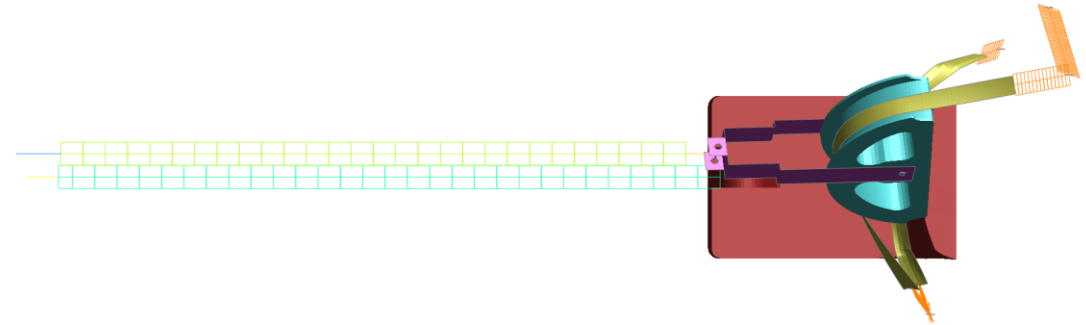
GENERATE_INCREMENT

GENERAL

INTERSECT

ADD

- Create a *SET_PART_COLLECT_TITLE to add the body blocks, seatbelt and parts created by the SBA Script so that it is out of global contact
- Take the next free ID or provide a Set Part ID to use



Body Blocks from *PART to *PART_INERTIA

- Select this option if you wish to change the Body Blocks to have the *PART_INERTIA option
- The values added into *PART_INERTIA such as total mass, inertia tensor components and coordinates of centre of mass are taken from the Body Blocks themselves using the 'Mass Prop' tool

CONSTRAIN THE VEHICLE

Create *BOUNDARY_SPC card:

☒

☐

Node set for SPC:

Define

Sketch

☐

MISCELLANEOUS

Create *AUTO_SINGLE_SURFACE contact:

☒

☐

Exempted part set:

Define

Sketch

☐

Create *SET_PART_COLLECT_TITLE:

☒

☐

Set part id:

Define

Sketch

☐

Change *PART to *PART_INERTIA for body blocks

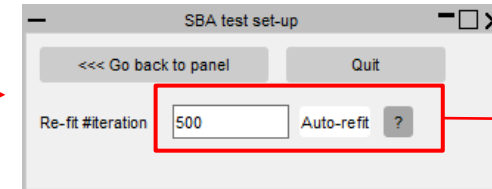
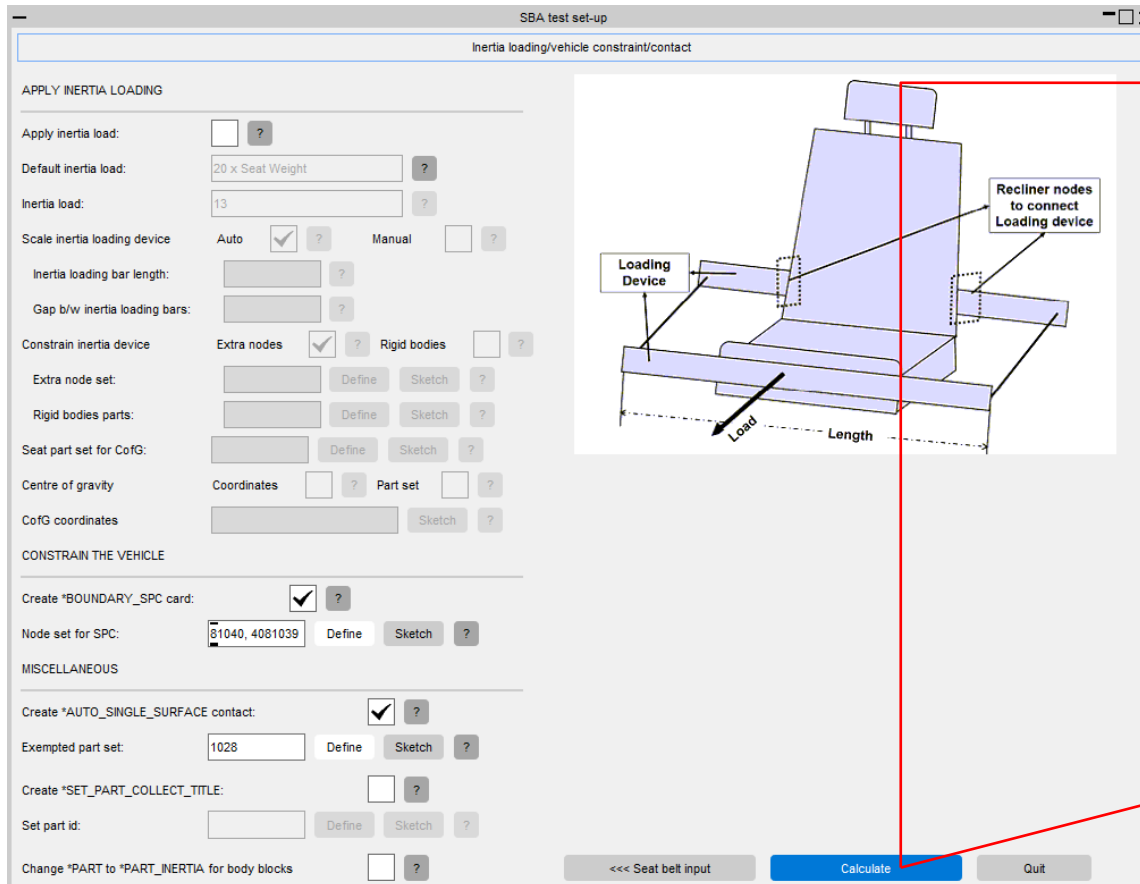
☐

☐



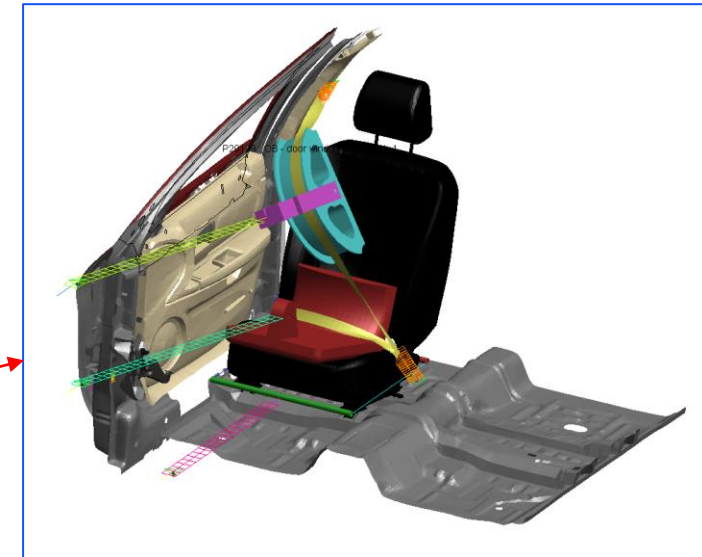
Calculate

- Once all the required inputs have been defined, **Calculate** will become active.
- Hit **Calculate** to start the calculation. After the calculation, the loading device will be positioned at R-point in the vehicle.



If belt is not fit properly, use Belt re-fitting

Output



Contact us

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