



YOUR  
TECHNOLOGY  
ADVISOR



## Customer References

Approach to the top down design  
of a railway bogie

Ing. Carmelo Siciliano

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### Presentation

- ›Client presentation
- ›Case study presentation

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- ›Optimising management in Top Down Design for PDMlink
- ›Analysing and updating the files using Modelcheck

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### Miglioramento progettuale con Creo Simulation Advanced

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### Controllo cinematico del carrello con il file di Layout



# ›01

## Presentazione del caso

### Client & Case Study presentation

- ›Creo Parametric Essentials
- ›Creo AAX (Advanced Assembly Extension)
- ›Simulation Advanced

### Client presentation

A leading Italian company in the field of rolling stock design, construction, revamping and maintenance

### Case study presentation

Completely upgrading the 3D models of a railway bogie designed years earlier to adapt them for a new design package order.

Inserting and managing the CAD models in PDMLink in order to follow their development on the basis of the product's life cycle.

## ›02

# Upgrading to the old project files

›Improving the organisation and management of the main references in the Skeleton files

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- ›Improving the organisation and management of the main references in the Skeleton files
- ›Introduced Publish Geometry features in order to allow the references to be identified and copied more quickly and easily

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```

/ A_11
/ A_12
x* Punto Riferimento ID 417
/ DTM7
/ DTM8
x* PNT_TRAV_REL_TEL
x* PNT_0_TRAV
/ A_BECCH_TRAV
/ A_ROL_TRAV
/ Curva ID 452
/ Superficie Trasformata ID 462
/ BECC_TRAV
/ ROLL_TRAV
/ A_TRAV
/ ROTA2_TRAV
/ P_NORM_ROTA2_TRAV
/ P_TRAVERSA
x* CS_MONT_TRAV
x* Punto Riferimento ID 493
/ P_SEC_TRAVERSA
x* Punto Riferimento ID 496
/ P_SEC_TELAIO
/ P_RALLA
/ P_LEVA_PATT_LONG_ANT
/ C_LEV_LONG_PAT
x* PNT_LEVA_LONG_ANT
x* CS0
x* CS1
x* CS2
x* CS3
/ P_LONG_ATTAC_LEV_PAT_TEL
/ P_TRASV_ATT_LEV_PAT_TEL
/ P_ATT_LEV_PAT_TEL
x* PNT_ATT_LEV_TEL
/ S_MOLLA_VERT_LEV_PAT
/ C_MOV_CIRC_LEV_PAT
x* PNT_ESTERNO_LEV_TRASV_PATT
/ C_LEVA_TRASV_PAT
x* PNT_INTERNO_LEV_TRASV_PATT
~ C_MOLLA_VERT_LEV_PAT
/ P_LONG_ROTAlA_750
/ A_ASSE_ROT_PAT
/ P_LONG_PAT
/ S_FENDINO_PAT
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~ C_FENDINO_PAT
x* PNT17
~ C_ATT_LEV_TEL

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/ INCLINAZIONE_LEVA_BAR_TORS_SX
/ INCLINAZIONE_LEVA_BAR_TORS_DX
/ P_ORIZ_LEVA_BAR_TORS_SX
/ P_ORIZ_LEVA_BAR_TORS_DX
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/ P_TRASV_LEVA_BAR_TORS_DX
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x* PNT_BIELLA_BAR_TORS_TEL_DX
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/ P_BIELLA_BAR_TORS_LONG_SX
/ P_BIELLA_BAR_TORS_ORIZ_SX
/ P_BIELLA_BAR_TORS_TRASV_DX
/ P_BIELLA_BAR_TORS_LONG_DX
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x* PNT_POST_ASSILE_CENTR
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x* CS_ASSILE_POST
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x* CS_STICK_UNGIBORDO_SX
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/ RIF_BARRA_TORSIONE
/ RIF_BOCCOLE
/ RIF_TRASCINAMENTO
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/ P_VERT_AMMO_TRASV_DX
/ RIF_AMMO TRASVERSALI
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x* PNT_POST_SX_SOLLEV
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~ BIELLETTA_POST_SX

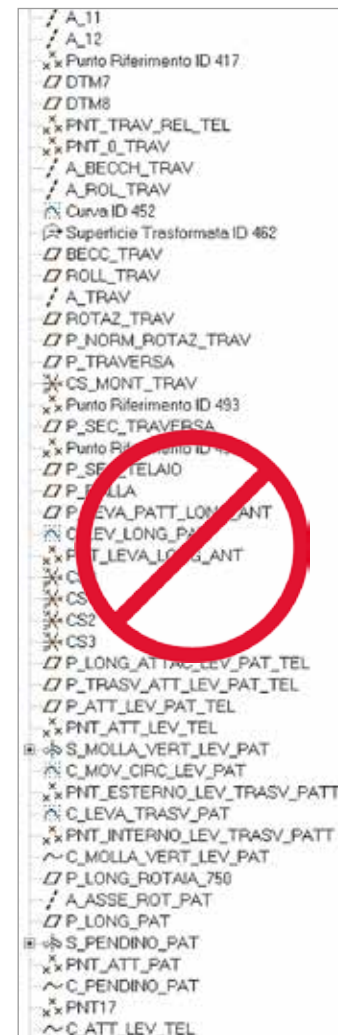
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## ›02

## Upgrading to the old project files

›Improving the organisation and management of the main references in the Skeleton files

›Introduced Publish Geometry features in order to allow the references to be identified and copied more quickly and easily



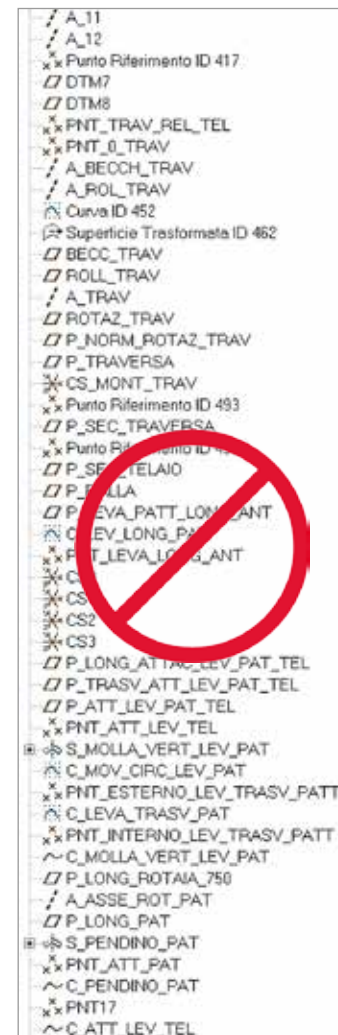


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# Upgrading to the old project files

Extended use of External Copy Geometry in place of Copy Geometry standard above all in combination with Publish Geometry.

In a shared Windchill PDMlink management environment, the link is therefore a direct one with the external reference and not with the ensemble that contains it, thereby providing evident savings in overall resources.

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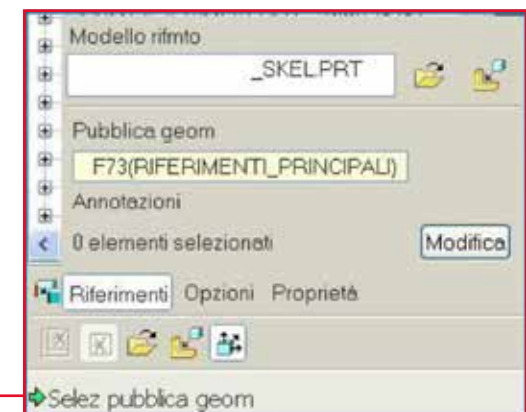


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# Upgrading the files using Modelcheck

Modelcheck analysis: standard and customizable checks for qualitatively checking 3D models.

- ›Checks on geometrical compatibility
- ›Checks on component compatibility

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Controlla ▼	
1	⚠ Arrotondamenti precoci
2	✖ Componenti collocati
3	✖ Componenti soppressi
4	✖ Controlli della geometria
5	✖ Elementi inizio
6	✖ Errori di parametro
7	✖ Feature annidate
8	✖ Feature con riferimenti di spigolo
9	✖ Feature incomplete
10	⚠ Feature Riferimento su livelli riattivati
11	⚠ Feature soppresse
12	✖ Figli arrotondamento
13	⚠ Info di dipendenze esterne
14	✖ Livelli mancanti
15	✖ Parametri di parte non iniziale
16	✖ Parametri mancanti
17	⚠ Riferimenti circolari
18	✖ Spigoli corti
19	⚠ Stato livello

# PART REPORT CONFIGURATION						
ACCURACY_INFO	YNEW	W	W	W	W	Y
ADD_CHK_PARAM	YN	N	N	N	N	N
BURIED_FEAT	YNEW	E	E	E	E	Y
CHAMFER_CHILD	YNEW	E	E	E	E	Y
CHILDREN_EXIST	YNEW	E	E	E	E	Y
COSMETIC_FEAT	YNEW	Y	Y	N	N	Y
CYL_CUT_SLOTS	YNEW	N	N	N	N	N
CYL_DIAMS	YNEW	N	N	N	N	N
DATUM_RENAME	YNEW	W	W	N	N	Y
DEF_DENSITY	YNEW	Y	Y	N	N	N
DEFAULT_CHILD	YN	Y	Y	N	N	Y
DRAFT_ANGLES	YNEW	N	N	N	N	Y
DRAFT_CHILD	YNEW	N	N	N	N	N
DTM_AXES_INFO	YN	Y	Y	N	N	Y
DTM_CSYS_INFO	YN	Y	Y	N	N	Y
DTM_CURVE_INFO	YN	Y	Y	N	N	Y
DTM_PLANE_INFO	YN	Y	Y	N	N	Y
DTM_POINT_INFO	YN	Y	Y	N	N	Y
DUPLICATE_MODELS	YNEW	W	W	W	W	Y
EARLY_CHAMFER	YNEW	W	W	N	N	Y
EARLY_COSMETIC	YNEW	N	N	N	N	N
EARLY_DRAFT	YNEW	N	N	N	N	Y
EARLY_ROUND	EENN	W	W	N	N	Y
EDGE_REFERENCES	YNEW	E	E	E	E	Y
EXTRA_LAYERS	YNEW	N	N	N	N	N

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CYL_DIAMS	YNEW	N	N	N	N	N
DATUM_RENAME	YNEW	W	W	N	N	Y
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# Upgrading the files using Modelcheck Customised check in order to:

›Check whether there are part, overall and design parameters to be added to the old files and create them should there be none →



Nome	Tipo	Operatore	Valore	☑
FORNITORE	(PDM)			☑
NOME_MODELLO	(PDM)			☑
PTC_WM_LIFECYCLE_STATE	(PDM)			☑
PTC_WM_REVISION	(PDM)			☑
RIF_NUM_TIPO	STRINGA	EQ	NULL	☑
SPECIFICA	(PDM)			☑
TRATTAMENTO	(PDM)			☑

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›Create specific parameters for PDMLink that are not present in the old models →



Part errori parametri: 7

Aggiorna

Nome	Tipo	Operatore	Valore	Γ
FORNITORE	(PDM)			✓
NOME_MODELLO	(PDM)			✓
PTC_WM_LIFECYCLE_STATE	(PDM)			✓
PTC_WM_REVISION	(PDM)			✓
RIF_NUM_TIPO	STRINGA	EQ	NULL	✓
SPECIFICA	(PDM)			✓
TRATTAMENTO	(PDM)			✓

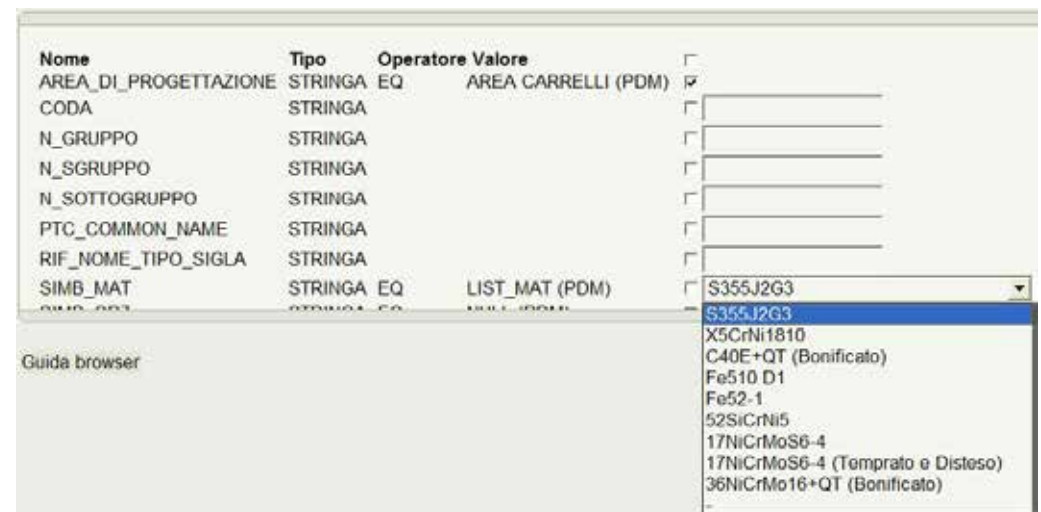
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›Modify parameter values according to default values or organised lists



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- ›Modify parameter values according to default values or organised lists
- ›Eliminate any obsolete parameters



## ›02

# Upgrading the files using Modelcheck Customised check in order to:

›Check whether there are layers to be added to the old files and create them should there be none





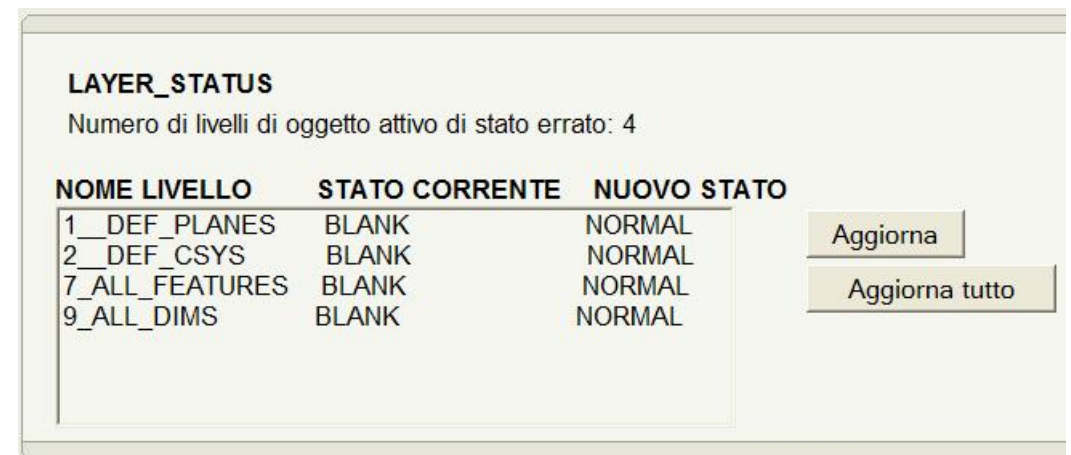
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# Riqualifica dei files con Modelcheck

## Verifica personalizzata per:

›Check whether there are layers to be added to the old files and create them should there be none

›Modify the default status of the layers



## ›02

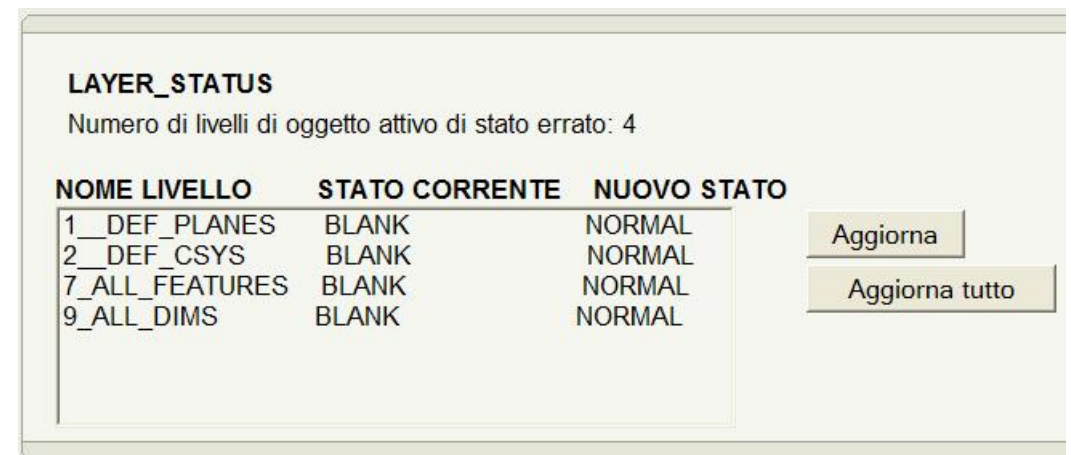
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## Verifica personalizzata per:

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›Eliminate any obsolete layers



**LAYER\_STATUS**  
Numero di livelli di oggetto attivo di stato errato: 4

NOME LIVELLO	STATO CORRENTE	NUOVO STATO
1__DEF_PLANES	BLANK	NORMAL
2__DEF_CSYS	BLANK	NORMAL
7__ALL_FEATURES	BLANK	NORMAL
9__ALL_DIMS	BLANK	NORMAL

Aggiorna  
Aggiorna tutto

## ›03

# Project design check using Creo Simulation Advanced - FEM analysis of a bolted plate:

Creo Simulation Advanced was used during the design phase to check components with critical operating conditions.

For example, it was necessary to carry out a structural analysis of a buffer plate according to new rules that were not in place when the old design package was produced.

The Creo Simulation Advanced analysis allowed the geometry to be rapidly modified in order to improve resistance as well as compliance with reference standards.

## &gt;03

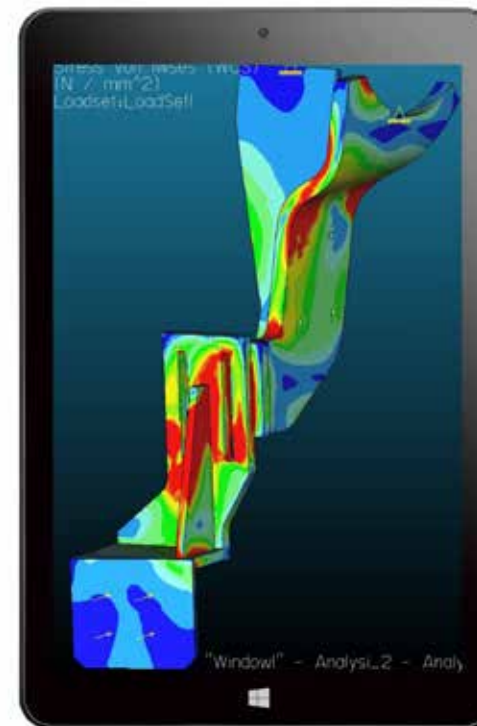
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Initial configuration



Final configuration



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A more sophisticated check was carried out by simulating the bolts with the Fasteners features of Creo Simulation Advanced.

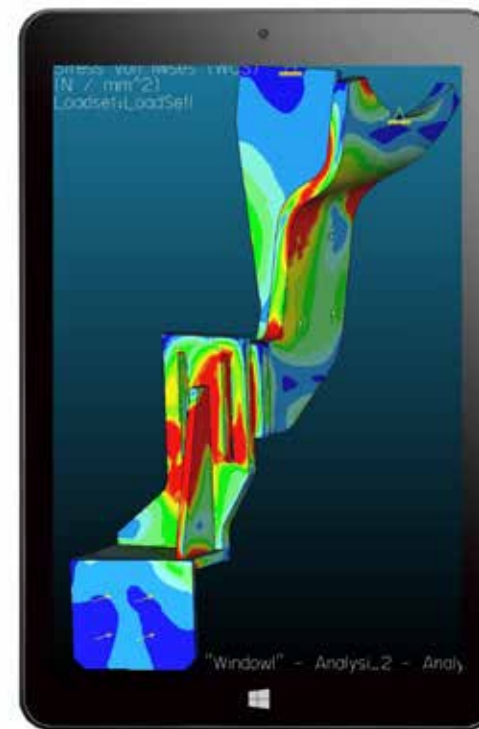
It was possible to analyse and quantify:

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It was possible to analyse and quantify:  
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## ›03

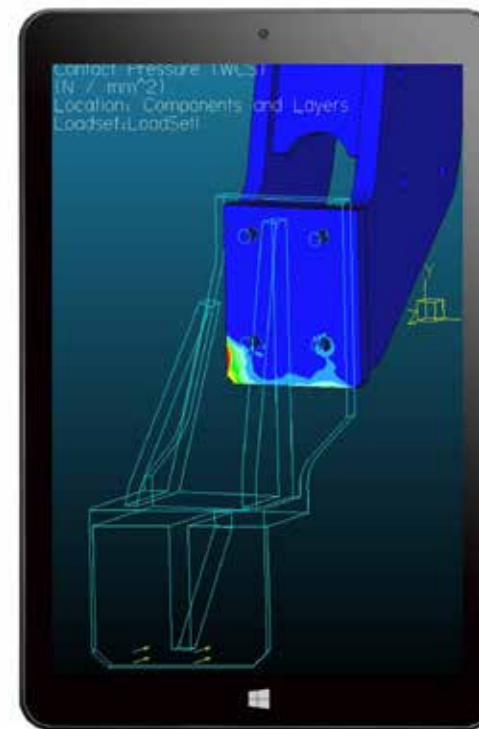
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- ›the real contact of the plate against its support base during strain



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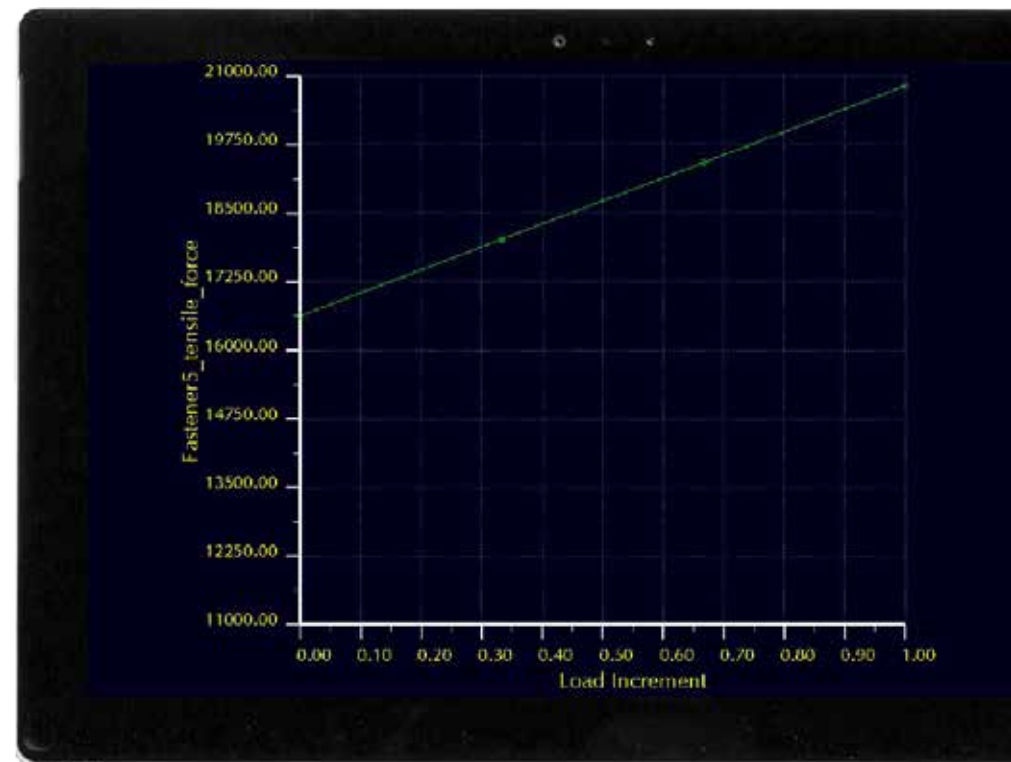
A more sophisticated check was carried out by simulating the bolts with the Fasteners features of Creo Simulation Advanced.

It was possible to analyse and quantify:

- ›the contribution of screw resistance

- ›the real contact of the plate against its support base during strain

- ›Variation of pre-loads on the screws before and after strain



## ›04

# Kinematic simulation of the bogie: Skeleton + Layout

In a complex project design package such as a railway bogie, it can be decisive to be able to simulate the real movements of the various assemblies.

It will thus be possible to better understand bogie behaviour in non-stationary conditions starting off with checking interferences and cable and hose movements.

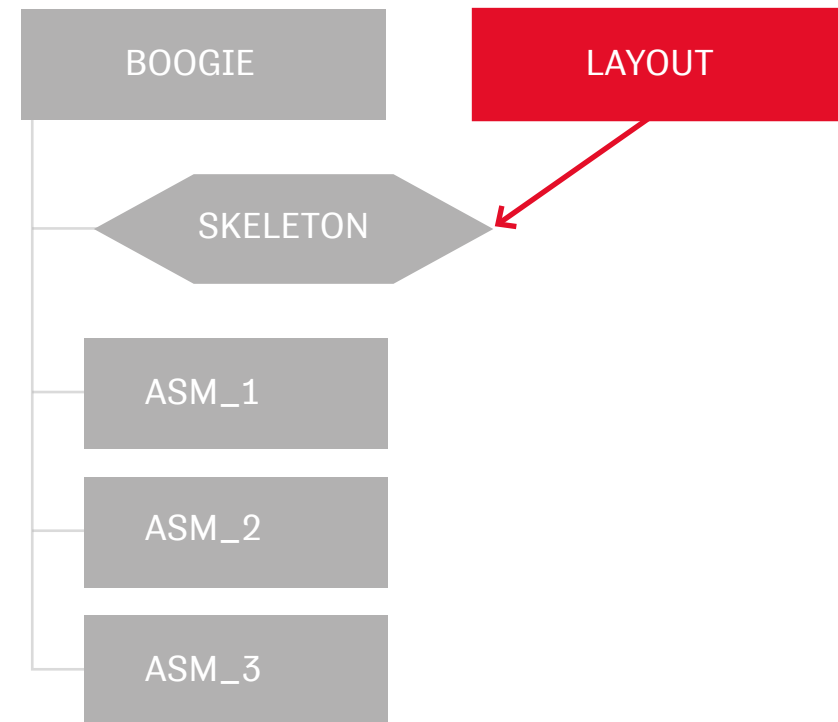
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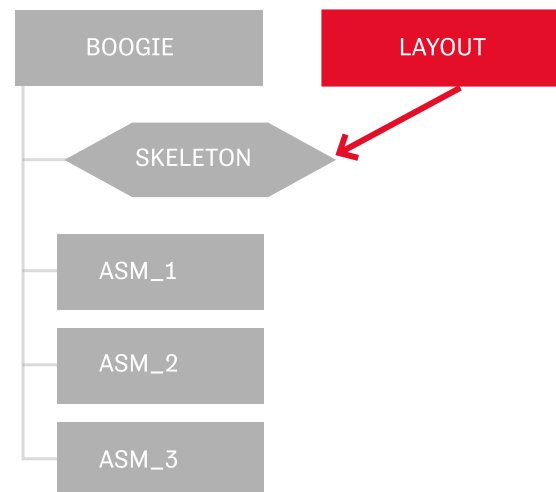
It will thus be possible to better understand bogie behaviour in non-stationary conditions starting off with checking interferences and cable and hose movements.

By connecting the Layout file to the Skeleton file, the former can be used, immediately and in a rule-based manner, to handle movement-related dimension modifications.



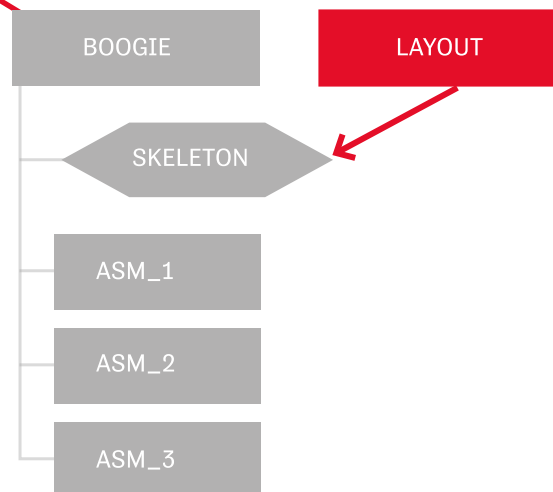
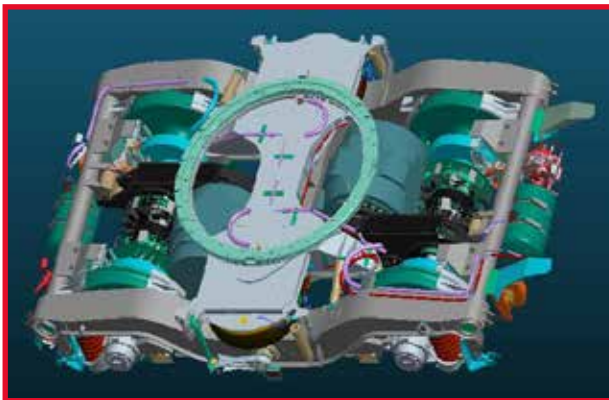
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# Kinematic simulation of the bogie: Skeleton + Layout



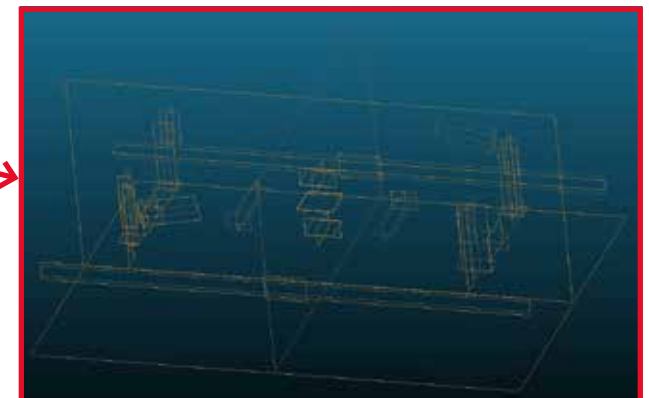
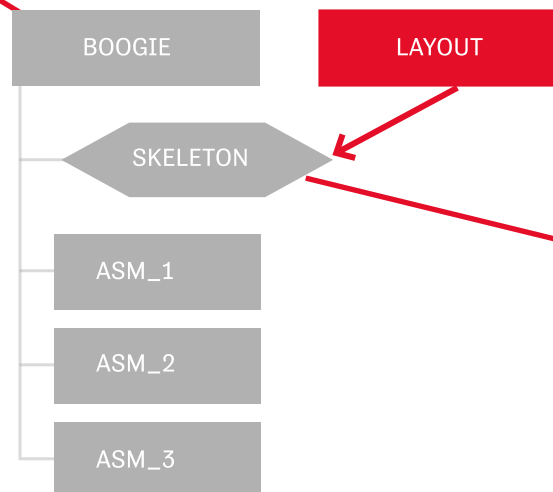
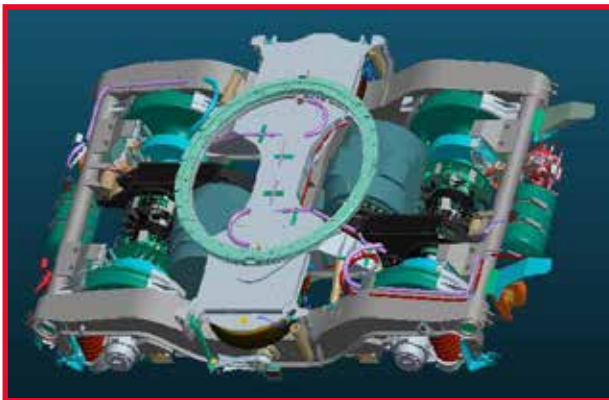
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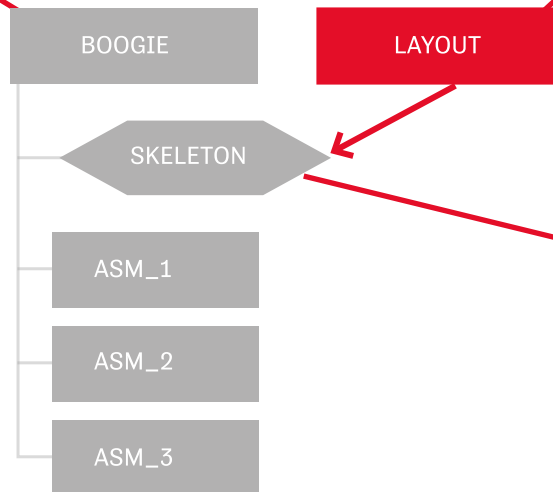
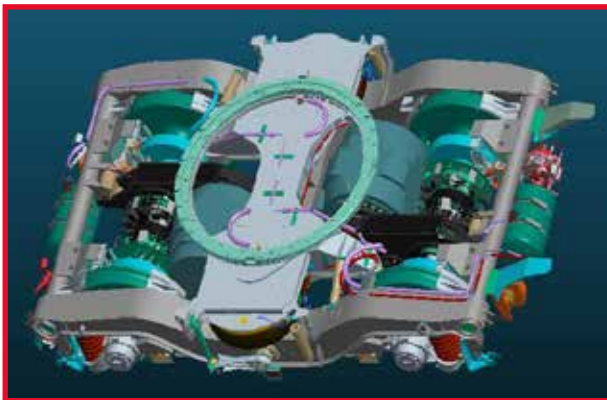
## ›04

# Kinematic simulation of the bogie: Skeleton + Layout

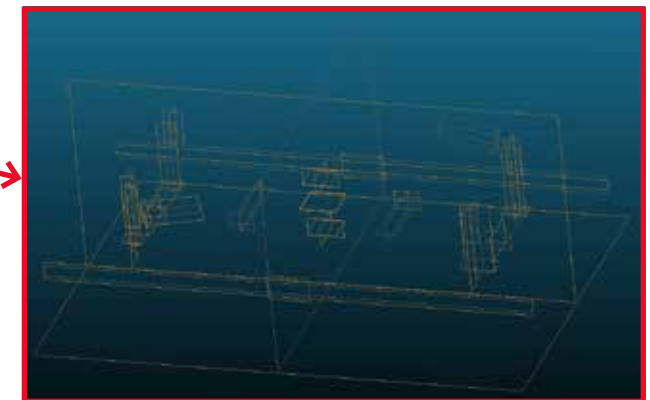


# >04

## Kinematic simulation of the bogie: Skeleton + Layout



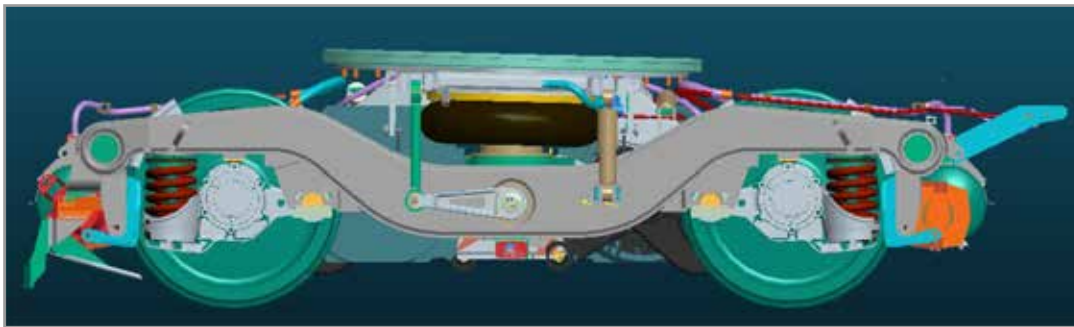
PARAMETRO	VALORI SCALA	VALORI (CORRENTI)
Reset ai valori di default	YES / NO	<b>NO</b>
SOSPENSIONE PRIMARIA		
Caricamento verticale primaria Z	± 25	<b>-25</b>
Movimento trasversale primaria Y	± 5	<b>0</b>
Movimento longitudinale primaria X	± 5	<b>0</b>
MOVIMENTI CASSA-CARRELLI		
Angolo di rotolamento trasversale	± 1,5°	<b>0</b>
Angolo di beccheggio trasversale	± 1,5°	<b>15</b>
Rotazione trasversale oscillante	± 0,5°	<b>0</b>
SOSPENSIONE SECONDARIA		
Caricamento verticale secondaria Z	+60 / +25	<b>0</b>
Movimento trasversale secondaria Y	± 35	<b>0</b>
Movimento longitudinale secondaria X	± 5	<b>0</b>
SECONDI STANDARD		
Min. distanza cassa-carrello ANTI SX	1	<b>0</b>
Min. distanza cassa-carrello ANTI DX	2	
Min. distanza cassa-carrello POST SX	3	
Min. distanza cassa-carrello POST DX	4	
Max. distanza cassa-carrello ANTI SX	5	
Max. distanza cassa-carrello ANTI DX	6	
Max. distanza cassa-carrello POST SX	7	
Max. distanza cassa-carrello POST DX	8	
Min. distanza cassa-carrello (con rotolli) ANTI SX	9	
Min. distanza cassa-carrello (con rotolli) ANTI DX	10	
Min. distanza cassa-carrello (con rotolli) POST SX	11	
Min. distanza cassa-carrello (con rotolli) POST DX	12	



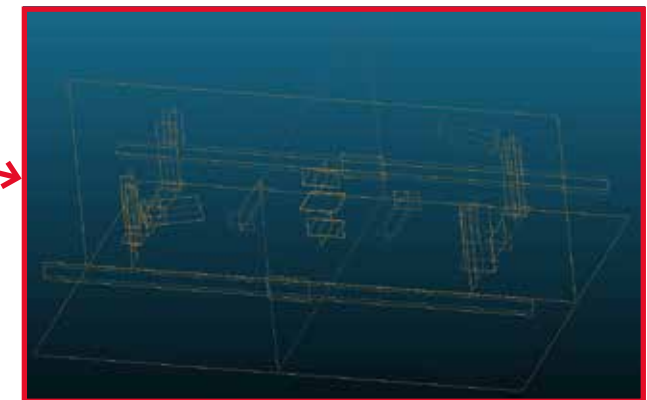
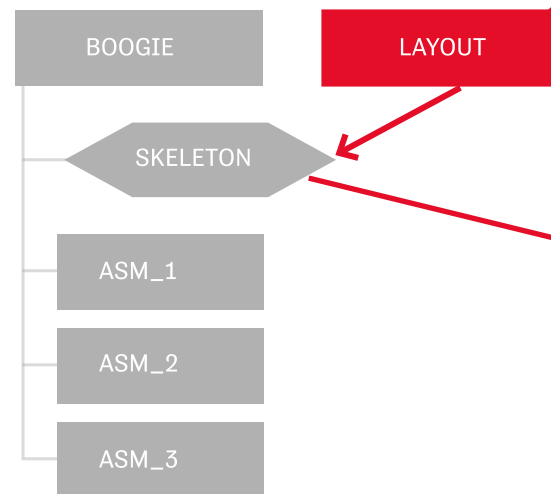


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## Kinematic simulation of the bogie: Skeleton + Layout

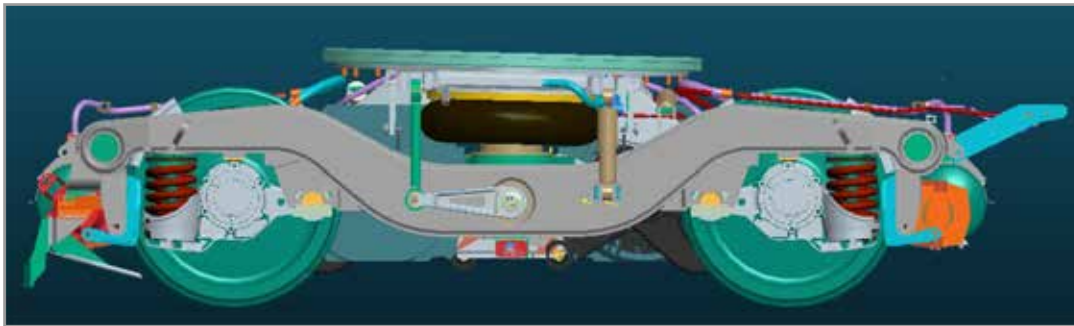


PARAMETRO	VALORI SCALA	VALORI (CORRENTI)
Reset ai valori di default	YES / NO	<b>NO</b>
SOSPENSIONE PRIMARIA		
Caricamento verticale primaria Z	± 25	<b>-25</b>
Movimento trasversale primaria Y	± 5	<b>0</b>
Movimento longitudinale primaria X	± 5	<b>0</b>
MOVIMENTI CASSA-CARRELLI		
Angolo di rollio traversa	± 1,5°	<b>0</b>
Angolo di beccheggio traversa	± 1,5°	<b>15</b>
Rotazione traversa oscillante	± 0,5°	<b>0</b>
SOSPENSIONE SECONDARIA		
Caricamento verticale secondaria Z	+60 / +25	<b>0</b>
Movimento trasversale secondaria Y	± 35	<b>0</b>
Movimento longitudinale secondaria X	± 5	<b>0</b>
SELEZIONI STANDARD		
Min. distanza cassa-carrello ANT SX	1	<b>0</b>
Min. distanza cassa-carrello ANT DX	2	
Min. distanza cassa-carrello POST SX	3	
Min. distanza cassa-carrello POST DX	4	
Max. distanza cassa-carrello ANT SX	6	
Max. distanza cassa-carrello ANT DX	7	
Max. distanza cassa-carrello POST SX	8	
Max. distanza cassa-carrello POST DX	9	
Min. distanza cassa-carrello (con rollio) ANT SX	10	<b>0</b>
Min. distanza cassa-carrello (con rollio) ANT DX	11	
Min. distanza cassa-carrello (con rollio) POST SX	12	<b>0</b>
Min. distanza cassa-carrello (con rollio) POST DX	13	

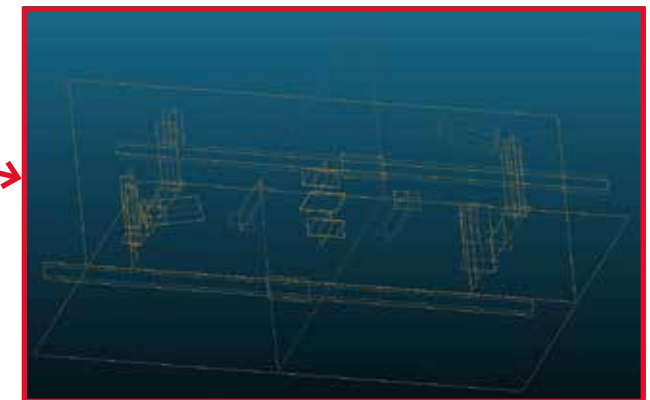
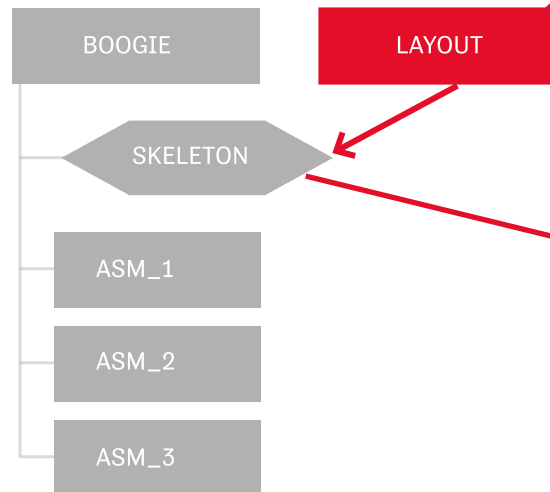


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## Kinematic simulation of the bogie: Skeleton + Layout

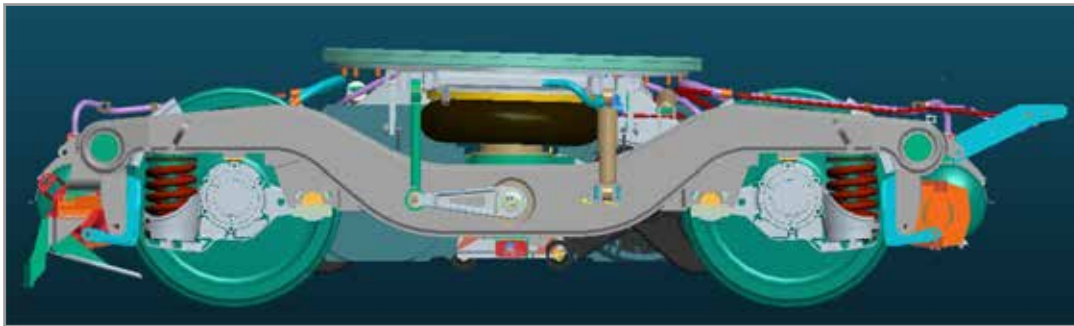


PARAMETRO	VALORI SCALA	VALORI LORRENTI
Reset ai valori di default	YES / NO	NO
SOSPENSIONE PRIMARIA		
Capinotte verticale primaria Z	± 25	-25
Maximale trasversale primaria Y	± 5	0
Movimento longitudinale primaria X	± 5	0
MOVIMENTI CASSA-CARRELLI		
Angolo di rotto trasversa	± 1,5°	0
Angolo di beccheggio trasversa	± 1,5°	15
Rotazione trasversa oscillante	± 1,5°	0
SOSPENSIONE SECONDARIA		
Capinotte verticale secondaria Z	+60 / +25	0
Movimento trasversale secondaria Y	± 35	0
Movimento longitudinale secondaria X	± 5	0
SEGNALI STANDARD		
Min. distanza cassa-carrello ANT SX	5	0
Min. distanza cassa-carrello ANT DX	5	
Min. distanza cassa-carrello POST SX	5	
Min. distanza cassa-carrello POST DX	5	
Max. distanza cassa-carrello ANT SX	6	
Max. distanza cassa-carrello ANT DX	6	
Max. distanza cassa-carrello POST SX	7	
Max. distanza cassa-carrello POST DX	8	
Min. distanza cassa-carrello (con rotoli) ANT SX	9	0
Min. distanza cassa-carrello (con rotoli) ANT DX	10	
Min. distanza cassa-carrello (con rotoli) POST SX	11	
Min. distanza cassa-carrello (con rotoli) POST DX	12	

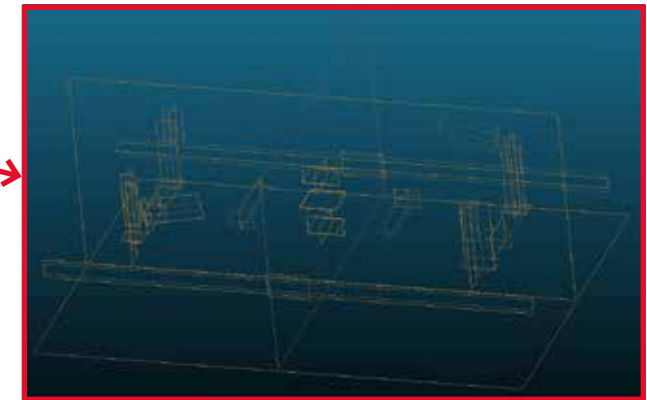
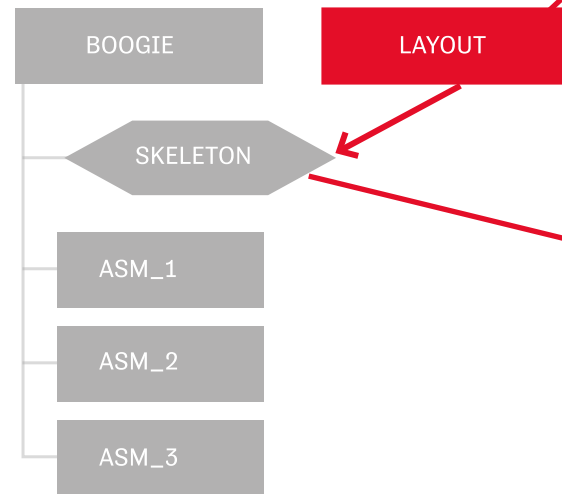


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## Kinematic simulation of the bogie: Skeleton + Layout



PARAMETRO	VALORI SCALA	VALORI LORRENTI
Reset ai valori di default	YES / NO	NO
SOSPENSIONE PRIMARIA		
Capinote verticale primaria Z	± 25	-25
Maximale trasversale primaria Y	± 5	0
Movimento longitudinale primaria X	± 5	0
MOVIMENTI CASSA-CARRELLI		
Angolo di rotto trasversa	± 1,5°	0
Angolo di beccheggio trasversa	± 1,5°	15
Rotazione trasversa oscillante	± 1,5°	0
SOSPENSIONE SECONDARIA		
Capinote verticale secondaria Z	+60 / +25	0
Movimento trasversale secondaria Y	± 35	0
Movimento longitudinale secondaria X	± 5	0
SCENARI STANDARD		
Min. distanza cassa-carrello ANT SX	5	0
Min. distanza cassa-carrello ANT DX	5	
Min. distanza cassa-carrello POST SX	5	
Min. distanza cassa-carrello POST DX	5	
Max. distanza cassa-carrello ANT SX	6	
Max. distanza cassa-carrello ANT DX	6	
Max. distanza cassa-carrello POST SX	7	
Max. distanza cassa-carrello POST DX	8	
Min. distanza cassa-carrello (con rotoli) ANT SX	9	
Min. distanza cassa-carrello (con rotoli) ANT DX	10	
Min. distanza cassa-carrello (con rotoli) POST SX	11	
Min. distanza cassa-carrello (con rotoli) POST DX	12	



## ›04 Conclusions

The examples shown here can become standard practice for handling complex designs and products, such as a railway bogie, within a PdmLink management environment and making the best use of the Top Down Design method.

**Publish&ExternalCopyGeometry** and the Layout file simplify access to the information and the main references in a Top Down Design environment.

**Modelcheck** not only allows the geometrical correctness of each model to be checked, it also allows one to verify whether all the files have parameters that comply with company standards and that they use the same company-compliant working techniques for any files that are to be exchanged with out-sourced design studios.

**Creo Simulation Advanced** proves to be precious in each design phase as an FEM module for analysing components that are subject to strain and deformation states that were not known a priori and that are to be modified from the point of view of shape or material.

All this guarantees and reduces the overall design timeframes as much as possible.

Thank you!



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