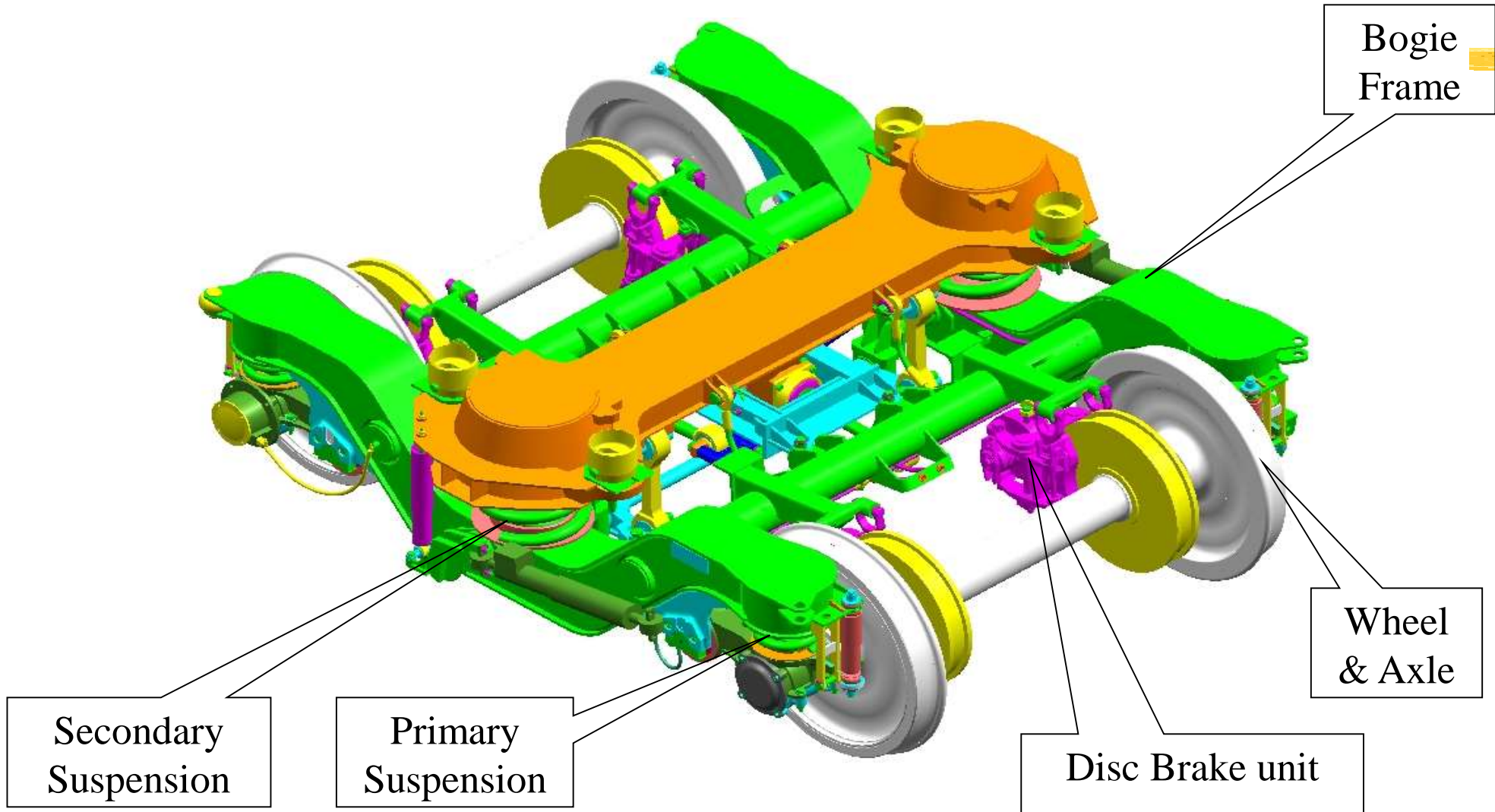
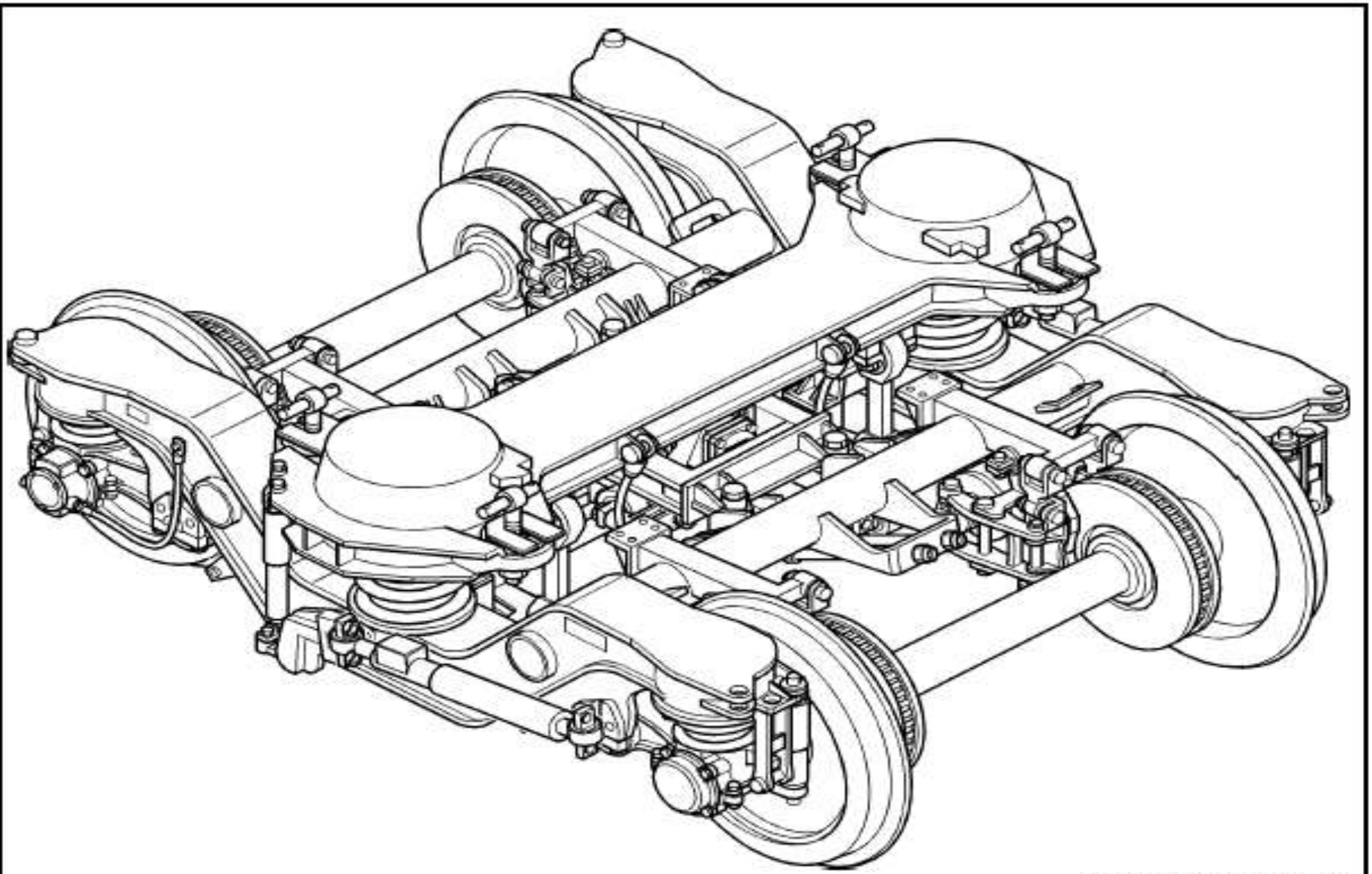


- **Design obtained from m/s ALSTOM-LHB, Germany as part of LHB-tot contract**
- **Adapted at RCF for various coach variants**
- **Fit to run up to 180 kmph**
- **Superior ride quality**
  - **Bump stops in primary and secondary suspension**
  - **Miner pads in secondary suspension**
  - **Yaw, lateral and vertical dampers**
  - **Nested spring sets with 2 helical and one rubber spring in secondary**
- **Less wear and tear**

(Complete Assembly)



# **BOGIE GENERAL ARRANGEMENT**





# BOGIE FRAME





# **DESIGN FEATURES:**

# **FIAT BOGIE**



## **SUB-SYSTEMS**

# **BOGIE FRAME**

- Solid welded frame -steel sheets(st-52) and forged, steel cast parts to material gs20mn5v;din 17182 (weldable).
- Two side frames connected by two cross beams - support brake units.  
various brackets on frame.
- The bogie frame rests on the primary suspension spring units and supports the vehicle body by means of a bolster beam. the bolster beam is connected to the bogie frame by secondary suspension.

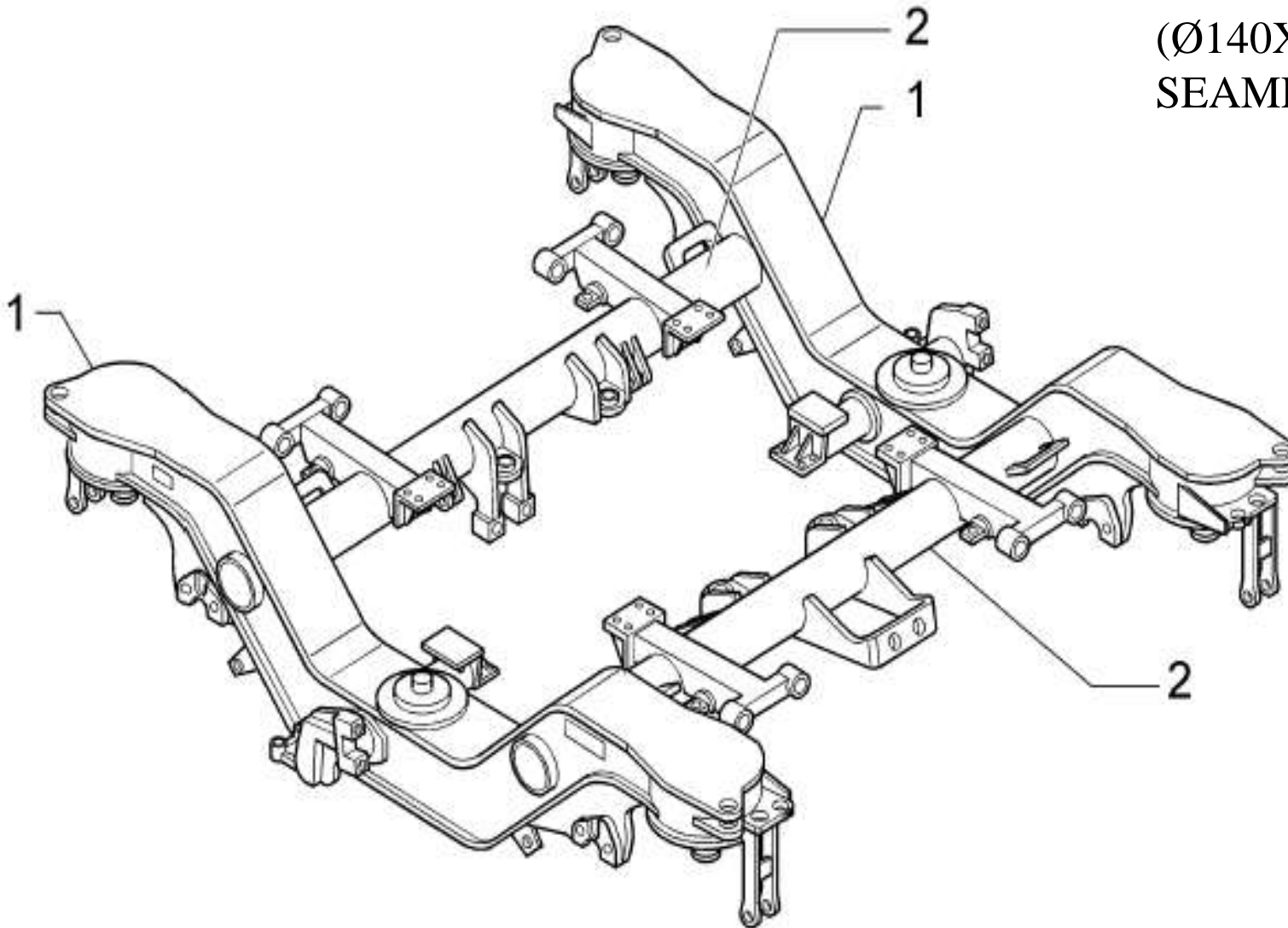


# BOGIE FRAME

1.-SIDE FRAME

2.-CROSS BEAM

(Ø140X Ø168X2506  
SEAMLESS PIPE)



# Primary suspension

- ⌘ Two coil springs, one vertical damper, articulated control arm, elastic joints connecting the axle bearing to the bogie frame
- ⌘ Better curve negotiation.

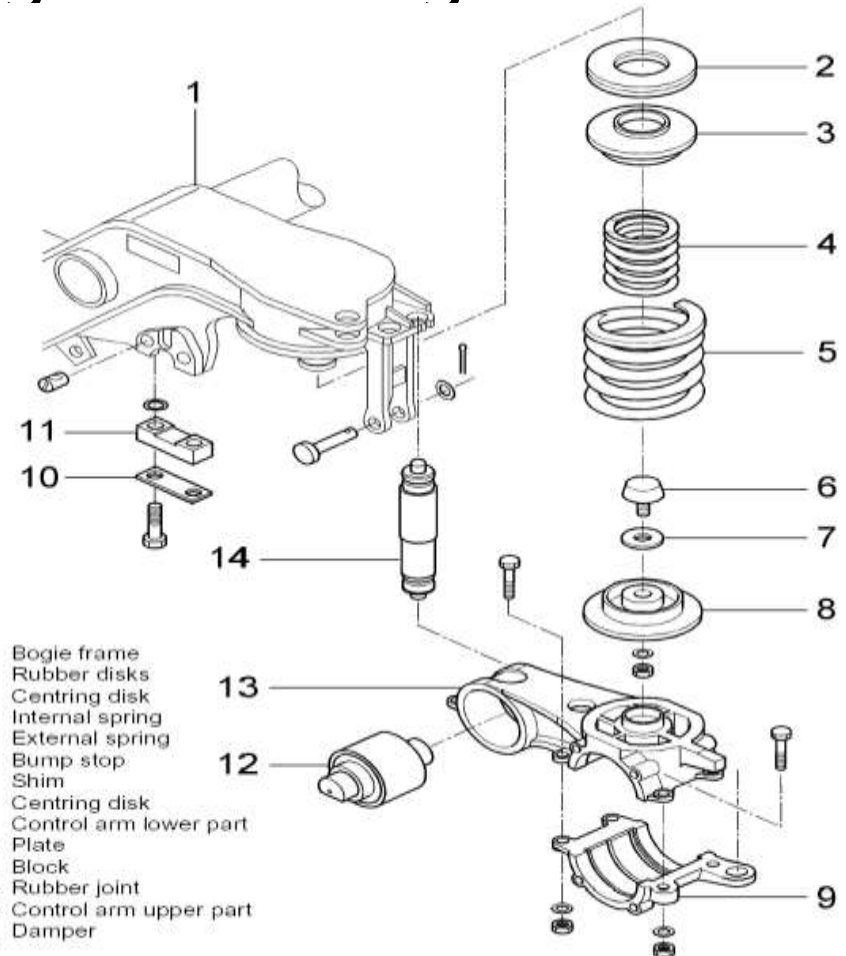
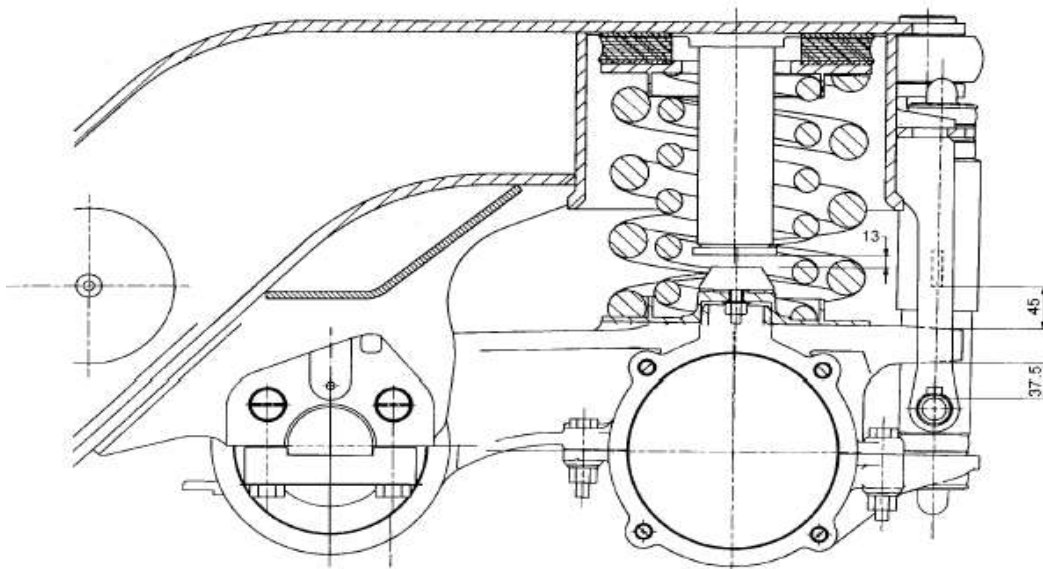
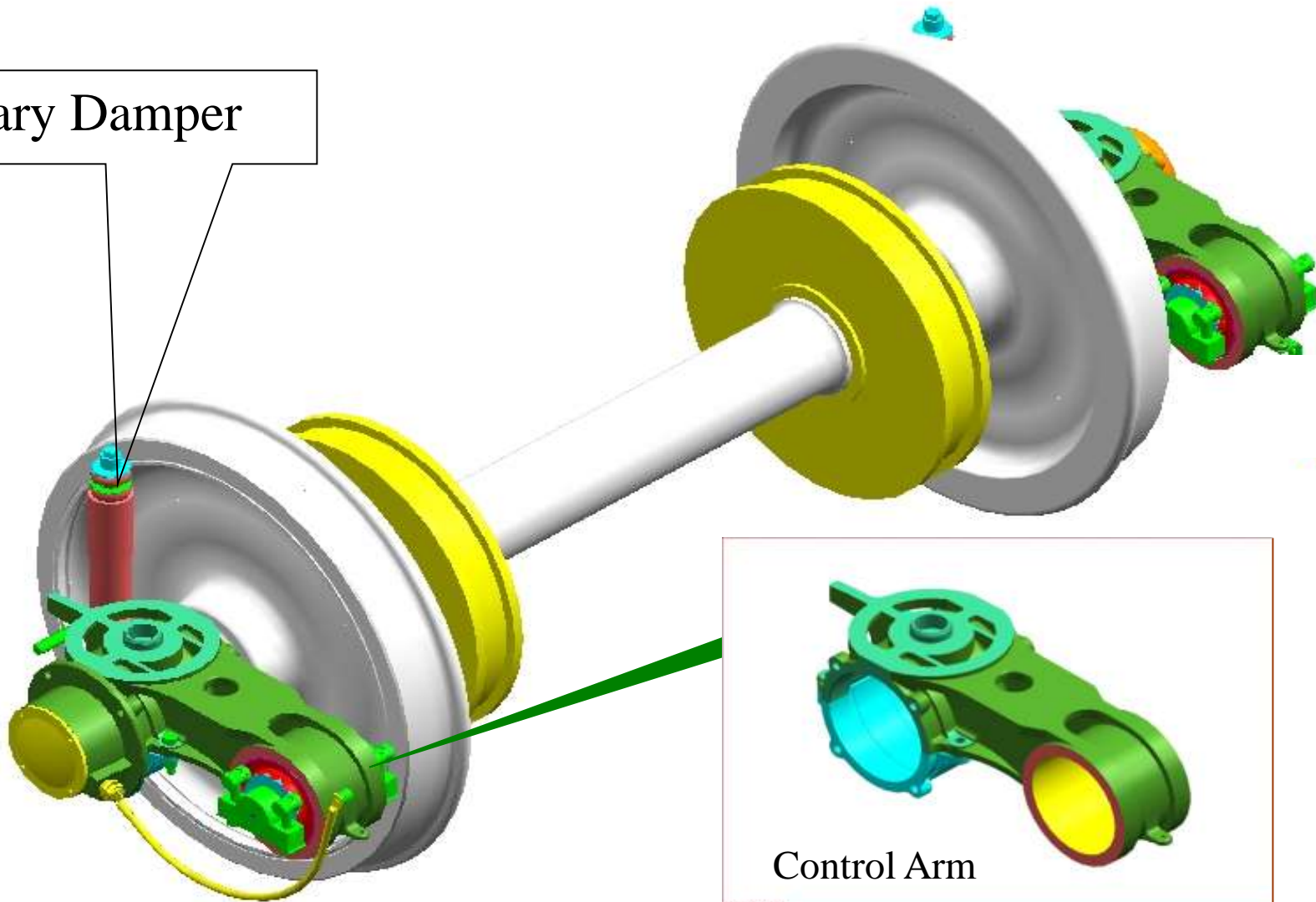


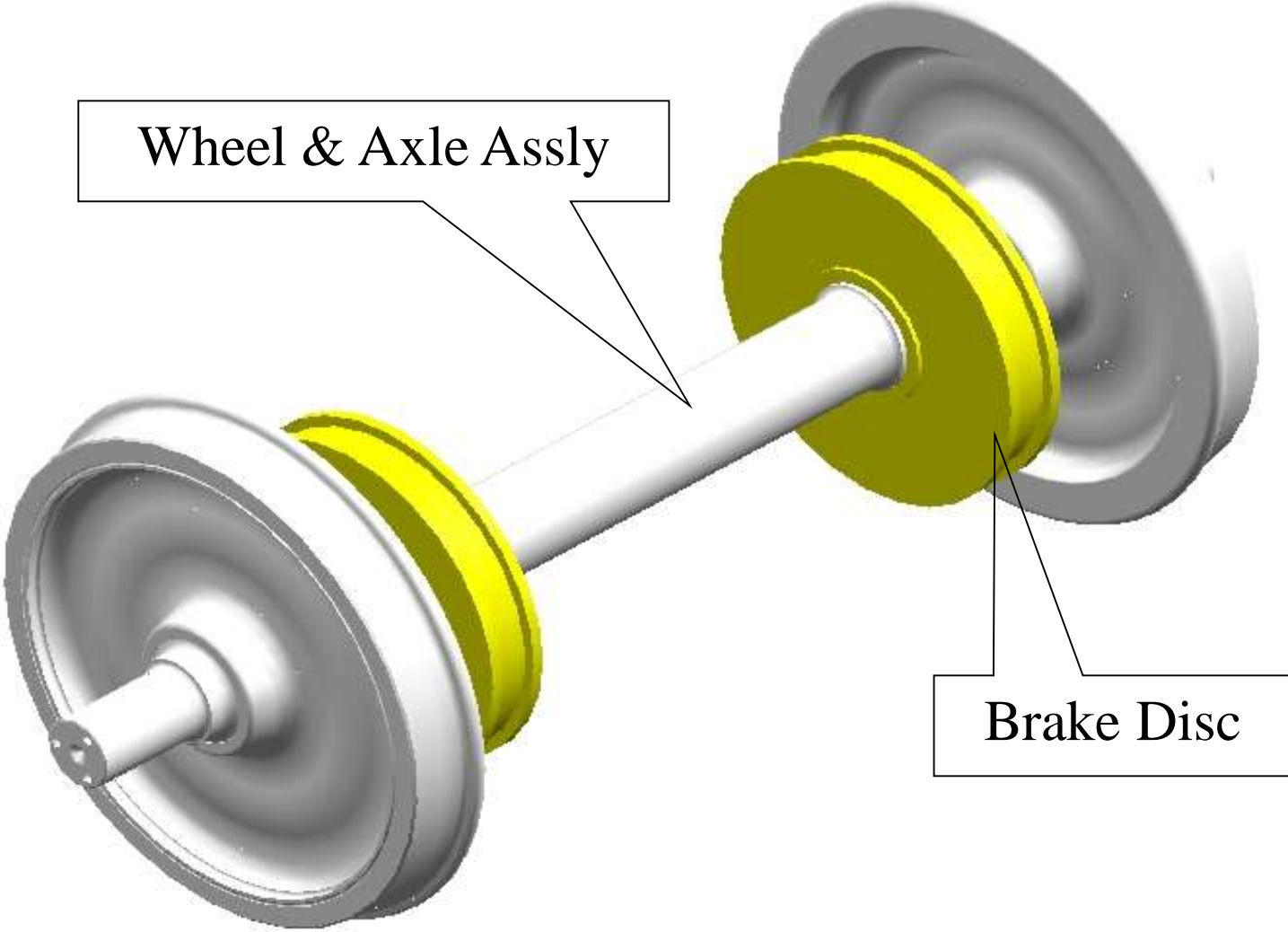
FIG. 1-8 PRIMARY SUSPENSION

(Wheel set with Primary springs removed)

Primary Damper



Control Arm

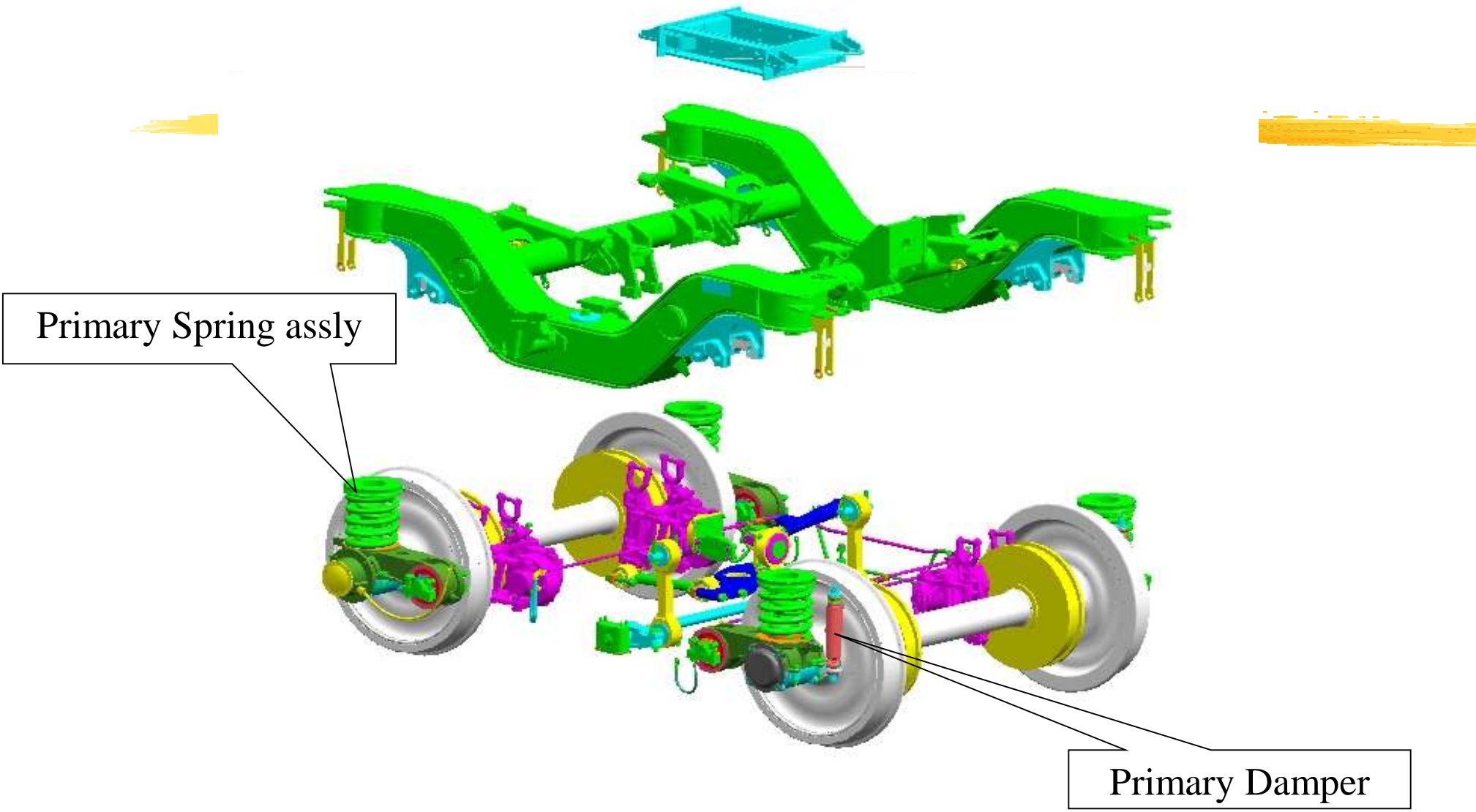


Wheel & Axle Assly

Brake Disc



(Bogie frame lifted)

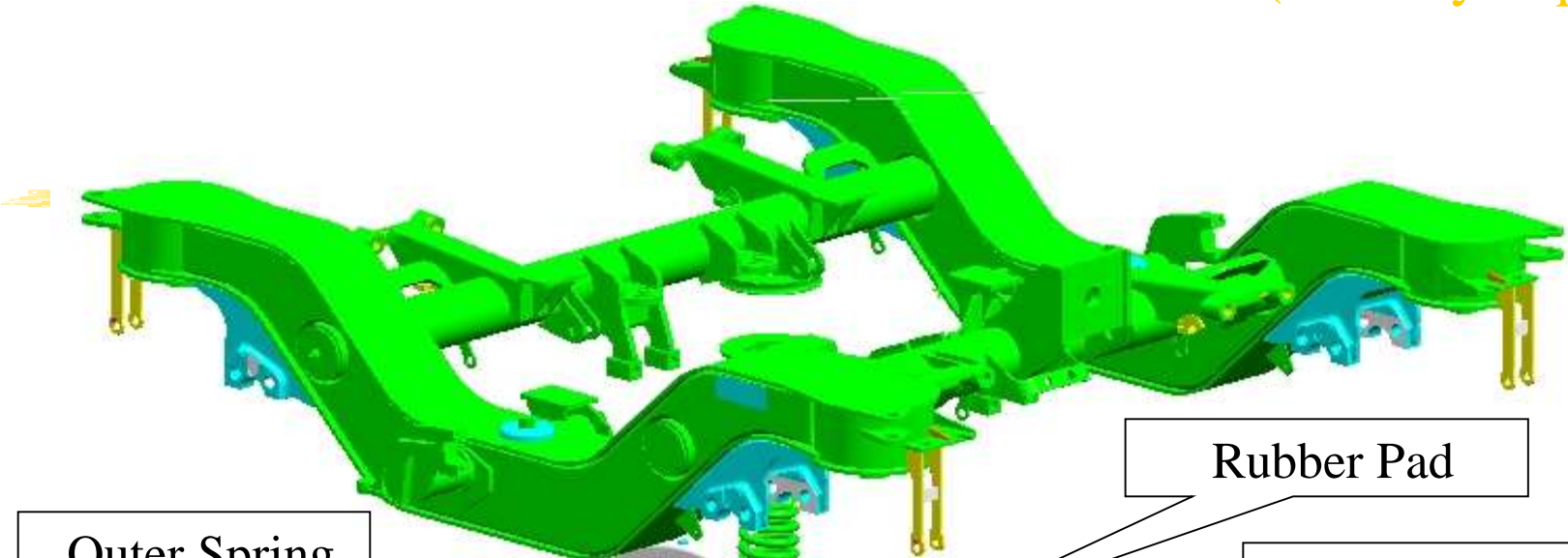


Primary Spring assly

Primary Damper



(Primary exploded)



Rubber Pad

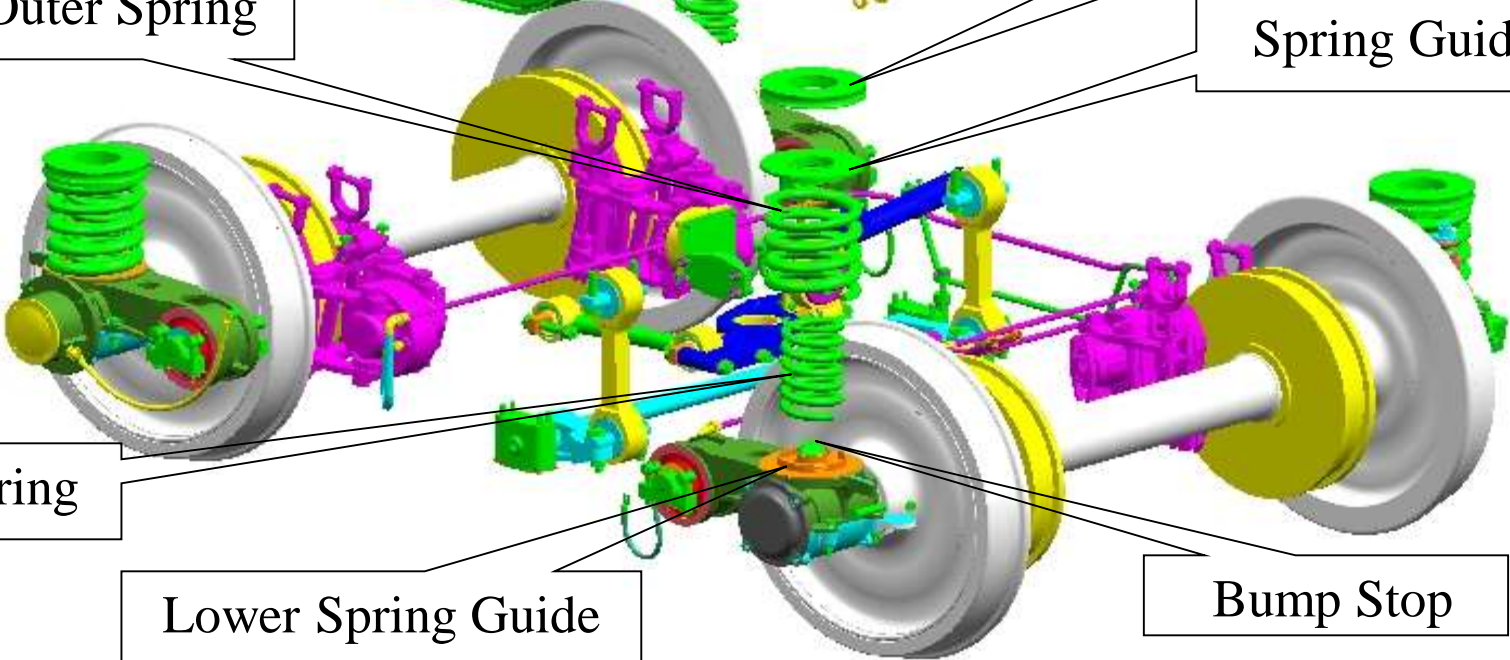
Outer Spring

Spring Guide

Inner Spring

Lower Spring Guide

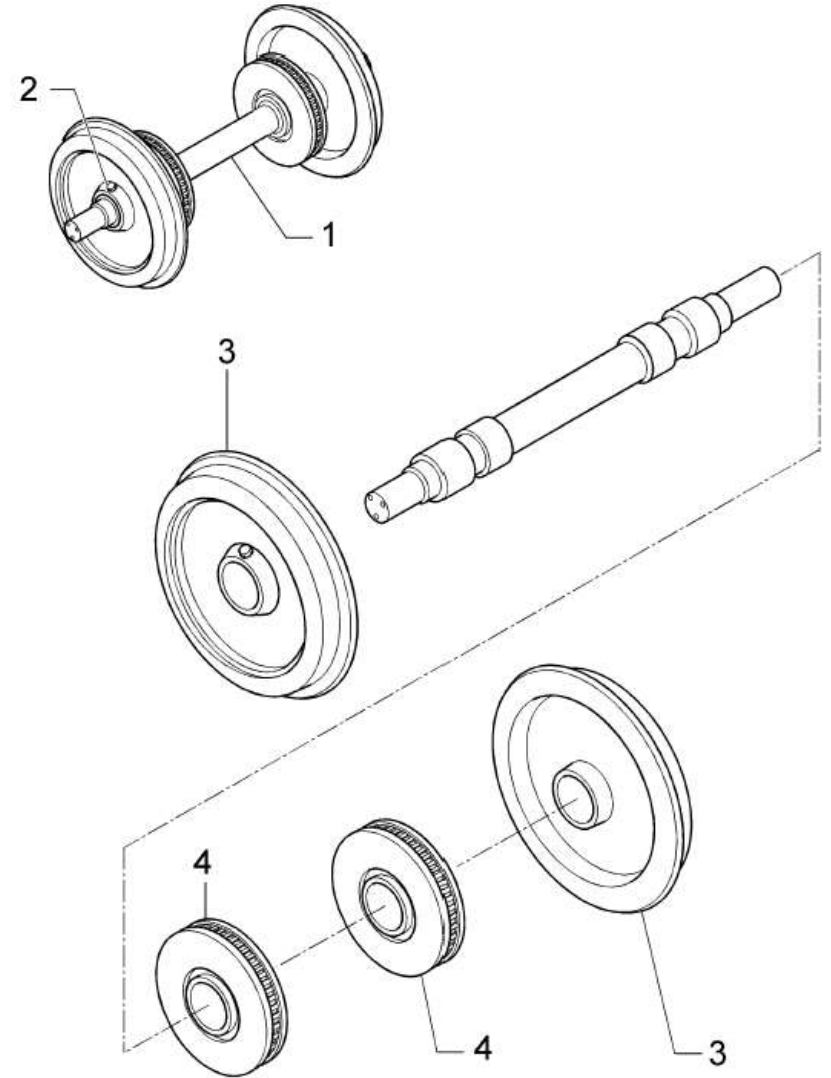
Bump Stop





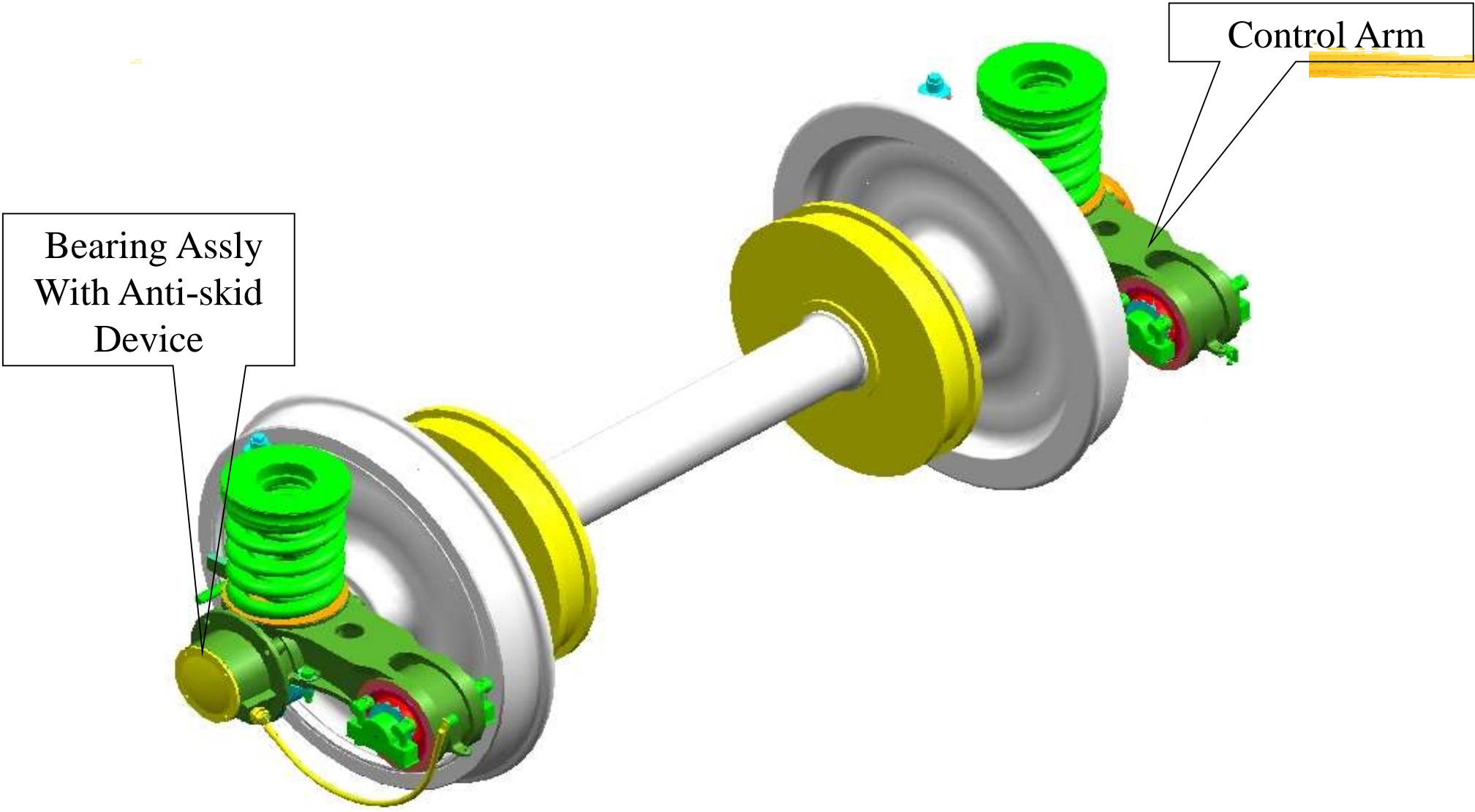
# Wheel and Axles

- ⌘ Two brake disks (4), diameter 640 mm and width 110 mm.
- ⌘ Two wheel disc of tread dia 915mm (New), 855mm (worn).



1. Axle
2. Plug
3. Wheel
4. Brake disk

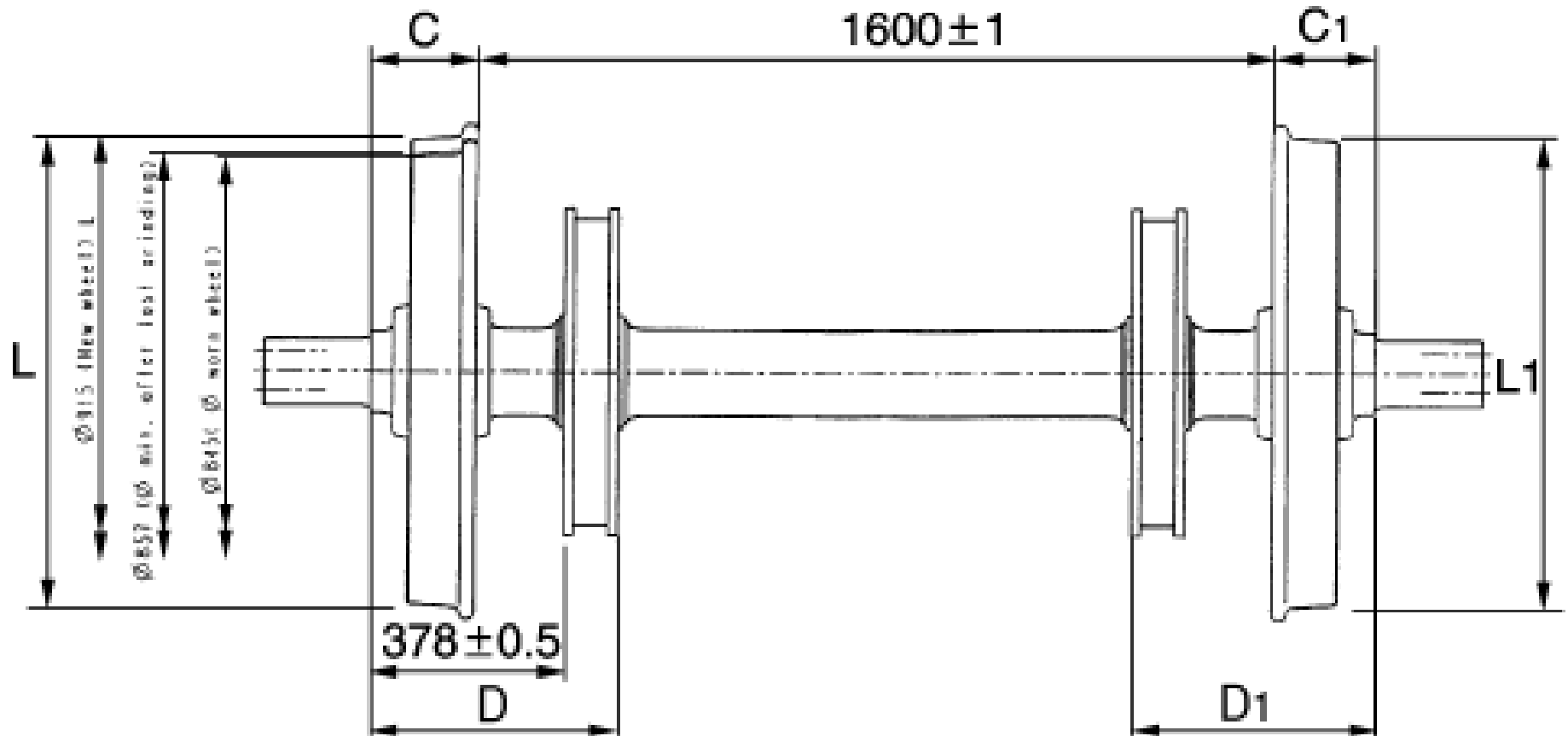
(Wheel set with Primary suspension)



Bearing Assly  
With Anti-skid  
Device

Control Arm

# DIMENSIONS OF WHEEL SET:



The following differences must be respected:

$$|L - L_1| \leq 0.5 \text{ mm}$$

$$|C - C_1| \leq 0.5 \text{ mm}$$

$$|D - D_1| \leq 0.5 \text{ mm}$$

# Wheel Disc:

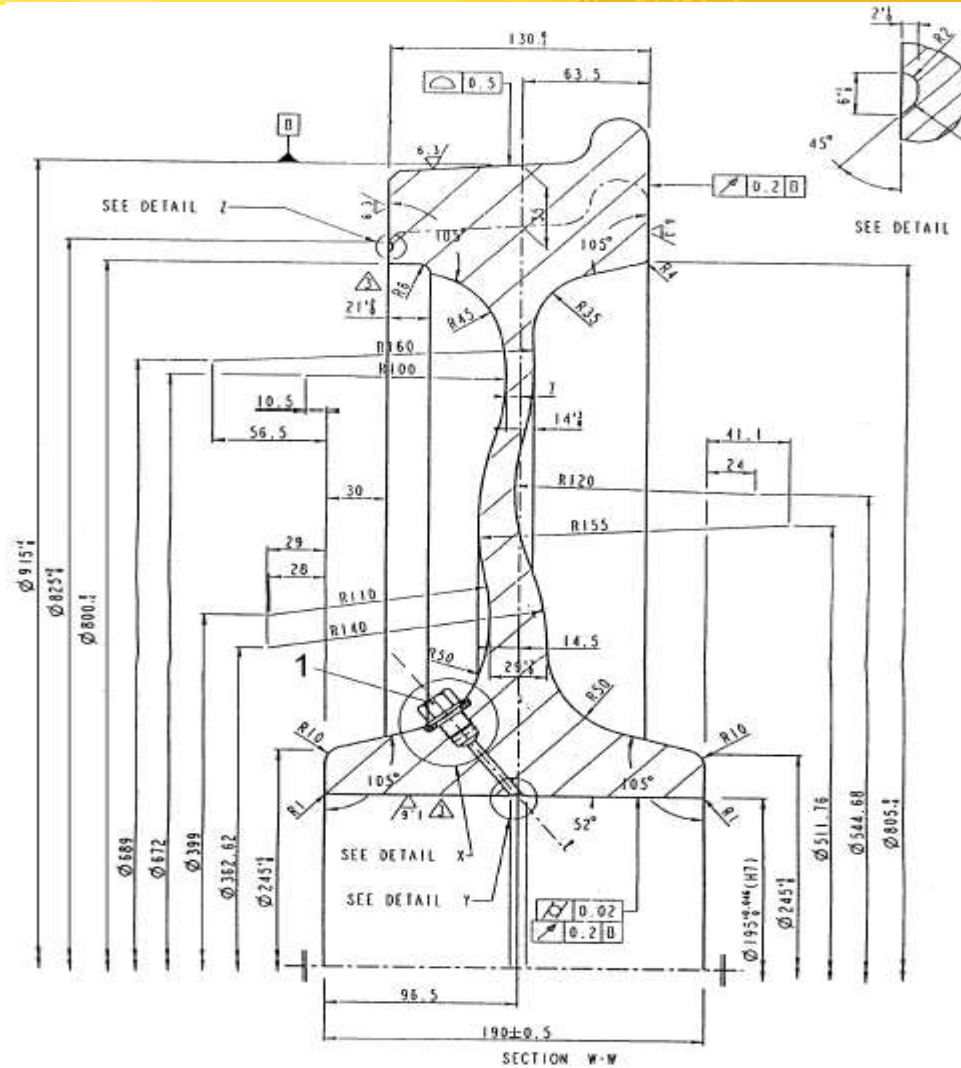


FIG. 4-3 WHEEL PROFILE

# Axle bearings

- ⌘ Taper roller cartridge type bearing
- ⌘ Pre-assembled unit.
- ⌘ Maintenance free- overhaul 1.2 million km.
- ⌘ Sensors for detecting speed

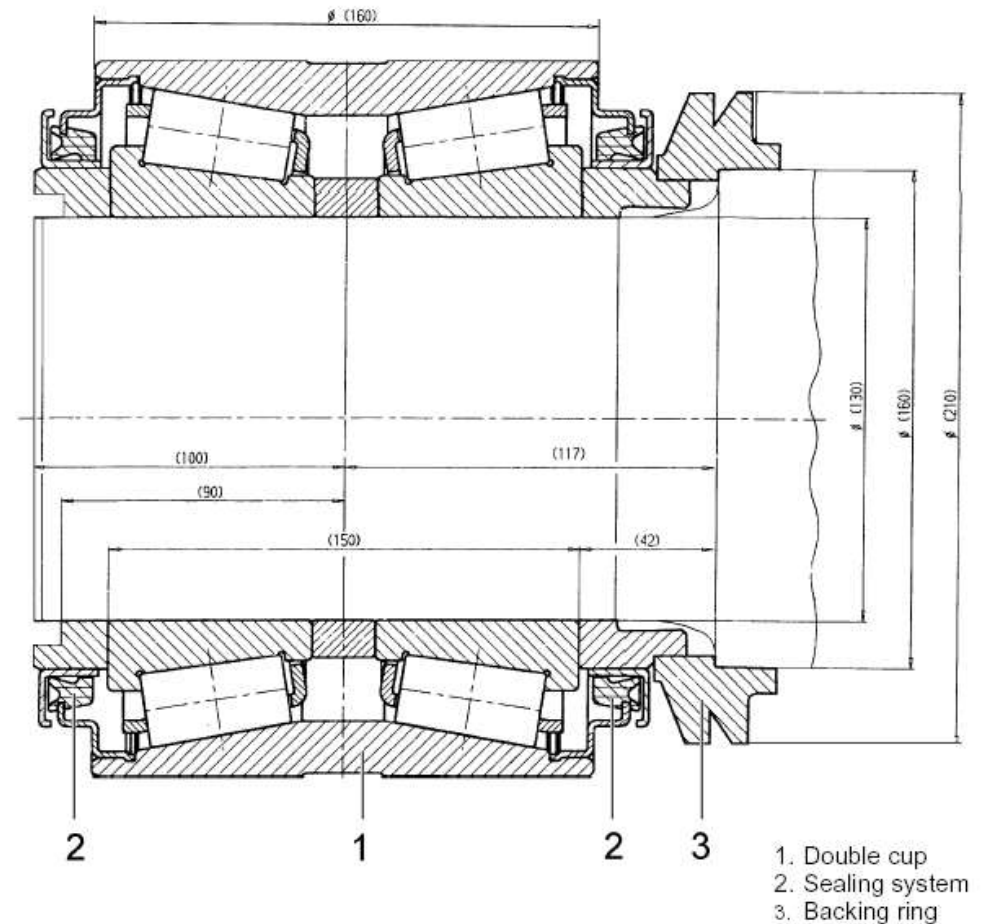


FIG. 1-4 AXLE BEARING LONGITUDINAL SECTION

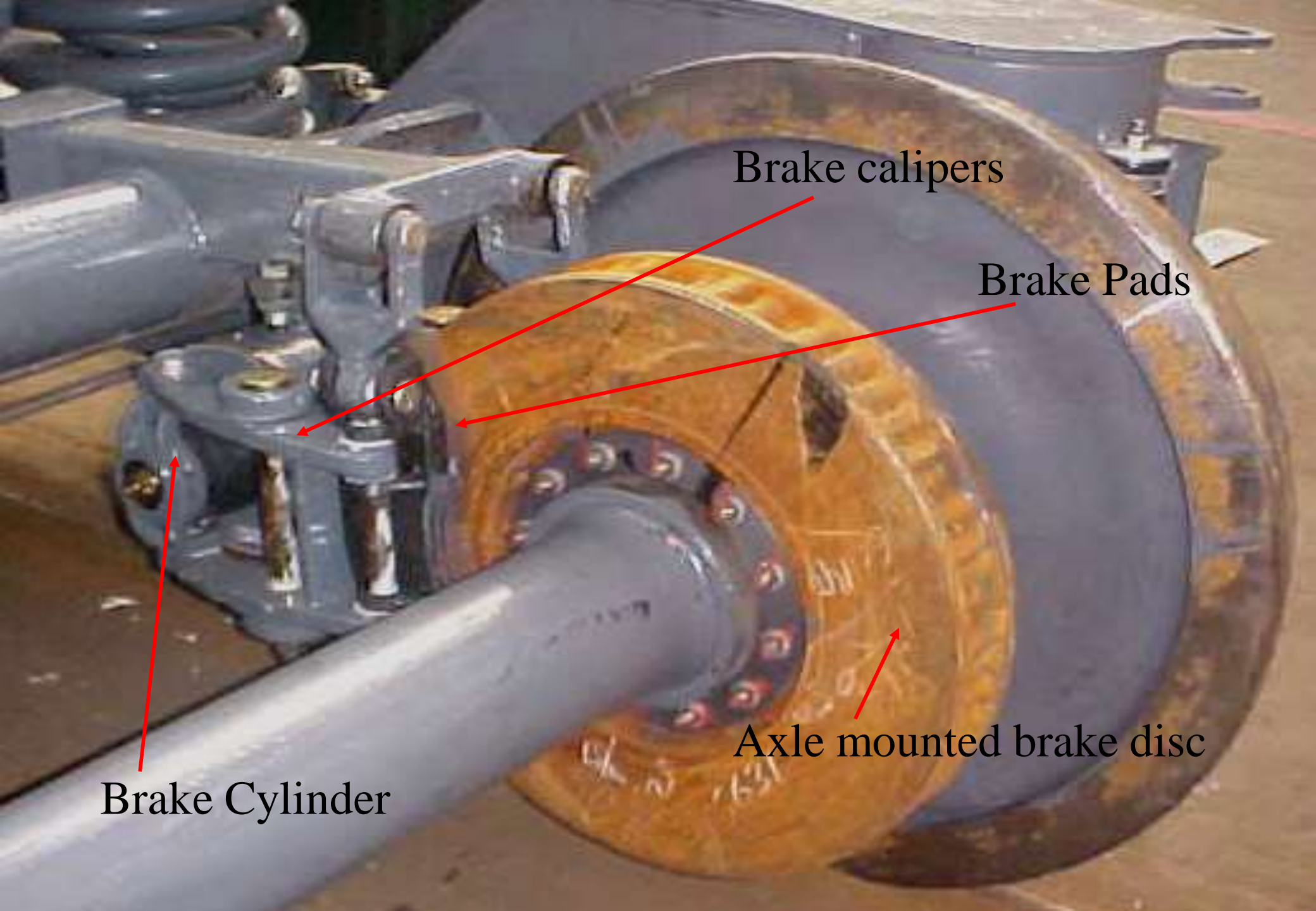
# DISC BRAKE SYSTEM

- ⌘ Axle mounted disc brake
- ⌘ Two discs per axle of dia. 640 mm
- ⌘ Inbuilt slack adjuster in brake cylinders
- ⌘ Caliper ratio 1:2.17 for all coaches except ACCN/SG & power car which is 1:2.48
- ⌘ 35mm brake pads



# BRAKE CALLIPER UNIT





Brake calipers

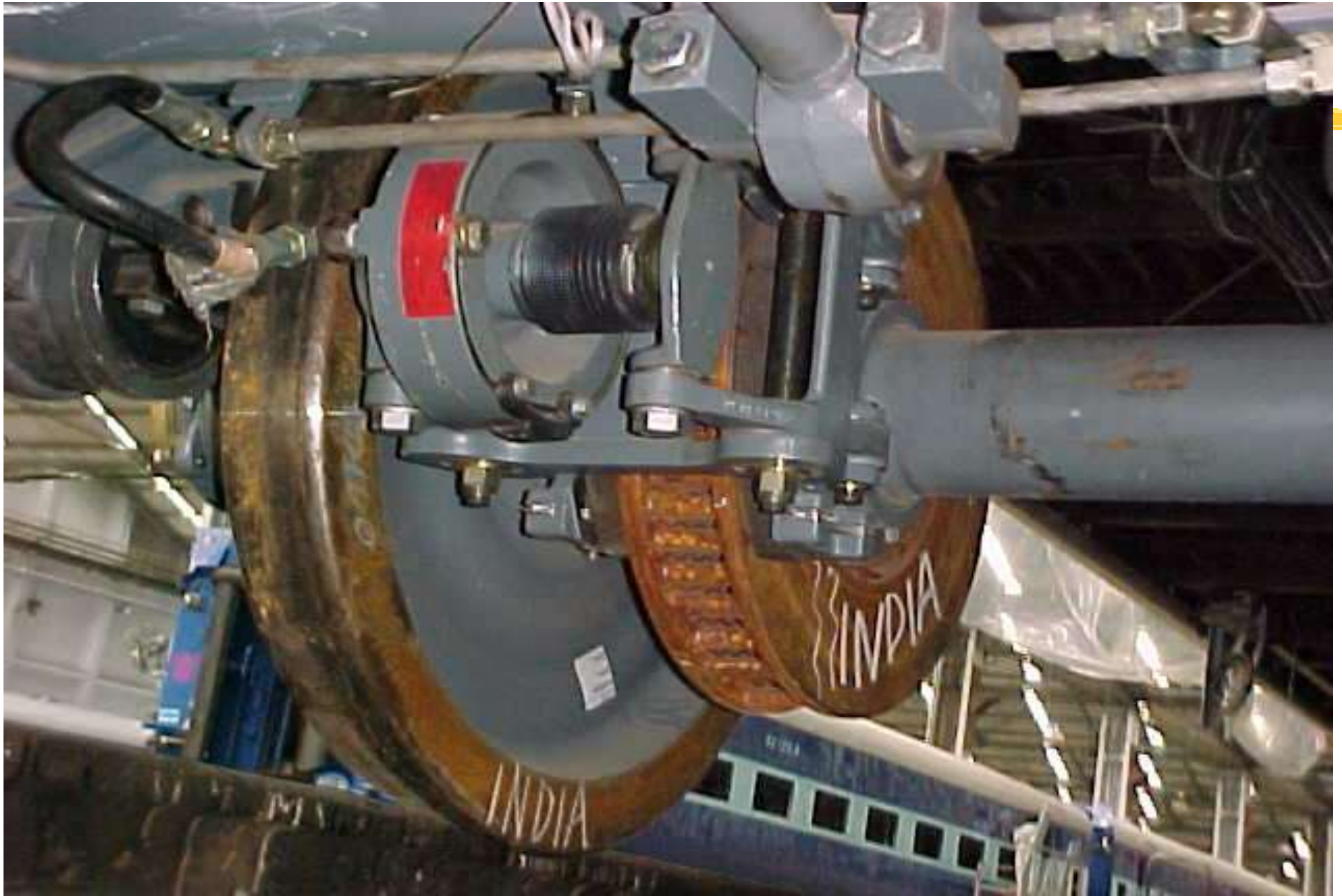
Brake Pads

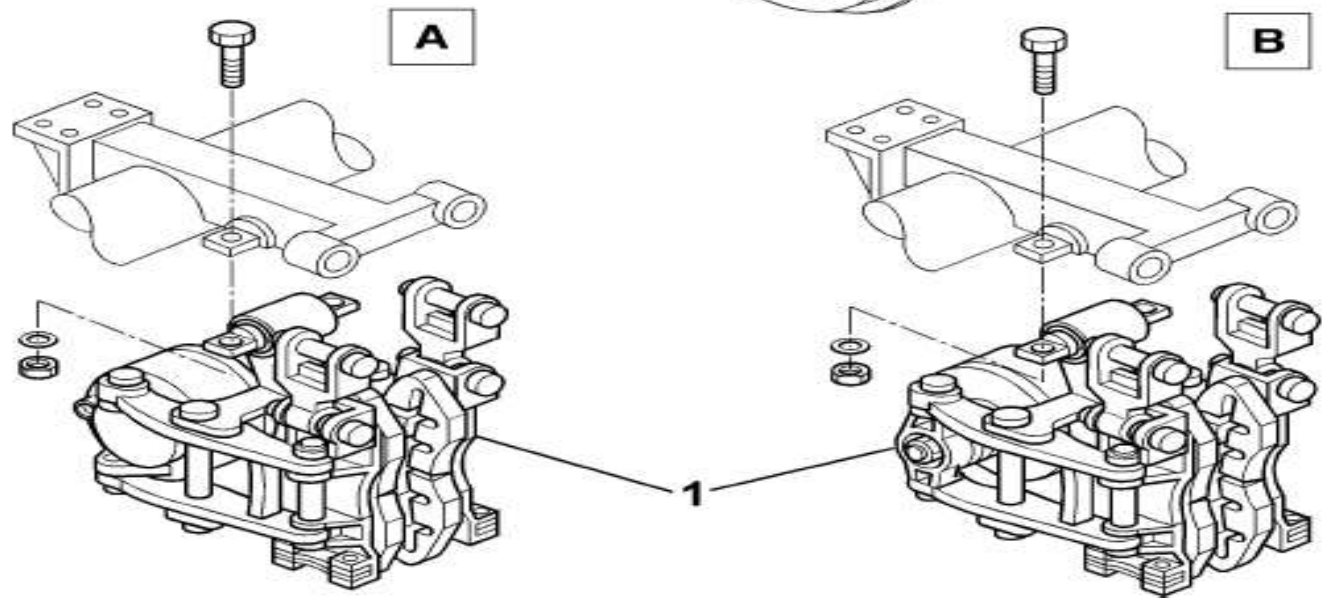
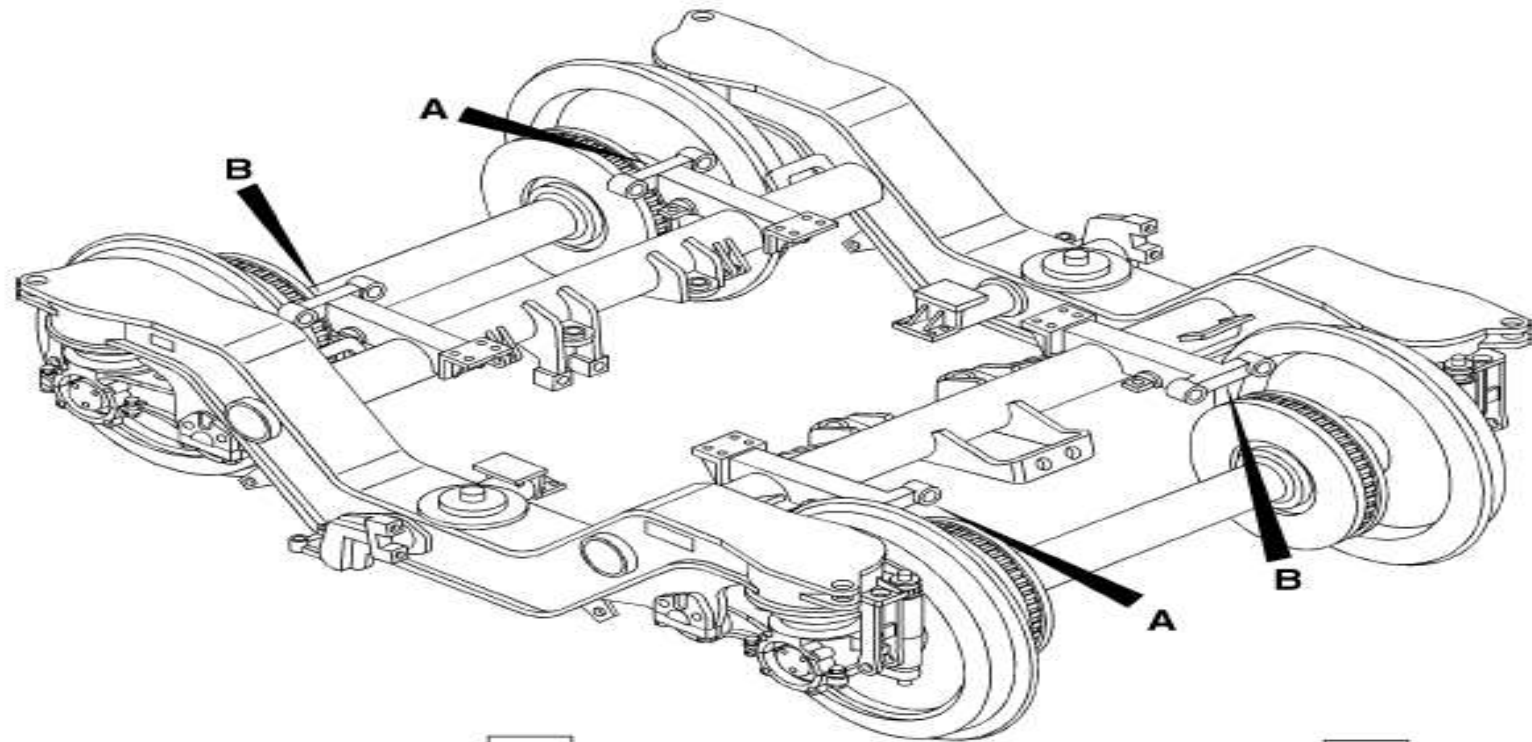
Axle mounted brake disc

Brake Cylinder



# BRAKE CYLINDER AND CALIPERS





1. Brake unit

FIG. 1-14 BRAKING SYSTEM FOR BOGIES 1267400 AND 1267700

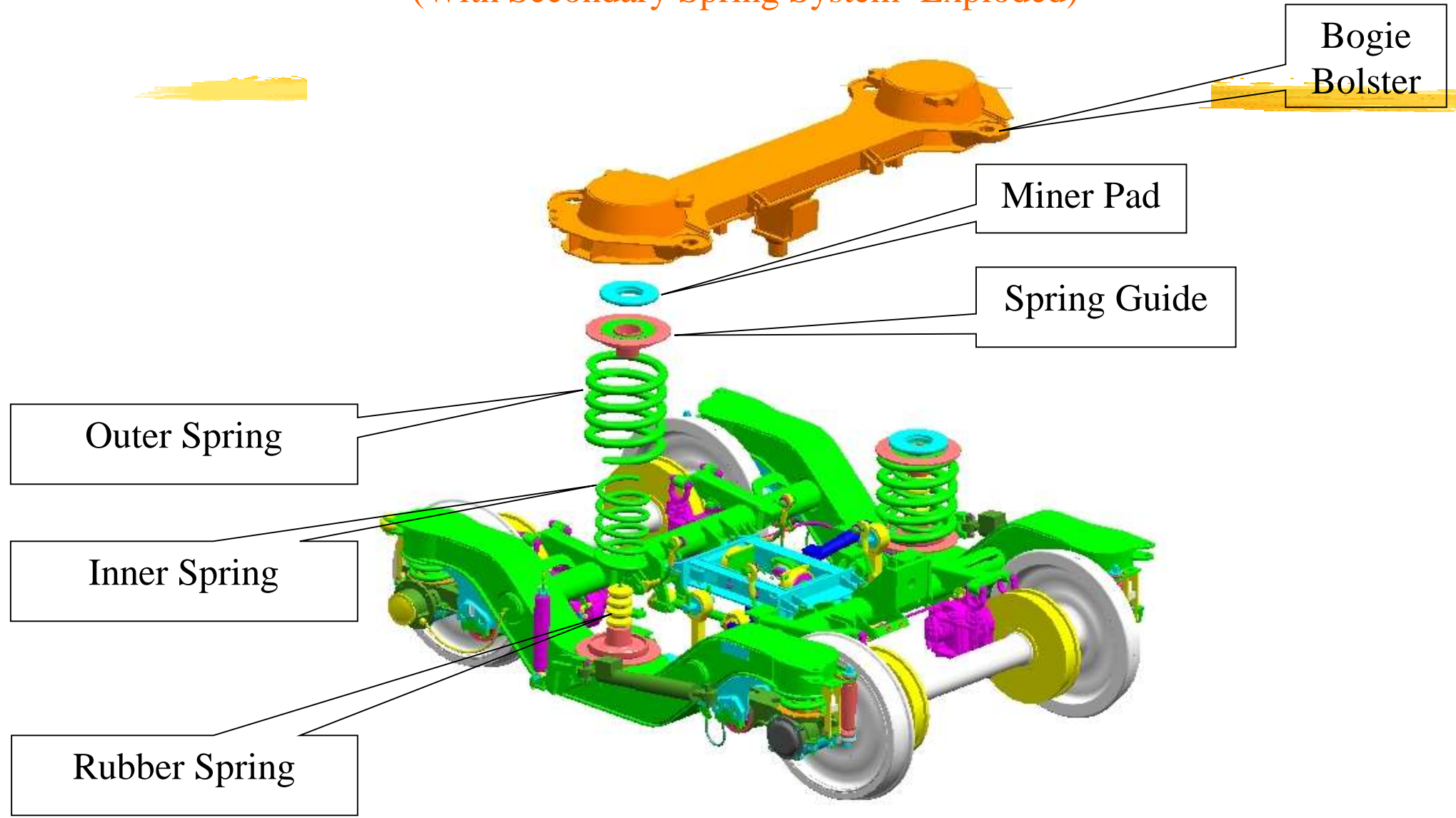
# SECONDARY SUSPENSION



- ⌘ Nest of flexi-coil springs inner and outer, rubber spring and secondary pad
- ⌘ Vertical dampers
- ⌘ Lateral dampers
- ⌘ Yaw dampers
- ⌘ Anti-roll bar
- ⌘ Anchor links



(With Secondary Spring System Exploded)



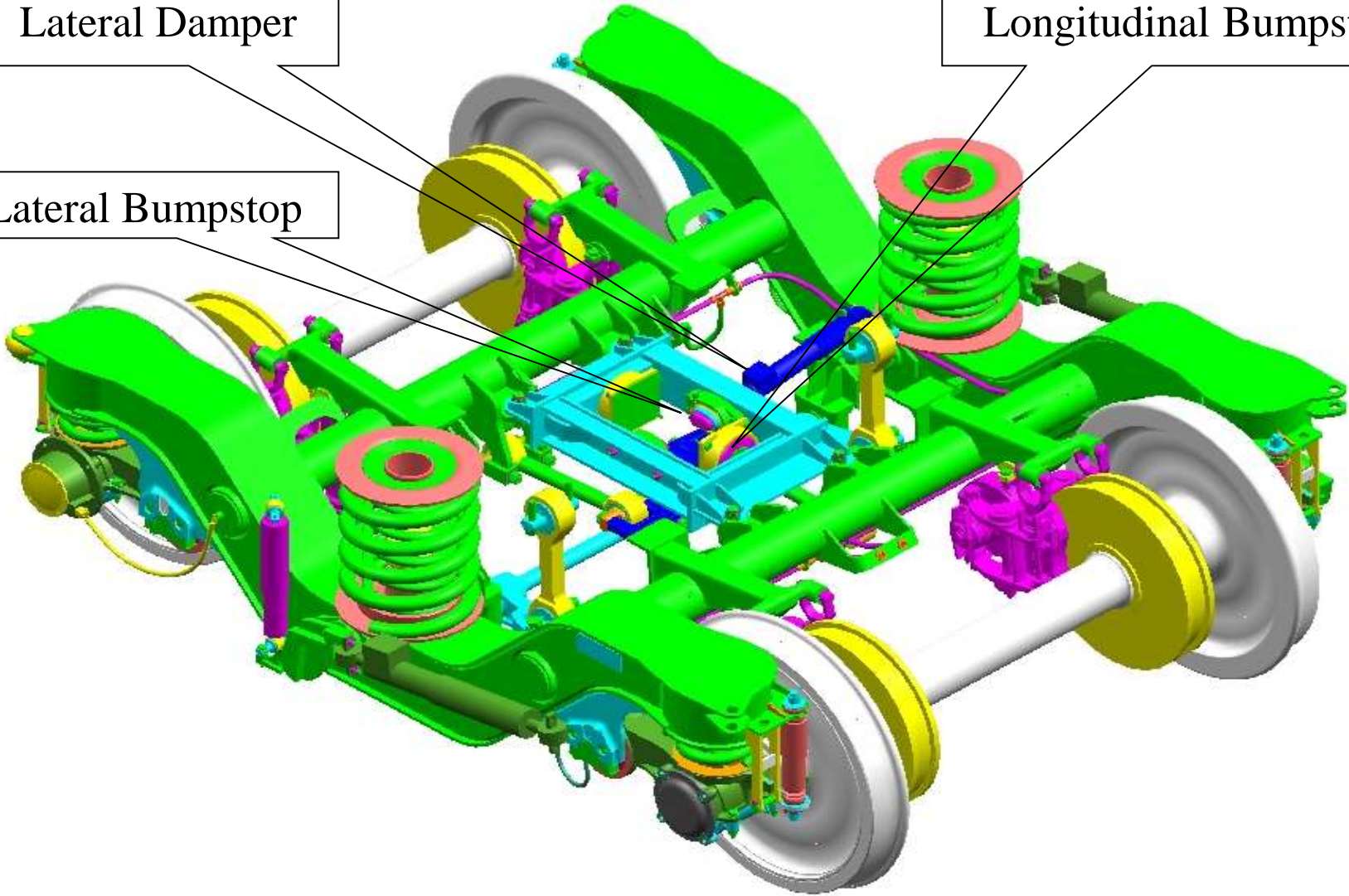


(Bolster removed)

Lateral Damper

Longitudinal Bumpstop

Lateral Bumpstop



(With Bolster Lifted)

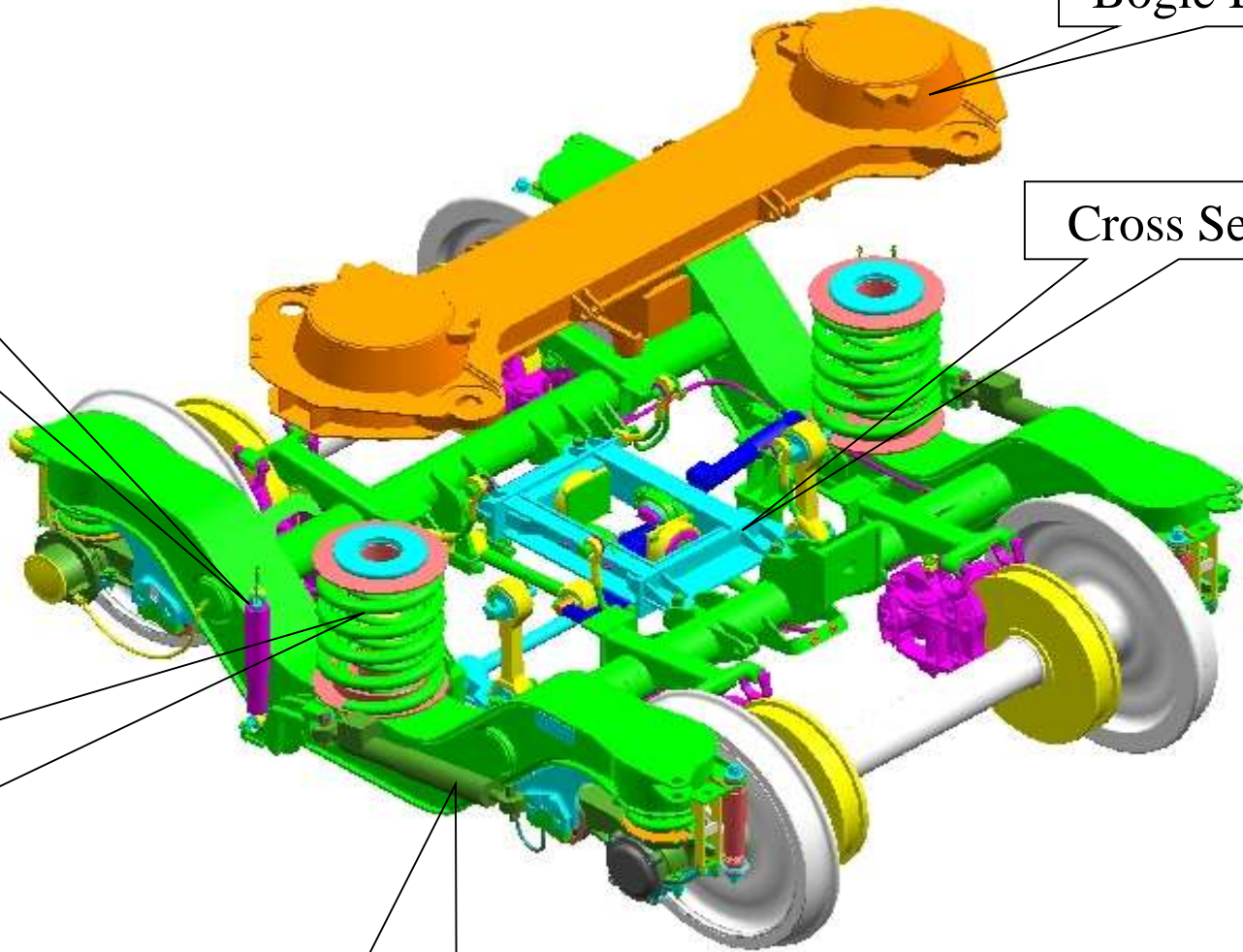
Bogie Bolster

Sec. Vertical  
Damper

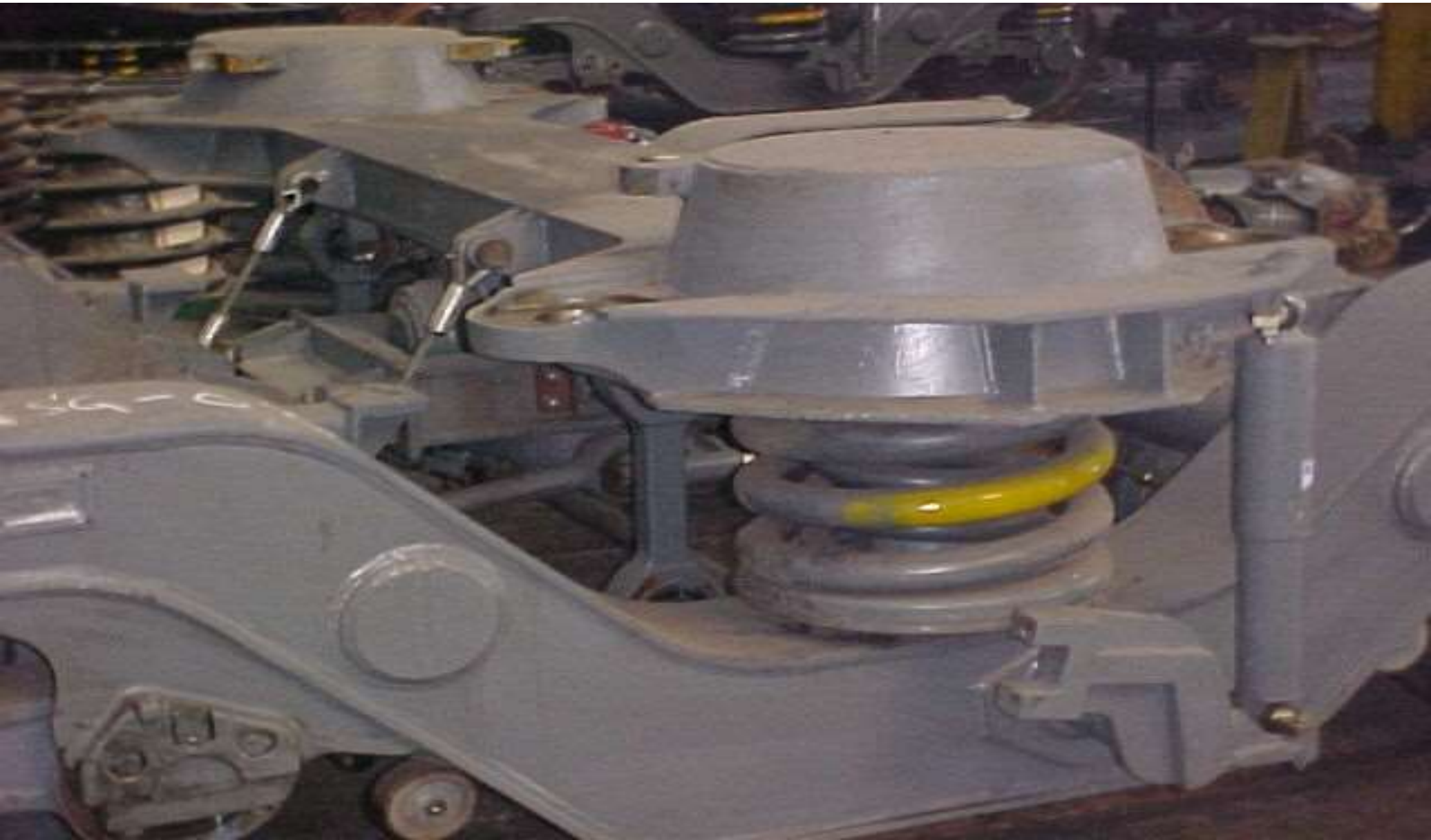
Cross Section

Nested  
Secondary  
Spring  
Assembly

Yaw Damper



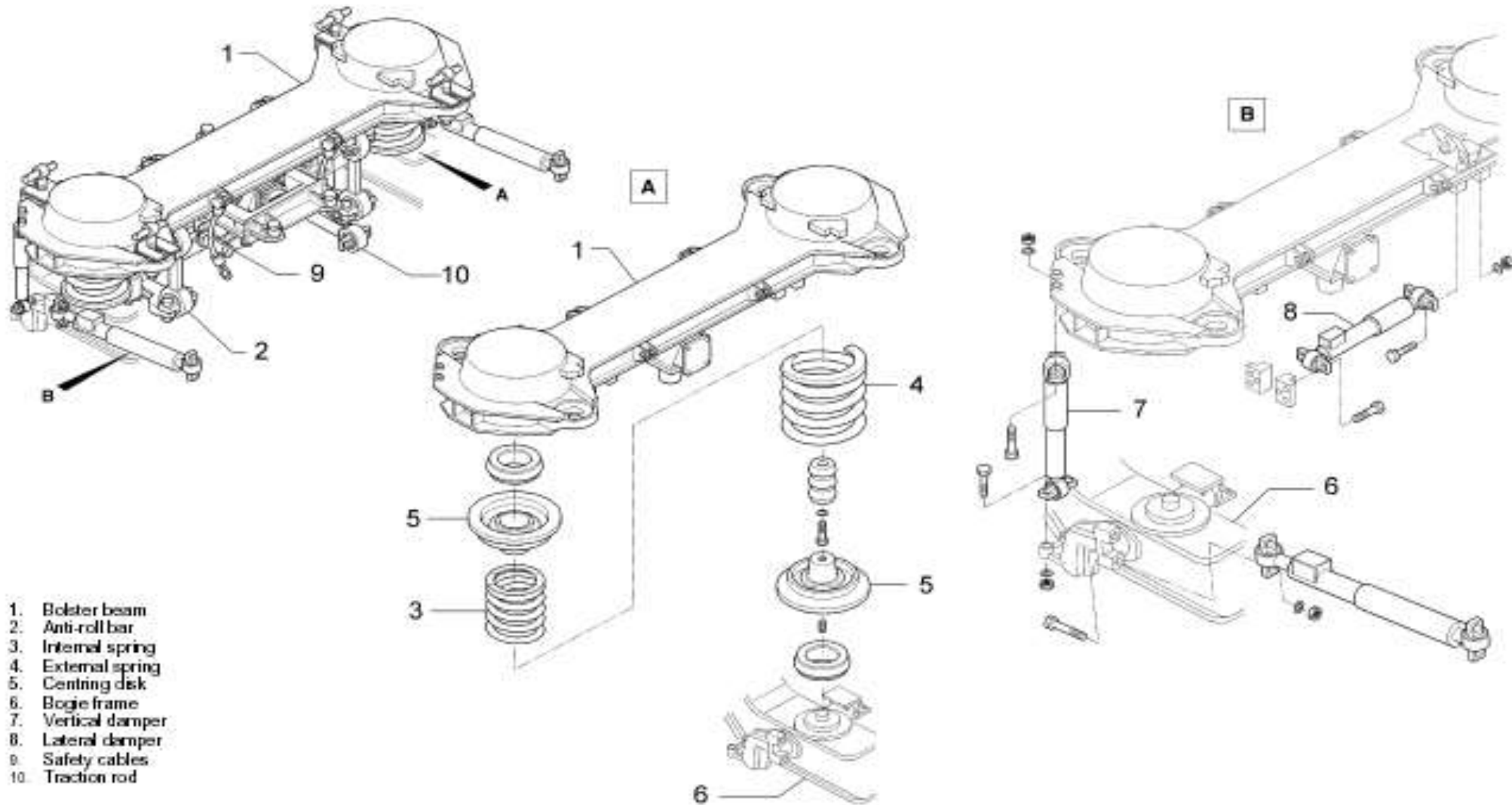
# SECONDARY SUSPENSION



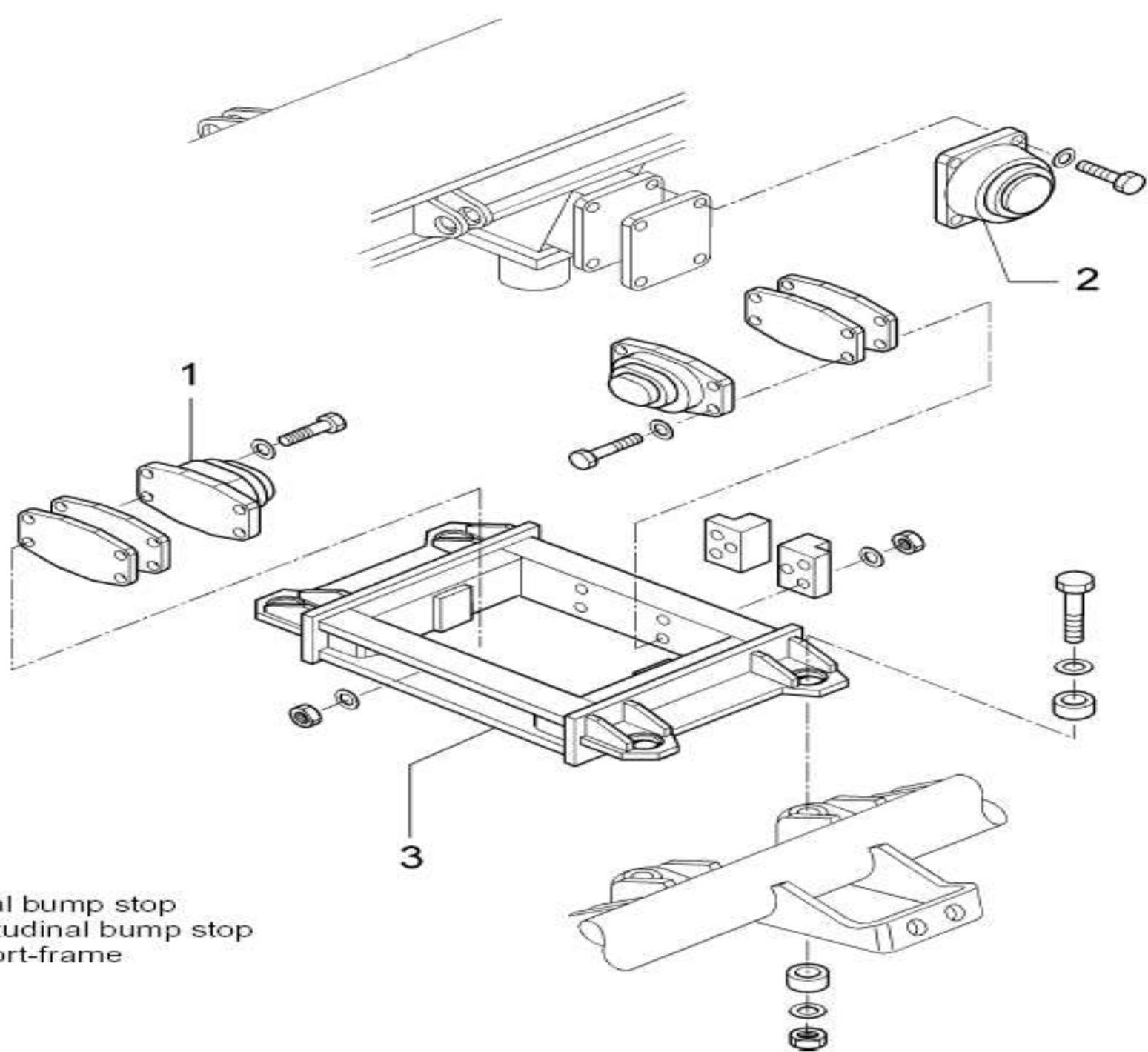


# SECONDARY SUSPENSION

FIG. 1-10 SECONDARY SUSPENSION UNIT



1. Bolster beam
2. Anti-roll bar
3. Internal spring
4. External spring
5. Centring disk
6. Bogie frame
7. Vertical damper
8. Lateral damper
9. Safety cables
10. Traction rod



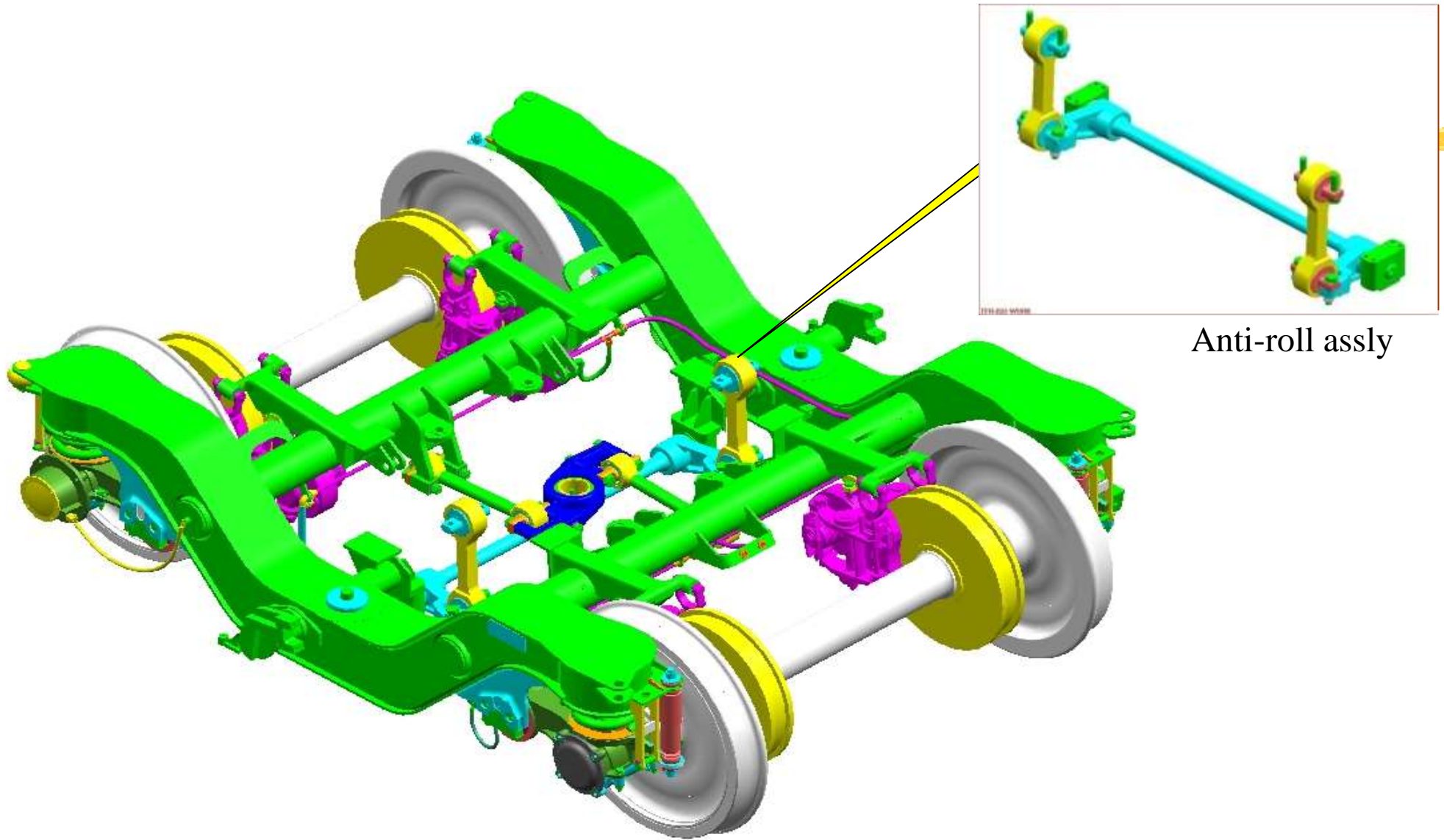
1. Lateral bump stop
2. Longitudinal bump stop
3. Support-frame

# ANTI-ROLL BAR:



⌘ A torsion bar having two forks is provided between bogie frame transvers beam with the help of two links to resist rolling motion of coach





Anti-roll assly

# ANTI-ROLL BAR:

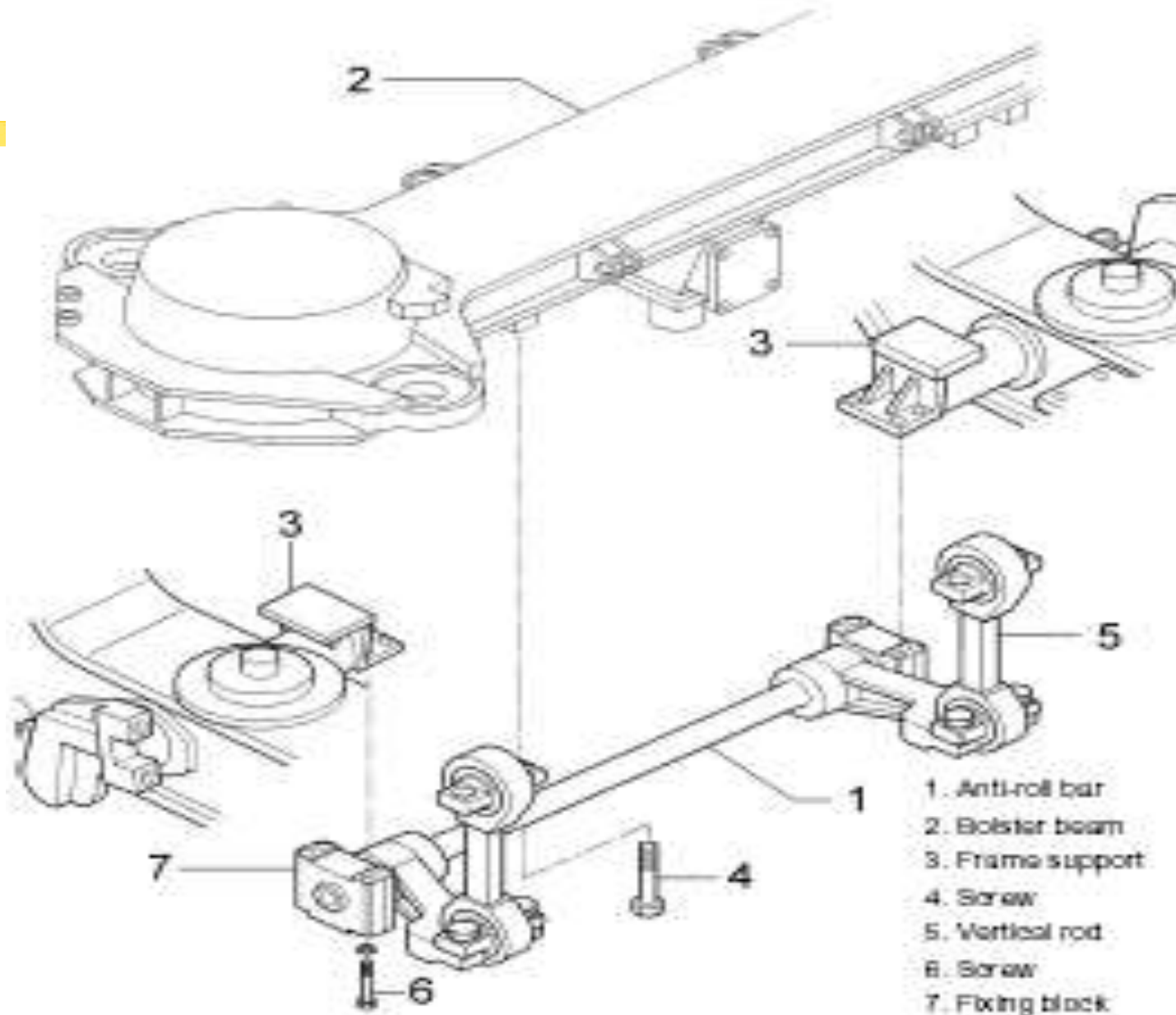


FIG. 3-6 REMOVAL OF THE ANTI-ROLL BAR

# ANTI ROLL BAR

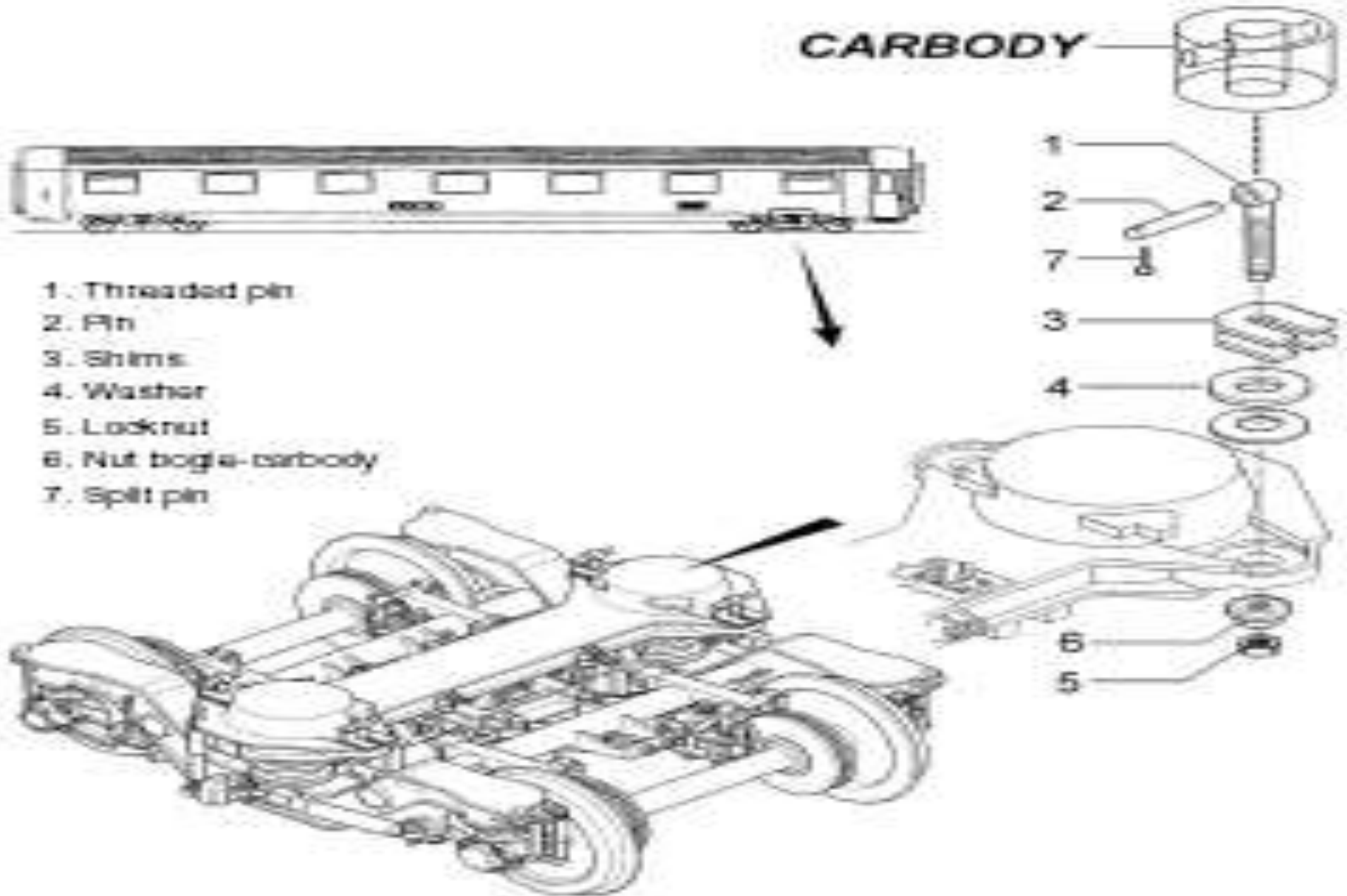


# **BUFFER HEIGHT ADJUSTMENT**



- ⌘ By adding or removing shims from body/bogie connection.
- ⌘ Shims will not be added/removed in Primary and Secondary Suspension for wheel wear compensation or buffer height adjustment.

# BOGIE BODY CONNECTION:





# Principles of force transmission



## Vertical forces:

⌘ Body-sec. springs-bogie frame-primary springs/ball joint control arm-axles.

## Lateral forces:

⌘ Body-sec. springs-bogie frame-ball joint control arm-axles.

# Longitudinal traction efforts and braking powers:

⌘ Body-traction  
centre-traction  
rods-traction  
lever-bogie  
frame-control  
arm-axles.

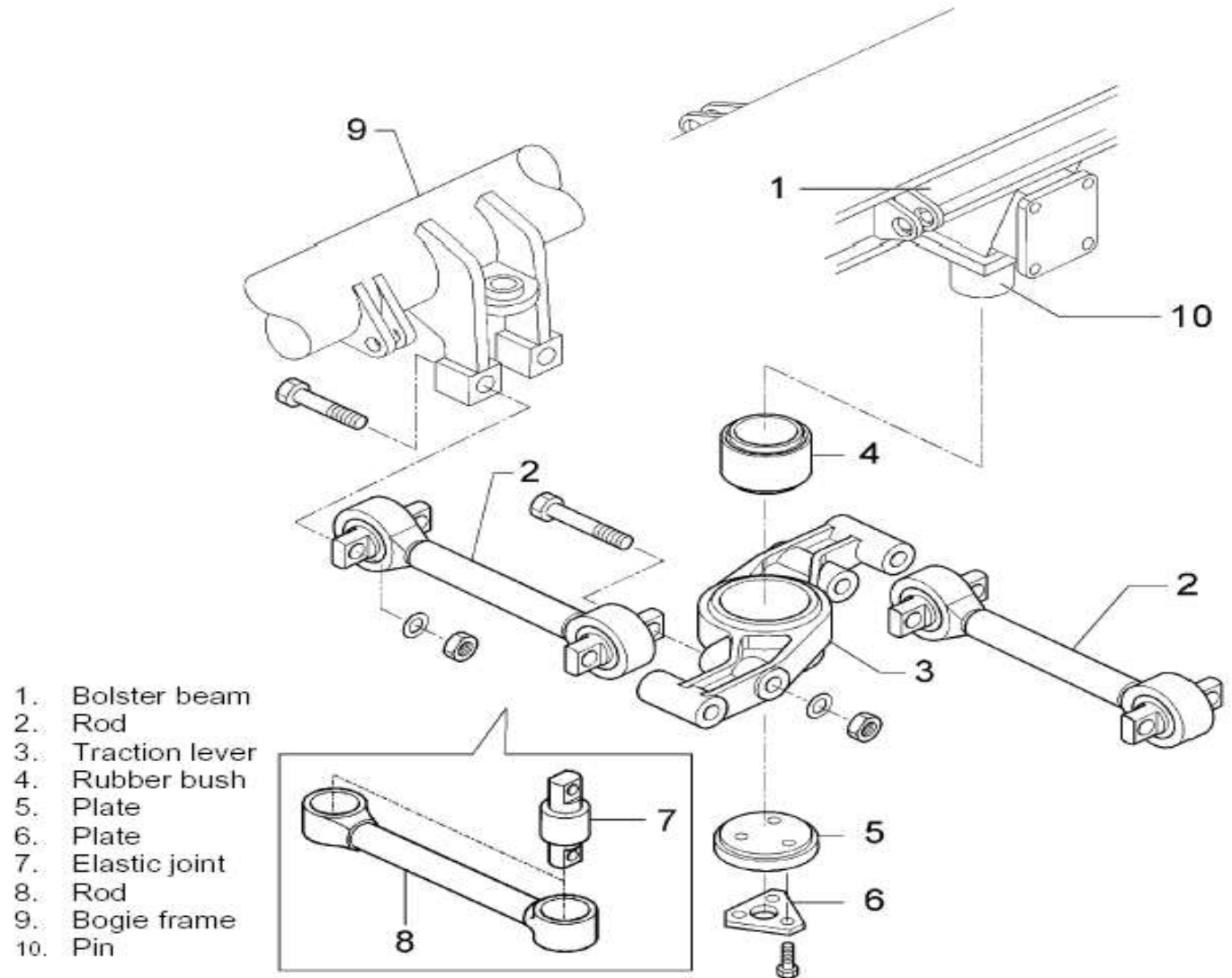
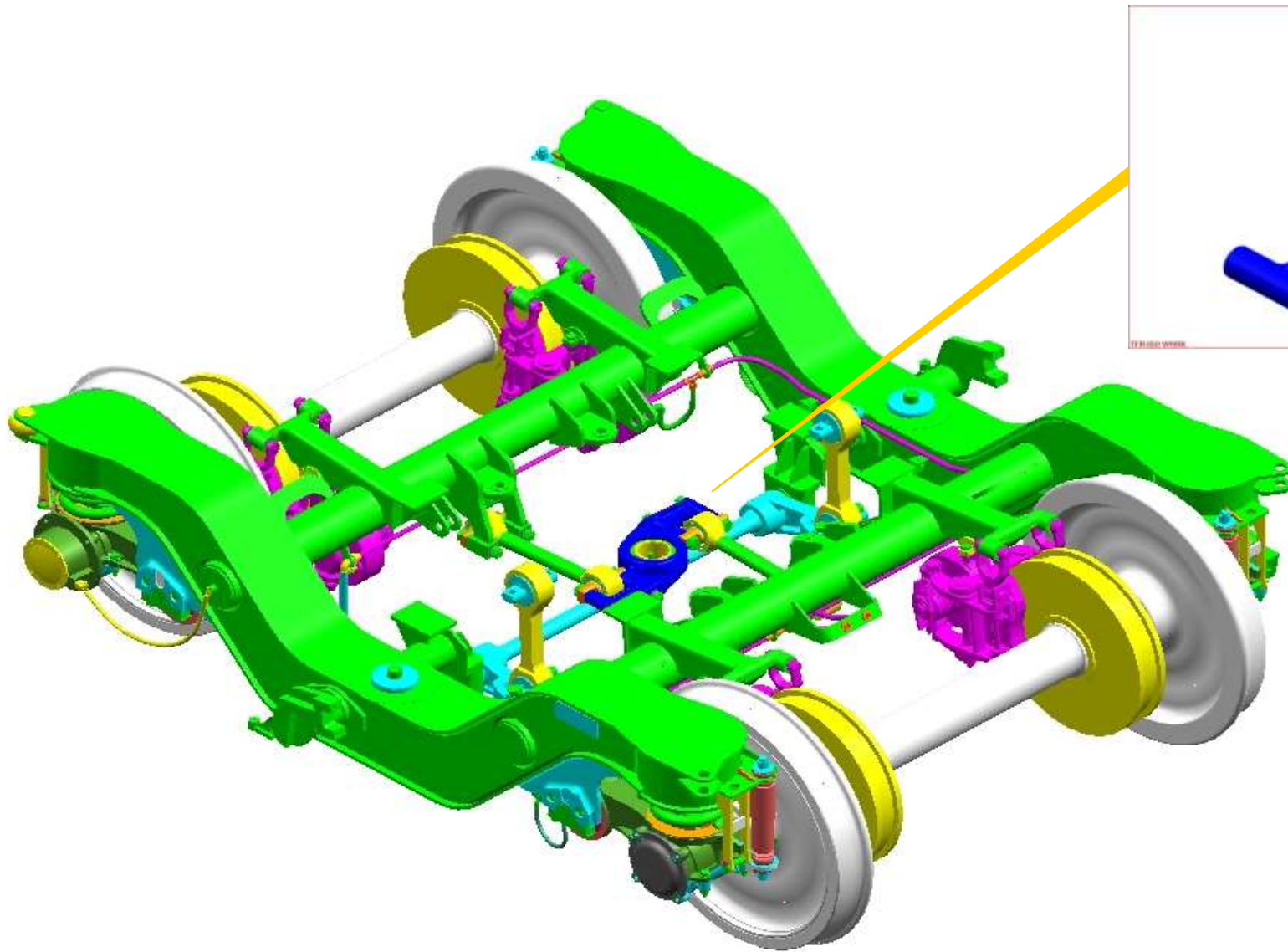


FIG. 1-11 TRACTION CENTRE





Traction Center

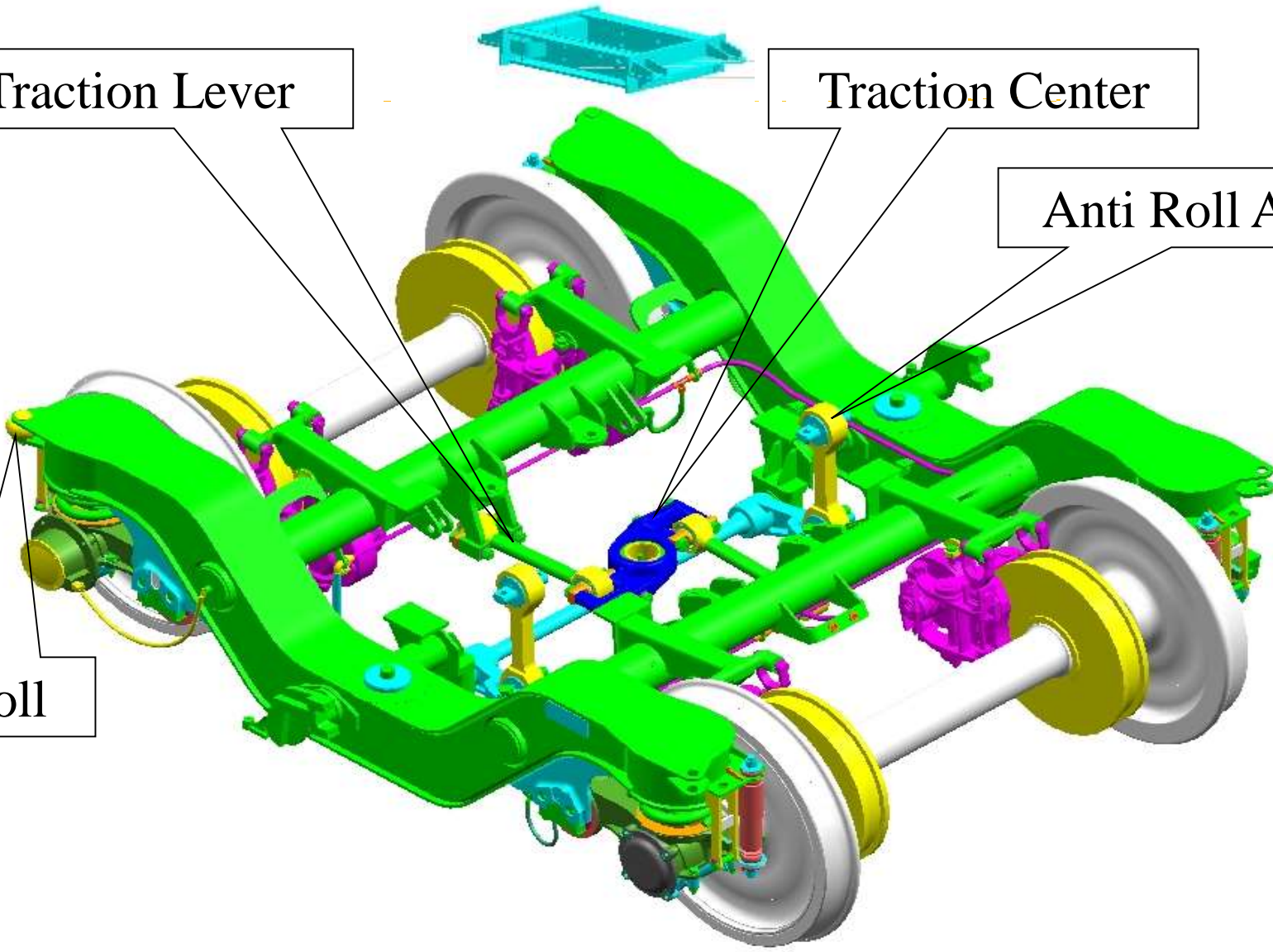
(X-section lifted)

Traction Lever

Traction Center

Anti Roll Assly

Curve Roll



# CURVE NEGOTIATION:



⌘ An articulated control arm is connecting axle bearing and side frame through elastic connection, which will provide flexibility between axle and side frame.

# Main Data:



⌘ Axle distance	2560 mm
⌘ Diameter of new wheel	915 mm
⌘ Diameter of max. Worn wheel	855 mm
⌘ Distance between wheel	1600 mm
⌘ Brake disc diameter	640 mm
⌘ Bogie width	3030 mm
⌘ Bogie length	3534 mm
⌘ Bogie weight	6300 kg

# Speed limit



- ⌘ Upto 160KMPH without any modification
- ⌘ upto 200KMPH with minor modification

# Ride Index

<b>Ride Index</b>	<b>Appreciation</b>	<b>Fatigue Limit</b>
1.0	very good	Over 24 hours
1.5	Almost very good	
2.0	Good	
2.5	Neatly Good	13 hours
3.0	Passable	5.6 hours
3.5	Still Passable	2.8 hours
4.0	Able to Run	1.5 hours
4.5	Not able to Run	45 minutes
5.0	Dangerous	15 minutes



# Oscillation trial

## Oscillation Trial Results on LHB coach having FIAT bogie

Speed (kmph)	Maximum Acceleration		Maximum Ride Index	
	Vertical	Lateral	Vertical	Lateral
120	0.16	0.12	2.20	2.10
130	0.16	0.098	2.18	2.21
140	0.14	0.14	2.38	2.19
150	0.18	0.13	2.40	2.28
160	0.19	0.13	2.41	2.54
170	0.29	0.12	2.44	2.19
180	0.18	0.11	2.46	2.19

# COMPARISION OF SALIENT FEATURES OF FIAT BOGIE AGAINST I.C.F. BOGIE

S.N.	I.C.F.	FIAT
1	SPEED=140 KMPH	MAX OPERATING SPEED=160 KMPH TESTED SPEED=180 KMPH POTENTIAL FOR OPERATION=200 KMPH
2	BOGIE FRAME I TYPE	H TYPE CONSTRUCTION
3	WHEEL BASE =2896 MM	WHEEL BASE = 2560 MM
4	WHEEL DIA =915 MM	915 MM(NEW) 855 MM (WORN)
5	CLASP TYPE BRAKE	AXLE MOUNTED DISC BRAKE
6	SPHERICAL ROLLER BEARING	TAPERED ROLLER BEARING

# COMPARISION CONTD.....

S.N.	I.C.F.	FIAT
7	PRIMARY SINGLE SPRING	PRIMARY NESTED SPRING =2 NOS.
8	LIMITED NOISE CONTROL FEATURES	NOISE CONTROLLED BY USING THICK RUBBER PAD
9	SECONDARY SPRING ON L.S. BEAM	SECONDARY SPRING DIRECTLY MOUNTED ON SIDE FRAME (NO L.S. BEAM)
10	COACH LOAD IS TRANSFERRED THROUGH SIDE BEARER (100%)	THROUGH BOGIE BODY CONNECTION TO SIDE FRAME VIA SEC. SPRINGS.
11	CENTER PIVOT TRANSFER TRACTION AND SHOCK LOAD	PIVOT ASSY ON TRANSVERS BEAM AND BRACKET ON DOME TAKE TRACTION/ BRACKING, SHOCK LOAD.

# COMPARISION CONTD.....

S.N.	I.C.F.	FIAT
12	RIDE INDEX TRANSVERSE=3.5 VERTICAL=2.5	TRANSVERSE=2.75 VERTICAL=2.5
13	NO SUCH ARRANGEMENT	ANTI ROLL BAR HAS BEEN PROVIDED TO CURB THE TEDENCY OF ROLL.
14	MAINTT. REQD. 1)AXLE BOX GUIDE ARRANGEMENT 2)SPHERCAL ROLLER BEARING 3)MORE PIN JOINTS	VERY LITTLE MAINTT. IN P.O.H.
15	WEIGHT OF BOGIE=6.2 T	WEIGHT OF BOGIE=6.3 T

# Problems Found in FIAT Bogie



- ⌘ Uneven lateral bump clearance.
- ⌘ Anti roll bar mechanism failure.
- ⌘ Bolster dome upper plate weld open.
- ⌘ Wear of bogie frame at control arm rubber joint location.
- ⌘ CTRB failures.
- ⌘ Wheel shelling.

# Uneven Lateral Bump Clearance

- ⌘ Due to improper orientation and matching/changing of secondary suspension spring.



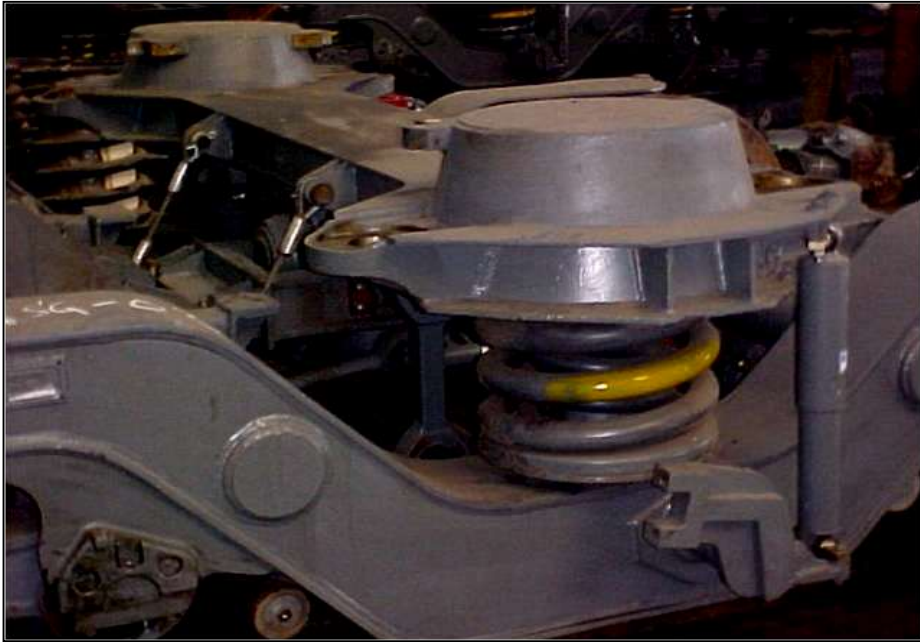


# Anti roll bar mechanism failure

- ⌘ The cases of shifting of anti roll bar considerably high.
- ⌘ The permissible gap is max. 5 mm.
- ⌘ In some cases this gap observed 10 to 12 mm.
- ⌘ One case of Anti roll bar breakage noticed on date 01.09.2007 at HNKM on coach No. 07110/LACCW within 6 month of manufacturing after earning 165794 KM.



# Bolster Dome Upper Plate Weld Open



# Wear of bogie frame at control arm rubber joint location.

Control arm rubber joint at ends in upper half round portion worn out.



Mating part at frame location worn out.



# CTRB failures

Bearing back seal broken in three pieces



Backing ring rotating freely on Axle soldier





# Wheel shelling







**THANKS**