Centre d'Ingénierie du Matériel
4 allée des Gémeaux 72100 Le Mans

DESIGN OF THE ROLLING STOCKS STRUCTURE

TWO COMPLEMENTARY REQUIREMENTS BASED ON FUNCTIONAL REQUIREMENTS

EXPLOITATION

PROTECT ROLLING STOCK

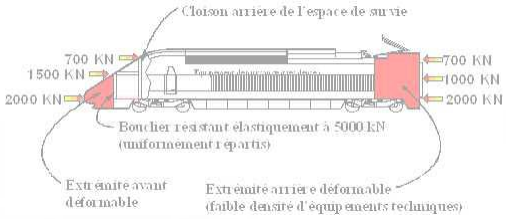
OBJECTIVES

PASSIVE SAFETY

LIMIT THE CONSEQUENCES OF THE ACCIDENTS FOR THE OCCUPANTS

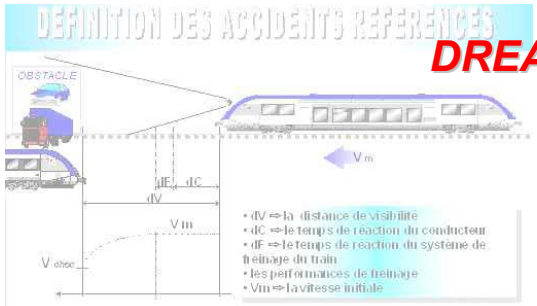
APPLICATION DOMAIN AND LOADINGS

OPERATING CURRENT EVENTS



CONVENTIONAL LOADINGS

DREADED EVENTS



COLLISION SCENARIOS

ASSESSMENT CRITERION

MATERIAL YIELD STRESS NOT EXCEEDED
DESIGN IN THE FATIGUE DOMAIN

RESISTANCE AND ENERGY ABSORPTION CAPACITY, INTRUSION, ANTI-CLIMBERS, STABILITY

SNCF
DIRECTION DU MATERIEL

Patrick JUMIN
Ddier LEVEQUE

PASSIVE SAFETY REQUIREMENTS

Experience gained from accident

Simulation

Accidents

Accident analysis

Reference collisions

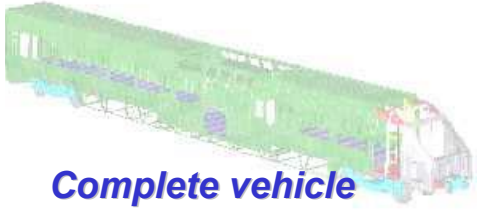
Design in Passive Safety

Modelling VALIDATION testing

VALIDATION METHOD

Absorption devices validation

Sub-assemblies validation



Complete vehicle structure validation

Passive Safety Validation

• Modelling of the energy absorption devices • Modelling of the dynamic tests on absorption devices • Dynamic tests on the devices (scale 1) • Numerical simulation and calibration of the tests	• Sub-assemblies modelling • Modelling of the dynamic tests on sub-assemblies • Dynamic tests on sub-assemblies(scale 1) • Simulation and calibration of the tests	• Modelling of the complete set structure (calibrated frontal part and inter-trailers, with current part respecting the crash modelling criterion) • Modelling of the rest of the trainset according to the expected behaviour	• Modelling of the reference collision scenarios • Numerical simulation of these scenarios • Verifications of criterion linked to the passive safety requirements

Centre d'Ingénierie du Matériel
4 allée des Gémeaux 72100 Le Mans

HEAVY OBSTACLE ON LEVEL CROSSING

EUROPEAN / FRENCH ACCIDENT ANALYSIS

ERRI B205.1

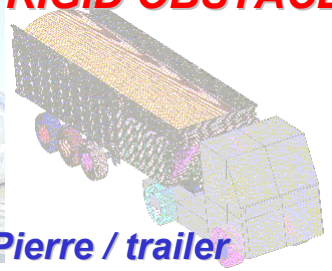
IVS INFRA SNCF

Operator Specifications STI STANDARD SAFETRAIN

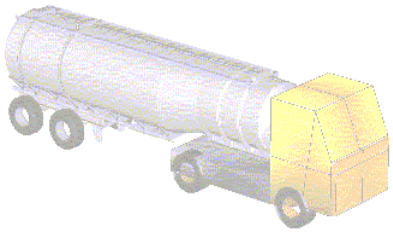
3rd scenario: FLAT RIGID OBSTACLE OF 15 T

RETURN OF EXPERIENCE OF THE SNCF

FLAT RIGID OBSTACLE OF 15 T NON COHERENT ➡ REAL OBSTACLES



Neuillé-Pont-Pierre / trailer Aluminium + wheat (33t)

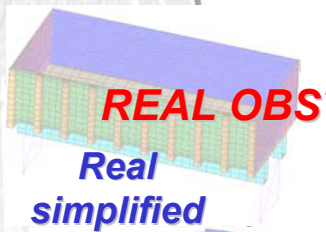


Port-Sainte-Foy / Fuel tank (29t)

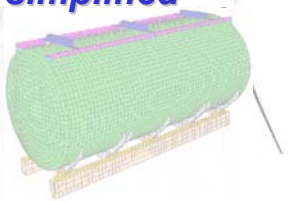
Morcenx / Trailer Steel + sand (39t)

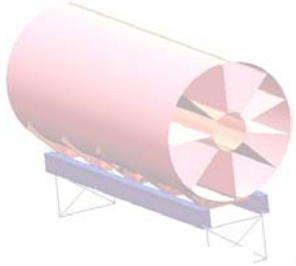
SIMPLIFICATION OF THE NUMERICAL MODEL

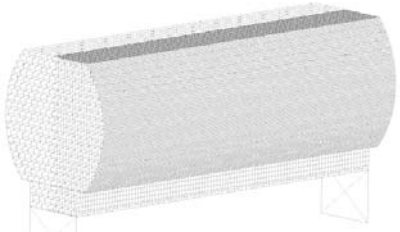
REAL OBSTACLES TO SIMPLIFY ➡ EQUIVALENT DEFORMABLE OBSTACLES



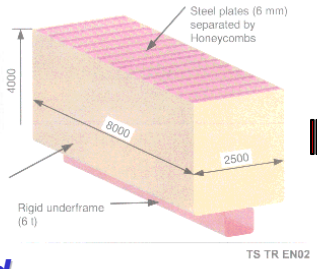
Real simplified

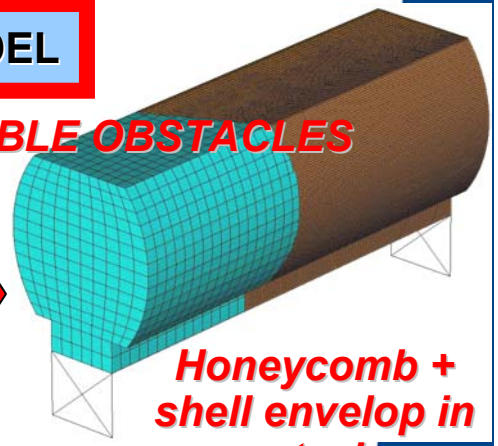






Equivalent simplified





Honeycomb + shell envelop in steel