

Appendix

Table A1 Parameters of equivalent vehicle model

Parameter	Value	Unit
Mass of car body	35600	kg
Mass of bogie	2190	kg
Mass of wheelset	1530	kg
Roll moment of inertia of car body	39500	kgm ²
Pitch moment of inertia of car body	1.07×10^6	kgm ²
Yaw moment of inertia of car body	1.53×10^6	kgm ²
Roll moment of inertia of bogie	1460	kgm ²
Pitch moment of inertia of bogie	1460	kgm ²
Yaw moment of inertia of bogie	2740	kgm ²
Roll moment of inertia of wheelset	815	kgm ²
Yaw moment of inertia of wheelset	815	kgm ²
Total length of car body	20	m
Half longitudinal distance between bogie centres	7.1	m
Half longitudinal distance between axles of two wheelsets	1.3	m
Half lateral distance between primary springs and dampers	1.0	m
Half lateral distance between secondary springs and dampers	1.2	m
Vertical distance from the centre of gravity of each wheelset to that of the car body	1.19	m
Vertical distance from the centre of gravity of each wheelset to that of a bogie	0.068	m
Half track gauge	0.75	m
Nominal rolling radius of wheelset	0.42	m
Stiffness of primary longitudinal spring	21.5	MN/m

Stiffness of primary lateral spring	200	MN/m
Stiffness of primary vertical spring	3.15	MN/m
Stiffness of primary longitudinal damper	20	kNs/m
Stiffness of primary lateral damper	20	kNs/m
Stiffness of primary vertical damper	5.0	kNs/m
Stiffness of secondary longitudinal spring	8.0	MN/m
Stiffness of secondary lateral spring	1.0	MN/m
Stiffness of secondary vertical spring	0.605	MN/m
Damping of secondary longitudinal damper	1.3	kNs/m
Damping of secondary lateral damper	64	kNs/m
Damping of secondary vertical damper	26	kNs/m
Bending stiffness of beam for vertical bending	3.08	MNm ²
Bending stiffness of beam for lateral bending	4.95	MNm ²
Torsional stiffness of beam	450	MNm ²
Mass per unit length	1780	kg/m
Torsional inertia	1.93	kgm
Damping coefficients for vertical bending*	0.001	
Damping coefficients for lateral bending*	0.001	
Damping coefficients for torsion*	0.0001	
Effective stiffness of rail	99	MN/m
Effective damping of rail	200	kNs/m
Effective mass of rail	300	kg
Coulomb friction coefficient	0.3	
Hertzian contact stiffness	1.30 x 10 ⁹	N/m

*Stiffness proportional coefficient of Rayleigh damping