

Generic fender database

The generic fender database contains the properties of several fender types. The contents of the generic fender database cannot be changed. A copy of a leaf can be made into a project's "Material database" node. Here it is possible to change the fender properties.

The generic fender database contains fenders from the following manufacturers:

- Bridgestone Tire Co. Ltd.
- Kléber Industrie
- Sumitomo Rubber Industries Ltd.
- Yokohama Rubber Co. Ltd.

There are 6 fender types available:

Radial cylindrical (Ref. [1])

The inner diameter of all subtypes is half the outer diameter. The properties of the fenders depend on the diameter (= height of the fender) and the length.

Trapezoidal (Ref. [1, 2])

The Kléber trapezoidal and Bridgestone Super M and Super Arch fenders were studied. The dimensionless static load-compression curves are approximately similar for both types of fenders. The load at a compression of 50% of the height of the fender, however, is larger for the Kléber fender than for the Bridgestone types. The information in the database is based on the Kléber fender types, available in four grades. The static load-compression curve of the fender depends on the grade, height and length of the fender.

PI type (Ref. [4])

The static load-compression curve is similar to the trapezoidal fenders. Again the static load-compression curve depends on the grade, height and length of the fender.

Cell (Ref. [1, 3])

The Kléber axial and Bridgestone cell fenders were studied. Comparing both fenders, the cell fenders take a much larger load at a maximum compression. The non-dimensional static load-compression curve has a similar form for the trapezoidal, pi-type and the axial fender. Only the particulars of the Bridgestone cell fenders are included in the database. The static load-compression curve (based on 55% of the height as maximum compression displacement) is used for all cell fender subtypes, although the maximum deflection for the C-type is 50%. The properties of the curve depend on the grade and height of the fender

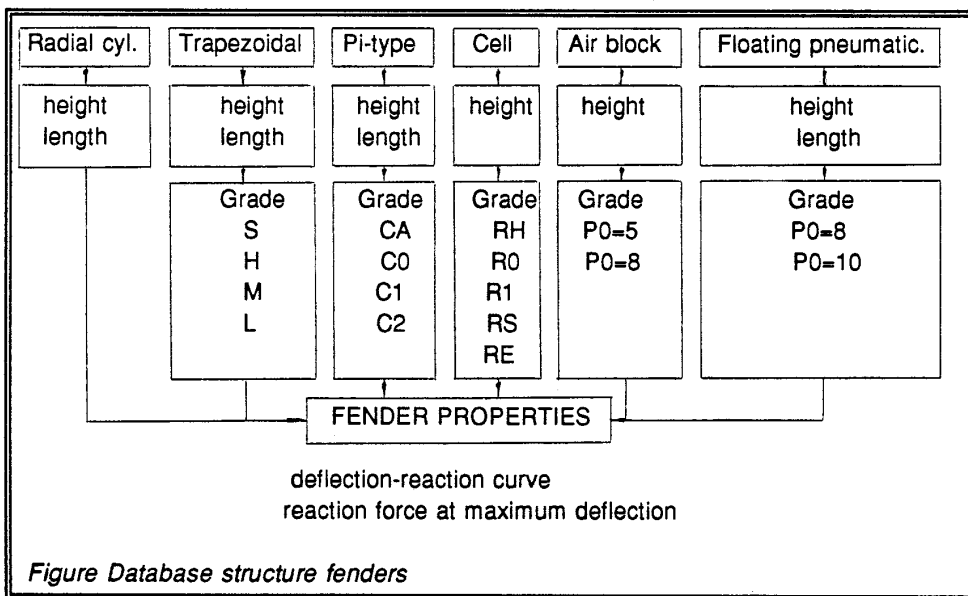
Air block (Ref. [5])

These fenders differ from the cell fenders in construction. When an air block fender deflects, the air inside is compressed which results in a different static load-compression curve with respect to the cell fenders. The air block fender can be divided into two grades which is caused by the initial air pressure. The properties of the fender depend on the grade and the height of the fender.

Floating pneumatic (Ref. [6])

The floating fender is available in two grades which differ in their initial air pressure. The static load-compression curve depends on the height, length and grade of the fender.

The following figures show the database structure.



RADIAL CYLINDRICAL FENDERS, BRIDGESTONE
Reaction force and energy absorption are for 50% deflection and 1 m fender length

| Height H [m] | Available length L [m] | Reaction force [kN/m] | Energy absorption [kNm/m] |
|--------------------|------------------------------|--------------------------|------------------------------|
| 0.150 | 12.0 | 72 | 2.3 |
| 0.200 | 12.0 | 95 | 4.2 |
| 0.250 | 12.0 | 120 | 6.5 |
| 0.300 | 12.0 | 143 | 9.5 |
| 0.380 | 12.0 | 181 | 15.2 |
| 0.400 | 12.0 | 191 | 16.9 |
| 0.450 | 12.0 | 215 | 21.4 |
| 0.480 | 12.0 | 231 | 24.5 |
| 0.500 | 12.0 | 239 | 26.5 |
| 0.530 | 12.0 | 253 | 29.6 |
| 0.600 | 12.0 | 286 | 38.1 |
| 0.700 | 12.0 | 335 | 51.9 |
| 0.800 | 12.0 | 383 | 67.8 |
| 0.900 | 12.0 | 431 | 85.7 |
| 1.000 | 10.0 | 479 | 105.9 |
| 1.100 | 3.0 | 527 | 128.1 |
| 1.200 | 3.0 | 575 | 152.5 |
| 1.300 | 3.0 | 623 | 179.0 |
| 1.400 | 3.0 | 670 | 207.6 |
| 1.500 | 3.0 | 718 | 238.4 |
| 1.600 | 3.0 | 766 | 271.1 |
| 1.700 | 2.5 | 814 | 306.2 |
| 1.800 | 2.5 | 862 | 343.3 |
| 1.900 | 2.0 | 909 | 382.4 |
| 2.000 | 2.0 | 957 | 423.8 |

TRAPEZOIDAL FENDER, KLEBER INDUSTRIE
Reaction force and energy absorption are for a 50% deflection and 1 m fender length

| Type [] | Height H [m] | Available length [m] | GRADE S | | GRADE H | | GRADE M | | GRADE L | |
|-------------|--------------------|-------------------------|----------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-----------------|
| | | | Reaction force | Energy absorbt. | Reaction force | Energy absorbt. | Reaction force | Energy absorbt. | Reaction force | Energy absorbt. |
| | | | [kN/m] | [kNm/m] | [kN/m] | [kNm/m] | [kN/m] | [kNm/m] | [kN/m] | [kNm/m] |
| TR 3 | 0.315 | 3.0 | 363 | 46.1 | 304 | 38.3 | 255 | 31.4 | 212 | 26.5 |
| TR 4 | 0.420 | 3.0 | 492 | 61.4 | 410 | 51.7 | 341 | 42.1 | 284 | 35.7 |
| TR 5 | 0.525 | 3.0 | 608 | 77.0 | 507 | 64.2 | 423 | 52.3 | 352 | 44.2 |
| TR 6 | 0.630 | 3.0 | 730 | 92.5 | 608 | 77.0 | 507 | 63.2 | 423 | 52.3 |
| TR 8 | 0.840 | 2.5 | 981 | 124.7 | 819 | 102.8 | 683 | 85.6 | 569 | 71.4 |
| TR 10 | 1.050 | 2.0 | 1226 | 156.2 | 1024 | 127.8 | 853 | 106.2 | 711 | 88.4 |

PI-TYPE FENDER, SUMITOMO RUBBER INDUSTRIES
Reaction force and energy absorption are for a 52.5% deflection and 1 m fender length.
(available lengths 1.0, 1.5, 2.0, 2.5 and 3.0 m)

| Type [] | Height H [m] | CA | | C0 | | C1 | | C2 | |
|-------------|--------------------|----------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-----------------|
| | | Reaction force | Energy absorbt. | Reaction force | Energy absorbt. | Reaction force | Energy absorbt. | Reaction force | Energy absorbt. |
| | | [kN/m] | [kNm/m] | [kN/m] | [kNm/m] | [kN/m] | [kNm/m] | [kN/m] | [kNm/m] |
| PI-400H | 0.400 | 346 | 53.0 | 324 | 49.1 | 277 | 42.2 | 231 | 35.3 |
| PI-600H | 0.600 | 520 | 77.7 | 485 | 71.9 | 416 | 61.2 | 346 | 51.5 |
| PI-800H | 0.800 | 693 | 103.9 | 646 | 95.2 | 554 | 81.7 | 462 | 68.3 |
| HPI-1000H | 1.000 | 862 | 128.1 | 804 | 119.2 | 690 | 102.5 | 575 | 85.7 |
| HPI-1250H | 1.250 | 1077 | 161.1 | 1006 | 148.9 | 862 | 127.4 | 718 | 107.4 |
| HPI-1400H | 1.400 | 1207 | 180.1 | 1126 | 166.4 | 965 | 142.2 | 804 | 119.6 |
| HPI-1700H | 1.700 | 1466 | 219.1 | 1368 | 201.4 | 1172 | 173.0 | 977 | 144.4 |
| HPI-2000H | 2.000 | 1724 | 258.1 | 1609 | 239.2 | 1379 | 201.9 | 1150 | 171.4 |
| HPI-2500H | 2.500 | 2155 | 322.9 | 2011 | 297.7 | 1724 | 254.5 | 1436 | 214.3 |

CELL FENDERS, BRIDGESTONE
Reaction force and energy absorption is based on 55% deflection (maximum deflection)
(For "C" type fenders the reaction force should be based on 50% deflection)

| Type | Height H m | Grade RH | | Grade RO | | Grade R1 | | Grade RS | | Grade RE | |
|----------|------------------|----------------|-------------------|----------------|-------------------|----------------|-------------------|----------------|-------------------|----------------|-------------------|
| | | Reaction force | Energy absorbtion | Reaction force | Energy absorbtion | Reaction force | Energy absorbtion | Reaction force | Energy absorbtion | Reaction force | Energy absorbtion |
| | | kN | kNm | kN | kNm | kN | kNm | kN | kNm | kN | kNm |
| C400H | 0.400 | 97 | 13.7 | 75 | 10.8 | 59 | 8.8 | 119 | 16.7 | 126 | 18.6 |
| C500H | 0.500 | 160 | 28.4 | 125 | 22.6 | 99 | 17.7 | 187 | 34.3 | 211 | 38.3 |
| SUC630H | 0.630 | 237 | 57.9 | 182 | 44.1 | 146 | 35.3 | 274 | 75.5 | 309 | 85.3 |
| SUC800H | 0.800 | 378 | 119.7 | 292 | 92.2 | 225 | 73.6 | 438 | 153.0 | 493 | 172.7 |
| SUC1000H | 1.000 | 603 | 263.9 | 464 | 203.1 | 372 | 162.8 | 697 | 304.1 | 785 | 343.4 |
| SUC1150H | 1.150 | 799 | 401.2 | 614 | 309.0 | 491 | 247.2 | 921 | 463.0 | 1038 | 521.9 |
| SUC1250H | 1.250 | 943 | 516.0 | 725 | 396.3 | 581 | 316.9 | 1088 | 594.5 | 1226 | 670.0 |
| SUC1450H | 1.450 | 1269 | 804.4 | 976 | 619.0 | 781 | 495.4 | 1465 | 929.0 | 1650 | 1045.7 |
| SUC1600H | 1.600 | 1545 | 1081.1 | 1189 | 831.9 | 951 | 655.1 | 1782 | 1247.8 | 2008 | 1405.8 |
| SUC1700H | 1.700 | 1744 | 1296.9 | 1342 | 997.7 | 1073 | 798.5 | 2013 | 1496.0 | 2267 | 1686.3 |
| SUC2000H | 2.000 | 2414 | 2112.1 | 1857 | 1624.5 | 1485 | 1299.8 | 2785 | 2436.8 | 3138 | 2744.8 |
| SUC2250H | 2.250 | 3391 | 3337.4 | 2608 | 2567.3 | 2217 | 2181.7 | 3913 | 3850.4 | 4404 | 4339.0 |
| SUC2500H | 2.500 | 4187 | 4578.3 | 3221 | 3521.8 | 2738 | 2993.0 | 4831 | 5282.7 | 5444 | 5451.7 |
| C3000H | 3.000 | 6622 | 7063.2 | 5101 | 5346.5 | 4316 | 4561.7 | - | - | - | - |

AIR BLOCKFENDERS, YOKOHAMA (pneumatic fenders)
Reaction force and energy absorption are for a 65% deflection

| Type | Height H m | P0 = 8 N/cm ² | | P0 = 10 N/cm ² | |
|-------|------------------|--------------------------|-------------------|---------------------------|-------------------|
| | | Reaction force | Energy absorbtion | Reaction force | Energy absorbtion |
| | | kN | kNm | kN | kNm |
| 800H | 0.800 | 394 | 76.5 | 452 | 88.3 |
| 900H | 0.900 | 499 | 107.9 | 572 | 125.6 |
| 1000H | 1.000 | 616 | 148.1 | 706 | 172.7 |
| 1100H | 1.100 | 746 | 198.2 | 854 | 229.6 |
| 1200H | 1.200 | 887 | 257.0 | 1020 | 298.2 |
| 1350H | 1.350 | 1118 | 365.9 | 1285 | 424.8 |
| 1500H | 1.500 | 1383 | 501.3 | 1589 | 582.7 |
| 1800H | 1.800 | 1991 | 866.2 | 2286 | 1010.4 |
| 2000H | 2.000 | 2462 | 1187.0 | 2825 | 1383.2 |
| 2100H | 2.100 | 2717 | 1373.4 | 3120 | 1599.0 |
| 2250H | 2.250 | 3120 | 1687.3 | 3581 | 1962.0 |
| 2400H | 2.400 | 3551 | 2050.3 | 4071 | 2383.8 |

P0 = initial air pressure

FLOATING PNEUMATIC RUBBER YOKOHAMA
Reaction force and energy absorption are for a 55% deflection of the height

| Height H m | Length L m | P0 = 5 N/cm ² | | P0 = 8 N/cm ² | |
|------------------|------------------|--------------------------|-------------------|--------------------------|-------------------|
| | | Reaction force | Energy absorbtion | Reaction force | Energy absorbtion |
| | | kN | kNm | kN | kNm |
| 0.500 | 1.000 | 49 | 4.2 | - | - |
| 0.600 | 1.000 | 58 | 5.9 | - | - |
| 0.700 | 1.500 | 103 | 12.5 | - | - |
| 1.000 | 1.500 | 139 | 23.7 | - | - |
| 1.000 | 2.000 | 196 | 33.6 | - | - |
| 1.200 | 2.000 | 229 | 47.3 | - | - |
| 1.350 | 2.500 | 325 | 76.6 | - | - |
| 1.500 | 3.000 | 430 | 111.0 | - | - |
| 1.700 | 3.000 | 479 | 142.0 | - | - |
| 2.000 | 3.500 | 654 | 225.6 | - | - |
| 2.200 | 4.500 | 976 | 370.9 | - | - |
| 2.500 | 4.000 | 939 | 396.2 | - | - |
| 2.500 | 5.500 | 1341 | 588.6 | 1802 | 816.7 |
| 3.300 | 4.500 | 1559 | 897.3 | 2063 | 1226.3 |
| 3.300 | 6.500 | 2406 | 1337.7 | 3205 | 1915.3 |
| 3.300 | 10.600 | 4037 | 2253.0 | 5381 | 3195.3 |
| 4.500 | 9.000 | 4531 | 3550.3 | 5951 | 5003.1 |
| 4.500 | 12.000 | 6213 | 4774.2 | 8402 | 6867.0 |

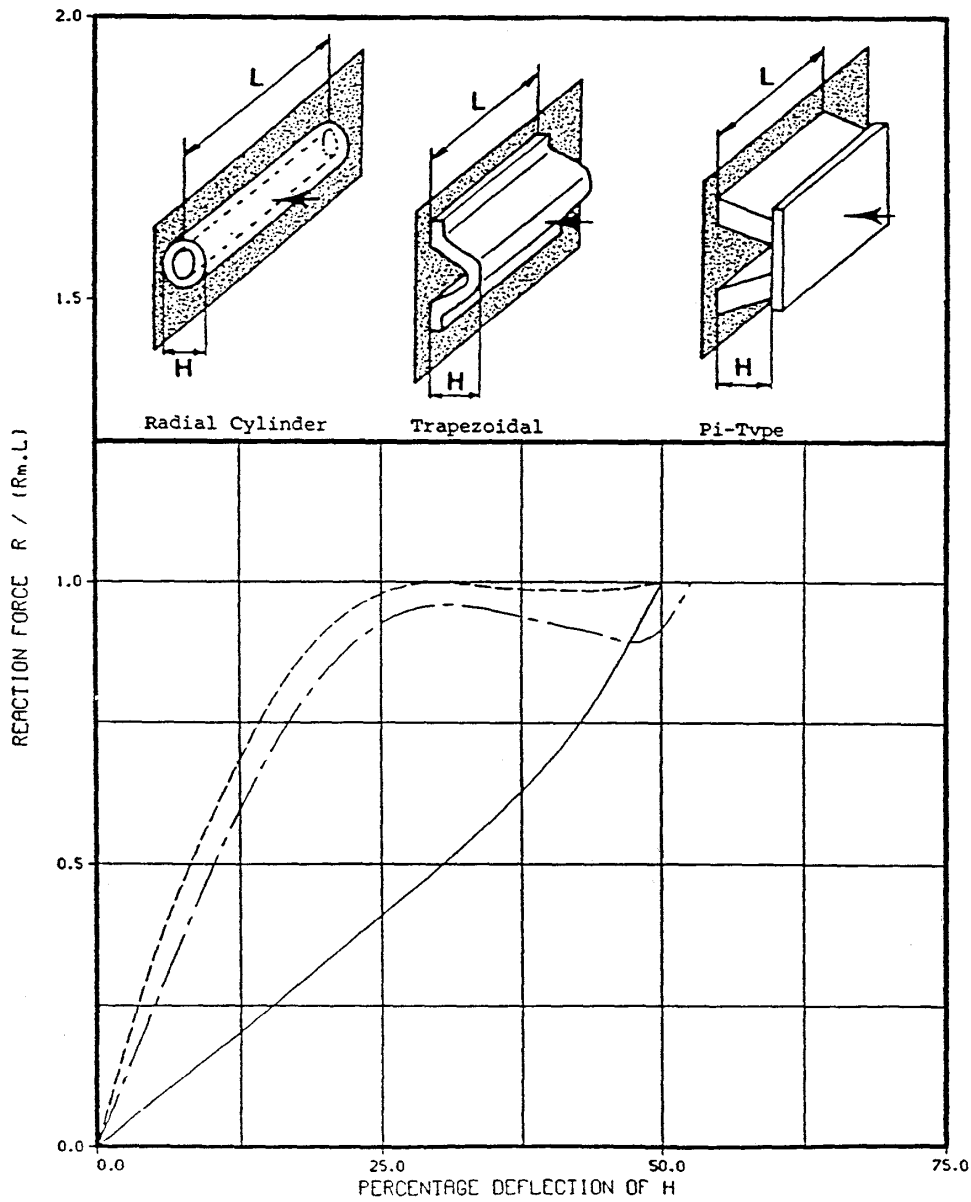
P0 = initial air pressure

DIMENSIONLESS REACTION FORCE CHARACTERISTICS FOR FENDERS

R = reaction force

R_m = reaction force from the tables

- RADIAL CYLINDER FENDER, BRIDGESTONE
- - - - - TRAPEZOIDAL FENDER, KLEBER INDUSTRIE
- · - · - PI-TYPE FENDER, SUMITOMO

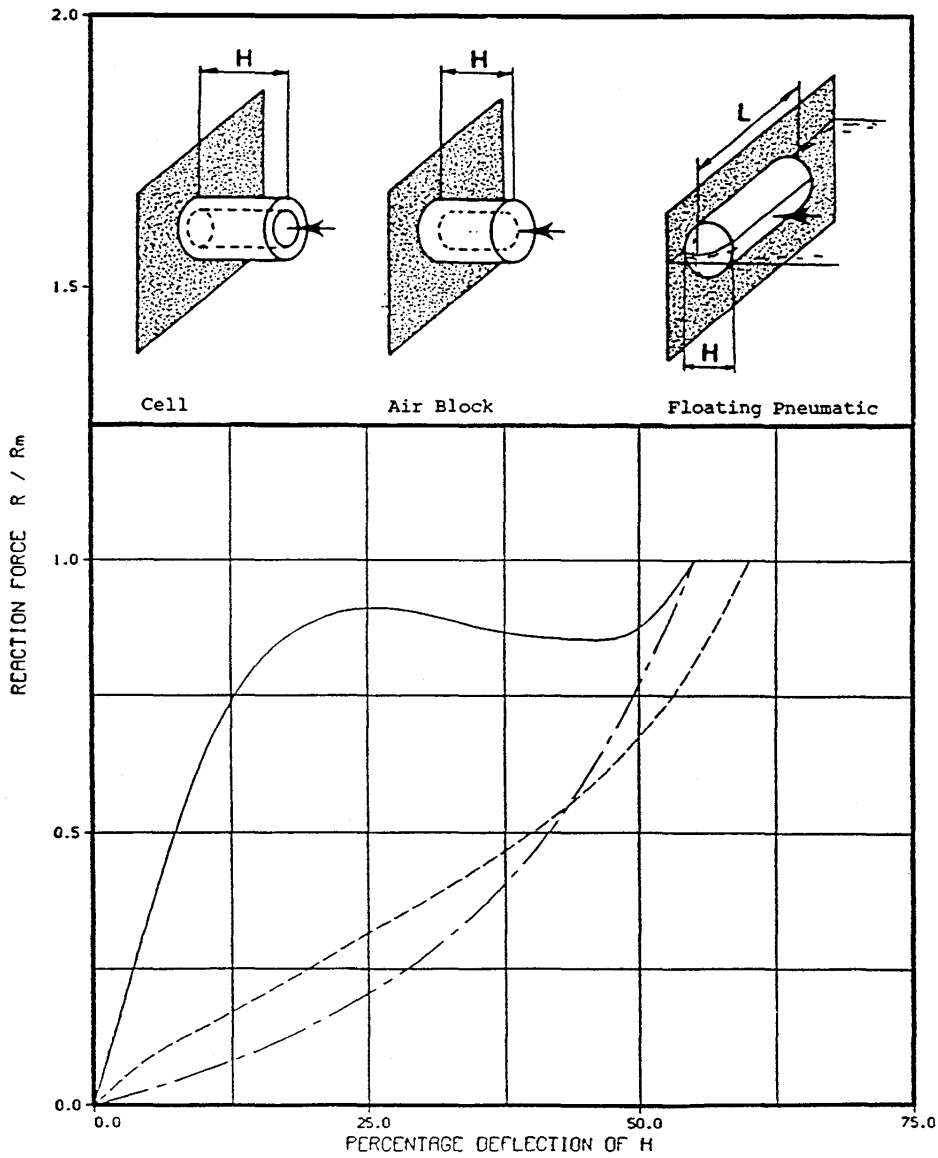


DIMENSIONLESS REACTION FORCE CHARACTERISTICS FOR FENDERS

R = reaction force

R_m = reaction force from the tables

- CELL FENDERS, BRIDGESTONE
- - - - AIR BLOCK FENDERS (ABF-P), YOKOHAMA
- · - · FLOATING PNEUMATIC RUBBER FENDER, YOKOHAMA



References

1. Cylinder fender catalogue, Bridgestone Tire Co. Ltd., Japan.
2. Trapezoidal fender catalogue, Kléber Industrie, Caoutchouc Manufacturé et Plastiques, France.
3. Axial fender catalogue, Kléber Industrie, Caoutchouc Manufacturé et Plastiques, France.
4. PI-type fender catalogue, Sumitomo Rubber Industries Ltd.
5. ABF-P (Air Block Fenders with Protector Plane) catalogue No. CN-0302S-OIE, Yokohama Rubber Co. Ltd.
6. Floating-type pneumatic rubber fender catalogue, Yokohama Rubber Co. Ltd.