

# Sostenibilidad: consumo y emisiones en el transporte ferroviario

## Sustainability: consumption and emissions in rail transport

Consumo de energía y emisiones de las principales rutas ferroviarias de larga distancia en 2015  
 Energy consumption and emissions of the main long-distance railway routes in 2015

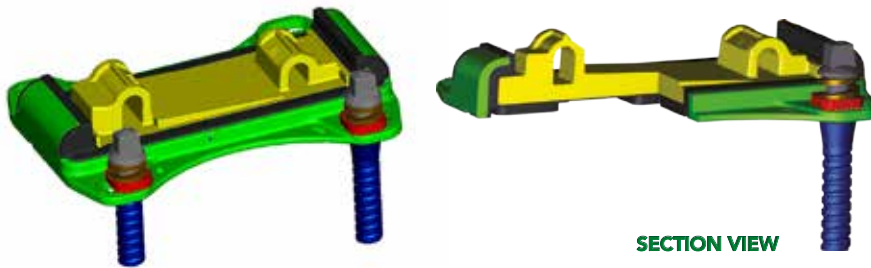
| Origen                                | Destino    | Consumo por tonelada | t/tren | Consumo por km | plazas/tren | Consumo por plaza.km | viajeros.km/ plaza.km (aprov) | Consumo por viajero.km |
|---------------------------------------|------------|----------------------|--------|----------------|-------------|----------------------|-------------------------------|------------------------|
|                                       |            | kWh/ t.km            |        | kWh/ tren.km   |             | kWh/ plaza.100km     |                               | kWh/ viajero.100km     |
| <b>Alta velocidad larga distancia</b> |            |                      |        |                |             |                      |                               |                        |
| Madrid                                | Barcelona  | 0,042                | 425    | 17,912         | 404         | 4,434                | 0,662                         | 6,697                  |
| Madrid                                | Sevilla    | 0,035                | 393    | 13,647         | 329         | 4,148                | 0,657                         | 6,313                  |
| Madrid                                | Valencia   | 0,052                | 322    | 16,671         | 365         | 4,567                | 0,609                         | 7,500                  |
| Madrid                                | Málaga     | 0,039                | 322    | 12,527         | 318         | 3,939                | 0,637                         | 6,184                  |
| Madrid                                | Zaragoza   | 0,033                | 425    | 14,159         | 404         | 3,505                | 0,562                         | 6,236                  |
| Madrid                                | Córdoba    | 0,038                | 393    | 14,945         | 329         | 4,543                | 0,657                         | 6,914                  |
| Barcelona                             | Zaragoza   | 0,037                | 425    | 15,688         | 404         | 3,883                | 0,662                         | 5,866                  |
| Madrid                                | Valladolid | 0,040                | 322    | 12,948         | 318         | 4,072                | 0,415                         | 9,812                  |
| Madrid                                | Tarragona  | 0,038                | 425    | 16,221         | 404         | 4,015                | 0,662                         | 6,065                  |
| <b>Larga distancia convencional</b>   |            |                      |        |                |             |                      |                               |                        |
| Barcelona                             | Valencia   | 0,027                | 312    | 8,506          | 299         | 2,845                | 0,627                         | 4,537                  |
| Madrid                                | Pamplona   | 0,036                | 247    | 8,998          | 238         | 3,781                | 0,572                         | 6,609                  |
| Madrid                                | Murcia     | 0,084                | 245    | 20,681         | 262         | 7,893                | 0,585                         | 13,493                 |
| Barcelona                             | Alicante   | 0,027                | 312    | 8,506          | 299         | 2,845                | 0,627                         | 4,537                  |
| Madrid                                | Asturias   | 0,036                | 312    | 11,215         | 299         | 3,751                | 0,627                         | 5,982                  |
| Madrid                                | León       | 0,031                | 312    | 9,772          | 299         | 3,268                | 0,627                         | 5,212                  |
| Madrid                                | Cádiz      | 0,031                | 312    | 9,639          | 299         | 3,224                | 0,670                         | 4,812                  |
| Madrid                                | Granada    | 0,043                | 261    | 11,149         | 298         | 3,741                | 0,592                         | 6,320                  |

Fuente: programa ALPI. Fundación de los Ferrocarriles Españoles

| $L_{300} / L_{010}$ | Consumo por viajero.km <sub>Orto</sub> | Consumo por viajero             | Factor emisiones          | Emisiones por viajero                          | Consumo asociado a la fabricación | Emisiones asociadas a la fabricación           |
|---------------------|--|---------------------------------|---------------------------|--|-----------------------------------|--|
|                     | kWh/viajero.<br>100km <sub>Orto</sub>  | kWh/<br>viajero <sub>Orto</sub> | gCO <sub>2</sub> /<br>kWh | kgCO <sub>2</sub> /<br>viajero <sub>Orto</sub> | kWh/<br>viajero <sub>Orto</sub>   | kgCO <sub>2</sub> /<br>viajero <sub>Orto</sub> |
| 1,22                | 8,182                                  | <b>41,591</b>                   | 188                       | <b>7,819</b>                                   | <b>1,388</b>                      | <b>0,259</b>                                   |
| 1,21                | 7,662                                  | <b>29,736</b>                   | 188                       | <b>5,590</b>                                   | <b>1,537</b>                      | <b>0,247</b>                                   |
| 1,30                | 9,757                                  | <b>29,370</b>                   | 188                       | <b>5,521</b>                                   | <b>0,751</b>                      | <b>0,160</b>                                   |
| 1,24                | 7,663                                  | <b>31,726</b>                   | 188                       | <b>5,964</b>                                   | <b>1,319</b>                      | <b>0,255</b>                                   |
| 1,12                | 6,962                                  | <b>19,144</b>                   | 188                       | <b>3,599</b>                                   | <b>0,955</b>                      | <b>0,148</b>                                   |
| 1,16                | 8,042                                  | <b>23,716</b>                   | 188                       | <b>4,459</b>                                   | <b>1,138</b>                      | <b>0,168</b>                                   |
| 1,26                | 7,384                                  | <b>18,829</b>                   | 188                       | <b>3,540</b>                                   | <b>0,712</b>                      | <b>0,141</b>                                   |
| 1,14                | 11,220                                 | <b>17,504</b>                   | 188                       | <b>3,291</b>                                   | <b>0,887</b>                      | <b>0,146</b>                                   |
| 1,23                | 7,465                                  | <b>32,024</b>                   | 188                       | <b>6,020</b>                                   | <b>1,325</b>                      | <b>0,250</b>                                   |
| 1,21                | 5,471                                  | <b>16,742</b>                   | 188                       | <b>3,148</b>                                   | <b>1,667</b>                      | <b>0,302</b>                                   |
| 1,41                | 9,340                                  | <b>28,486</b>                   | 188                       | <b>5,355</b>                                   | <b>1,282</b>                      | <b>0,341</b>                                   |
| 1,33                | 17,991                                 | <b>62,607</b>                   | 188                       | <b>11,770</b>                                  | <b>1,733</b>                      | <b>0,459</b>                                   |
| 1,36                | 6,183                                  | <b>25,227</b>                   | 188                       | <b>4,743</b>                                   | <b>2,088</b>                      | <b>0,484</b>                                   |
| 1,38                | 8,247                                  | <b>31,173</b>                   | 188                       | <b>5,861</b>                                   | <b>2,223</b>                      | <b>0,527</b>                                   |
| 1,23                | 6,405                                  | <b>18,191</b>                   | 188                       | <b>3,420</b>                                   | <b>1,504</b>                      | <b>0,283</b>                                   |
| 1,29                | 6,203                                  | <b>30,145</b>                   | 188                       | <b>5,667</b>                                   | <b>1,872</b>                      | <b>0,388</b>                                   |
| 1,63                | 10,291                                 | <b>37,047</b>                   | 188                       | <b>6,965</b>                                   | <b>1,250</b>                      | <b>0,494</b>                                   |

Fuente: programa ALPI. Fundación de los Ferrocarriles Españoles

## DELKOR ALT. 1



SECTION VIEW



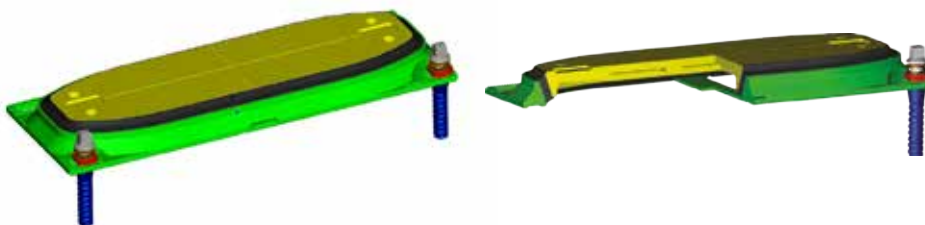
## DELKOR EGG



SECTION VIEW



## EGGS FOR TURNOUTS



SECTION VIEW



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no wearing parts
- Single rubber dampening element
- Proven fatigue life
- High electrical insulation
- Fail-safe design
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in excess of 30 years

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Consumo de energía y emisiones de las principales rutas ferroviarias de media distancia en 2015  
 Energy consumption and emissions of the main medium-distance railway routes in 2015

| Origen                                | Destino       | Consumo por tonelada | t/ tren | Consumo por km | plazas/ tren | Consumo por plaza.km | viajeros.km/ plaza.km (aprov) | Consumo por viajero.km |
|---------------------------------------|---------------|----------------------|---------|----------------|--------------|----------------------|-------------------------------|------------------------|
|                                       |               | kWh/ t.km            |         | kWh/ tren.km   |              | kWh/ plaza.100km     |                               | kWh/ viajero.100km     |
| <b>Alta velocidad media distancia</b> |               |                      |         |                |              |                      |                               |                        |
| Madrid                                | Toledo        | 0,033                | 222     | 7,389          | 237          | 3,118                | 0,496                         | 6,285                  |
| Madrid                                | Ciudad Real   | 0,034                | 222     | 7,483          | 237          | 3,157                | 0,477                         | 6,619                  |
| Sevilla                               | Córdoba       | 0,042                | 222     | 9,200          | 237          | 3,882                | 0,397                         | 9,778                  |
| Madrid                                | Segovia       | 0,032                | 230     | 7,410          | 237          | 3,127                | 0,591                         | 5,290                  |
| Madrid                                | Valladolid    | 0,032                | 230     | 7,410          | 237          | 3,127                | 0,591                         | 5,290                  |
| Barcelona                             | Lleida        | 0,032                | 251     | 8,132          | 281          | 2,894                | 0,410                         | 7,058                  |
| Madrid                                | Puertollano   | 0,034                | 222     | 7,483          | 237          | 3,157                | 0,477                         | 6,619                  |
| Sevilla                               | Málaga        | 0,042                | 251     | 10,438         | 281          | 3,714                | 0,397                         | 9,356                  |
| Barcelona                             | Girona        | 0,032                | 425     | 13,780         | 404          | 3,411                | 0,628                         | 5,431                  |
| Barcelona                             | Tarragona     | 0,041                | 425     | 17,390         | 404          | 4,304                | 0,410                         | 10,499                 |
| A Coruña                              | Santiago      | 0,053                | 251     | 13,280         | 281          | 4,726                | 0,252                         | 18,754                 |
| Girona                                | Figueras      | 0,046                | 425     | 19,490         | 404          | 4,824                | 0,628                         | 7,682                  |
| <b>Media distancia convencional</b>   |               |                      |         |                |              |                      |                               |                        |
| Barcelona                             | Reus          | 0,031                | 156     | 4,902          | 234          | 2,095                | 0,350                         | 5,985                  |
| Barcelona                             | Torredembarra | 0,031                | 156     | 4,902          | 234          | 2,095                | 0,350                         | 5,985                  |
| Madrid                                | Ávila         | 0,032                | 156     | 4,918          | 234          | 2,102                | 0,107                         | 19,642                 |
| Madrid                                | Salamanca     | 0,081                | 157     | 12,770         | 185          | 6,903                | 0,430                         | 16,053                 |
| Sevilla                               | Jerez F.      | 0,035                | 172     | 6,061          | 261          | 2,322                | 0,450                         | 5,160                  |

Fuente: programa ALPI. Fundación de los Ferrocarriles Españoles

| $L_{zon}/L_{orto}$ | Consumo por viajero. km <sub>Orto</sub> | Consumo por viajero         | Factor emisiones      | Emisiones por viajero                      | Consumo asociado a la fabricación | Emisiones asociadas a la fabricación       |
|--------------------|---|-----------------------------|-----------------------|--|-----------------------------------|--|
|                    | kWh/viajero. 100km <sub>Orto</sub>      | kWh/viajero <sub>Orto</sub> | gCO <sub>2</sub> /kWh | kgCO <sub>2</sub> /viajero <sub>Orto</sub> | kWh/viajero <sub>Orto</sub>       | kgCO <sub>2</sub> /viajero <sub>Orto</sub> |
| 1,14               | 7,142                                   | <b>4,714</b>                | 188                   | <b>0,886</b>                               | <b>0,364</b>                      | <b>0,066</b>                               |
| 1,08               | 7,164                                   | <b>11,319</b>               | 188                   | <b>2,128</b>                               | <b>0,695</b>                      | <b>0,114</b>                               |
| 1,06               | 10,348                                  | <b>12,418</b>               | 188                   | <b>2,335</b>                               | <b>0,786</b>                      | <b>0,123</b>                               |
| 0,83               | 4,376                                   | <b>3,545</b>                | 188                   | <b>0,666</b>                               | <b>0,538</b>                      | <b>0,051</b>                               |
| 1,14               | 6,037                                   | <b>9,417</b>                | 188                   | <b>1,770</b>                               | <b>0,656</b>                      | <b>0,119</b>                               |
| 1,36               | 9,630                                   | <b>12,422</b>               | 188                   | <b>2,335</b>                               | <b>0,746</b>                      | <b>0,185</b>                               |
| 1,08               | 7,168                                   | <b>13,834</b>               | 188                   | <b>2,601</b>                               | <b>1,014</b>                      | <b>0,166</b>                               |
| 1,85               | 17,309                                  | <b>27,695</b>               | 188                   | <b>5,207</b>                               | <b>0,688</b>                      | <b>0,314</b>                               |
| 1,08               | 5,868                                   | <b>5,105</b>                | 188                   | <b>0,960</b>                               | <b>0,450</b>                      | <b>0,066</b>                               |
| 1,32               | 13,814                                  | <b>10,499</b>               | 188                   | <b>1,974</b>                               | <b>0,428</b>                      | <b>0,092</b>                               |
| 1,18               | 22,164                                  | <b>12,190</b>               | 188                   | <b>2,292</b>                               | <b>0,647</b>                      | <b>0,120</b>                               |
| 1,00               | 7,682                                   | <b>2,612</b>                | 188                   | <b>0,491</b>                               | <b>0,207</b>                      | <b>0,026</b>                               |
| 1,13               | 6,783                                   | <b>6,105</b>                | 188                   | <b>1,148</b>                               | <b>0,997</b>                      | <b>0,251</b>                               |
| 1,72               | 10,298                                  | <b>7,003</b>                | 188                   | <b>1,317</b>                               | <b>0,278</b>                      | <b>0,161</b>                               |
| 1,36               | 26,704                                  | <b>23,767</b>               | 188                   | <b>4,468</b>                               | <b>2,378</b>                      | <b>0,861</b>                               |
| 1,31               | 21,041                                  | <b>37,243</b>               | 188                   | <b>7,002</b>                               | <b>1,477</b>                      | <b>0,385</b>                               |
| 1,17               | 6,020                                   | <b>5,418</b>                | 188                   | <b>1,019</b>                               | <b>0,582</b>                      | <b>0,156</b>                               |

Fuente: programa ALPI. Fundación de los Ferrocarriles Españoles

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