Choosing How to Travel

A practical comparison of planes, trains, coaches and cars - with carbon, time, cost and access trade-offs

Publication date: 12 September 2026

Publisher: WorldsDoor (worldsdoor.com)

Editorial status: Publisher-sponsored educational content. This paper does not claim independent commissioning, certification, or endorsement by cited organizations.

Evidence first. Practical choices. Clear limits.

Contents

Executive summary

Transport choices can differ sharply in greenhouse-gas intensity, but a single “grams per passenger-kilometre” number is not a universal answer. Occupancy, vehicle type, electricity mix, route length, cabin class, airport access, congestion and the way non-CO2 aviation effects are treated can all change the comparison. [1][2][4][7]

Using UK reporting factors presented by Our World in Data for 2022, national rail was about 35 gCO2e per passenger-kilometre, coach 27, an electric car 47, an average petrol car 170 and a domestic flight 246. These are useful reference values, not promises about a particular journey. [2][3]

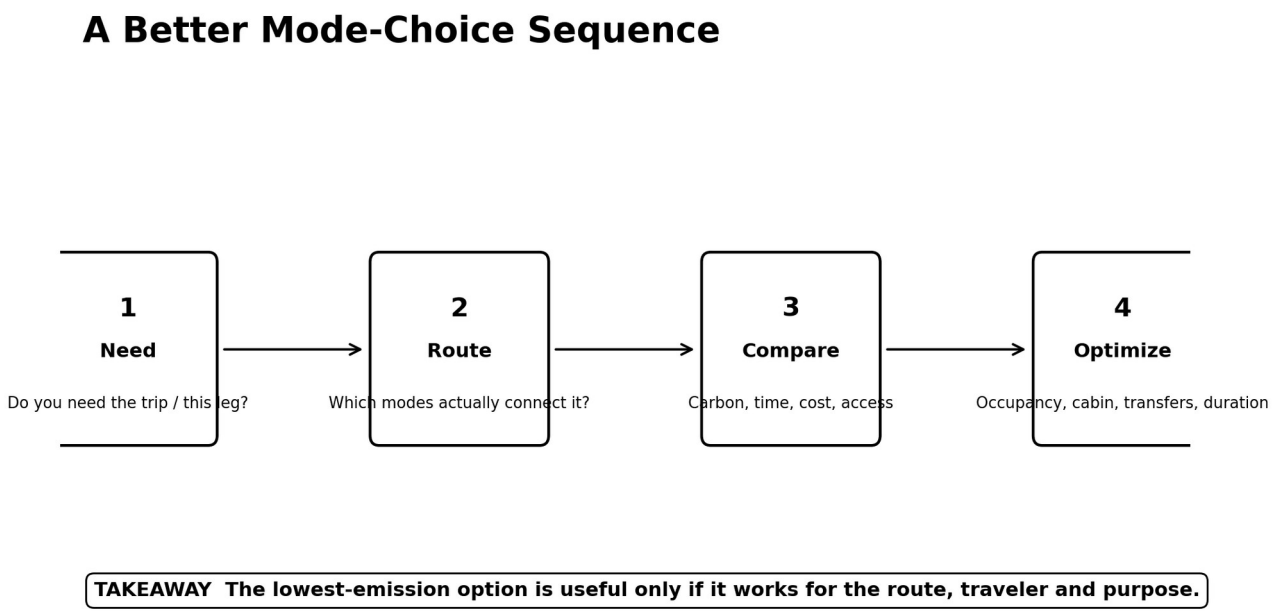
The decision that works best usually combines carbon with door-to-door time, cost, accessibility, reliability, baggage, group size and whether the trip is replaceable. This paper provides a transparent decision framework and shows why “train always wins” or “flying is always worst” can both be oversimplifications.

Audience and questions addressed

This paper is for travelers comparing intercity or international transport choices, including leisure travelers, business travelers and readers who want to interpret sustainability claims more carefully. It focuses on how to compare modes fairly, when per-kilometre data are useful, and what important factors those figures omit.

It is not a route-booking tool and does not estimate the emissions of a specific ticket. For an actual journey, use route-specific timetables and an emissions calculator that states its methodology; for aviation, ICAO provides an internationally approved CO2 calculator, while noting that it calculates CO2 rather than a full climate-impact multiplier. [8]

Figure 1. Four-stage mode-choice framework



Original infographic for comparing transport options. Source: WorldsDoor synthesis based on UK DfT/DESNZ, EEA and ICAO guidance.

Takeaway: Start with the need and route, then compare feasible options; optimize only after the basic mode choice is clear.

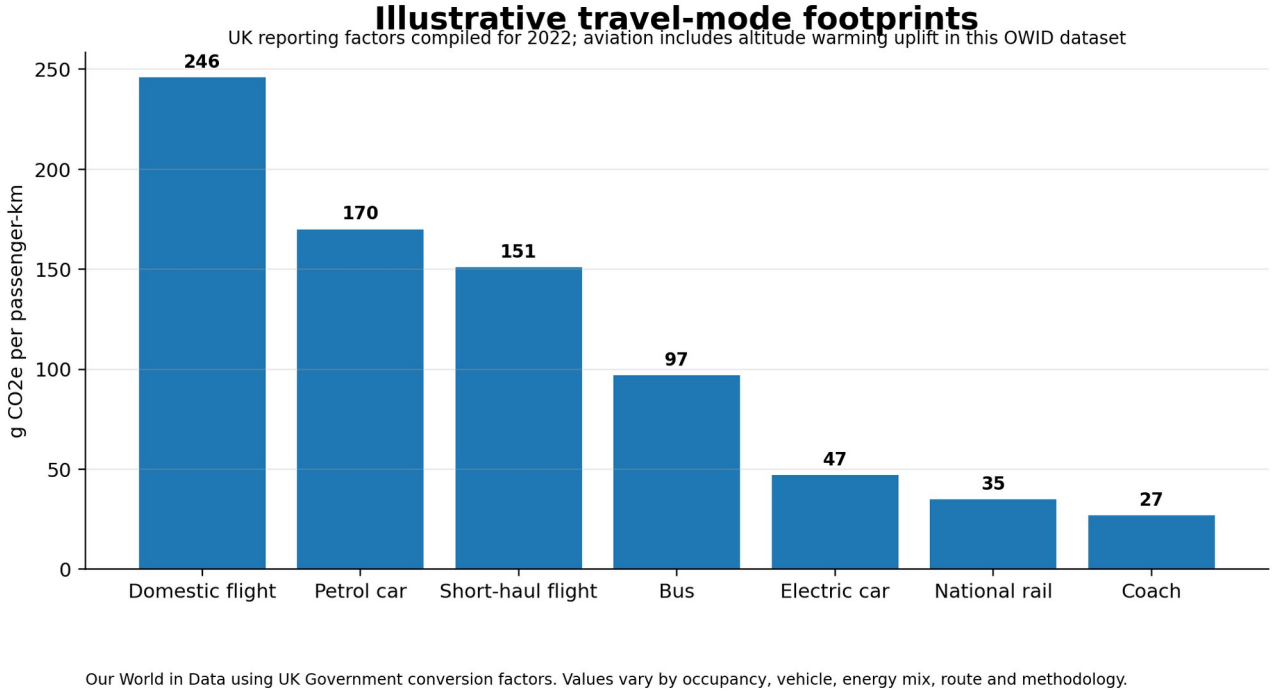
Why mode comparisons are difficult

Passenger-kilometre metrics divide emissions by the number of people carried and distance traveled. They are useful because they make modes comparable on a common unit, but the result depends strongly on assumptions. A nearly empty coach and a full coach do not have the same per-passenger footprint. A car carrying four people can look very different from a car carrying one. Rail electricity can be low-carbon in one country and more carbon-intensive in another. [1][2][4]

Aviation adds a special complication. Aircraft emit CO2 but also nitrogen oxides, water vapor and particles at altitude, and can contribute to contrails and aviation-induced cloud effects. ICAO states that important uncertainties remain in quantifying non-CO2 climate terms. Different calculators therefore may show different values depending on whether and how those effects are included. [7]

Distance itself is another source of distortion. Flight takeoff and landing use a larger share of energy on short routes, so domestic and short-haul flights often have higher emissions per passenger-kilometre than longer flights. That does not make a long-haul flight low-impact in total: a lower rate multiplied by thousands of kilometres can still produce a large trip footprint. [3]

Figure 2. Greenhouse-gas intensity by travel mode



Reference values in grams CO2-equivalent per passenger-kilometre. Dataset year: 2022; factors are derived from UK reporting methodology and are not global averages. Source: Our World in Data, based on UK Government Department for Energy Security and Net Zero conversion factors.

Takeaway: Rail and coach are low in this reference set, while flights and single-occupancy-style car assumptions are much higher; real journeys can differ.

Beyond carbon: time, access and reliability

Carbon is consequential, but a practical travel decision has other dimensions. Rail often brings passengers closer to city centers and reduces airport-transfer time. Coaches can be very low-carbon and inexpensive but slower. Cars can offer direct access for rural destinations, families or travelers with equipment; occupancy changes the per-person result. Flights become more competitive on door-to-door time as distance grows or where geography and rail networks make surface travel impractical.

Accessibility can outweigh small carbon differences. A traveler with mobility needs may require a direct route, accessible station, assistance service or private vehicle. Reliability also matters when missed connections create extra hotel nights or replacement journeys. The best comparison therefore uses feasible options rather than ranking modes that cannot meet the actual journey requirements.

EEA analysis for Europe supports the broad hierarchy that rail is the lowest direct greenhouse-gas contributor among major transport subsectors, while road dominates total transport emissions and aviation has grown rapidly. That system-level pattern is consistent with per-passenger comparisons, but it should not be confused with a guarantee about every route. [5][6]

Table 1. Multi-criteria transport decision matrix

Mode	Strengths	Trade-offs / limits	Best questions to ask
Rail	Often low-carbon; city-center access; productive travel time	Network gaps; fare volatility; overnight connections	Is the route direct? What is the electricity mix? Can one rail leg replace a flight?
Coach / bus	Low per-passenger emissions when well used; inexpensive	Longer journey; comfort and accessibility vary	Is it direct, reliable and accessible? How much extra time does it add?
Electric car	Flexible; can be low in use-phase emissions	Charging, grid mix, manufacturing not shown in trip factors; occupancy matters	How many passengers? What charging mix and detours are involved?
Petrol/diesel car	Door-to-door access; useful for groups/rural trips	High per-person emissions when lightly occupied; congestion	Can passengers share? Is park-and-ride or rail practical for part of trip?
Flight	Fast over long distance; essential for islands/remote routes	High climate impact; airport access; non-CO2 uncertainty	Can a short flight be replaced? Economy vs premium cabin? Is the trip length justified?

Editable decision matrix. Source: WorldsDoor synthesis based on UK Government, EEA and ICAO sources.

Takeaway: Compare only modes that genuinely work for the trip, then make assumptions explicit.

When the lowest-carbon option is not the usable option

The lowest numerical factor should not be treated as a command to choose an unusable journey. A night train that is sold out, a station without suitable step-free access, or a coach timetable that creates an unsafe overnight transfer may fail the traveler's actual constraints. A sound comparison records those constraints rather than hiding them. That makes the result more transparent and prevents a sustainability metric from being used to dismiss accessibility, caregiving, disability, safety or work obligations.

The same principle applies to cost and time. A very low fare can disappear once airport transfers, baggage, overnight accommodation or missed-work time are added; conversely, a higher rail fare may include city-center access and productive travel time. These are not environmental measurements, but they determine whether an option can realistically substitute for another. The decision framework therefore separates two questions: first, which modes are feasible; second, among feasible modes, which option best balances climate impact, total cost, time, access and reliability.

Worked examples

Example A: a 500 km intercity route with good rail. Using the 2022 reference factors purely for illustration, 500 km by national rail at 35 gCO2e/pkm corresponds to about 17.5 kgCO2e per passenger, while a petrol-car reference at 170 corresponds to about 85 kg and a domestic-flight reference at 246 corresponds to about 123 kg. These are multiplication examples, not route-specific estimates. They show why mode choice can dominate small efficiency tweaks. [2][3]

Example B: four people traveling to a rural area. A car's per-person impact falls as occupancy rises, while a rail journey followed by multiple taxis may add complexity and distance. The comparison should use the actual party size and full route. DfT methodology explicitly uses occupancy assumptions in journey comparisons; changing those assumptions changes the result. [4]

Example C: an intercontinental journey. Surface transport may not be practical. The useful decisions shift to trip frequency, length of stay, route directness, cabin class, and whether several purposes can be combined into one journey. ICAO's calculator uses route-specific data and cabin classes for CO2 estimates, which is more appropriate than multiplying a generic short-haul number across a long-haul route. [8]

Reader checklist

- Define the full door-to-door route, not just the main segment.
- Use the same functional unit and system boundary when comparing modes.
- Check whether the emissions figure is CO2 or CO2e and whether aviation non-CO2 effects are included.
- For cars, state passenger occupancy; for flights, state cabin class where possible.
- Include transfers, detours and additional hotel nights when they materially change the choice.
- Consider accessibility, safety, reliability, baggage and traveler needs alongside emissions.
- Prefer route-specific calculators for final estimates and retain the methodology/source.
- Where a low-carbon option is impractical, look for fewer trips, longer stays or combining purposes rather than making unsupported "carbon neutral" claims.

Conclusion

The evidence shows large average differences among transport modes, especially between rail/coach and aviation or lightly occupied conventional cars. Yet responsible comparison requires more than repeating a league table. The right metric, occupancy, route, electricity system and treatment of aviation effects all matter. [1][2][7]

A transparent decision is therefore better than a simplistic green label: state what was compared, which assumptions were used, what the data cover, and what practical constraints shaped the final choice.

Research method and limitations

This paper was prepared from publicly accessible sources reviewed on 12 September 2026. Core numerical comparisons use the Our World in Data 2022 transport-footprint dataset derived from UK Government reporting factors because it presents a consistent passenger-kilometre basis. Current 2026 UK conversion-factor documentation, DfT journey methodology, EEA system-level analysis and ICAO aviation guidance were used to explain limitations.

The quantitative chart is not a 2026 global-average chart. Transport intensity varies by country, electricity mix, vehicle, occupancy, route and methodology. Manufacturing emissions are not included consistently across all trip-factor datasets. Aviation non-CO2 effects remain scientifically important but methodologically uncertain, so calculators may legitimately report different scopes.

Publisher disclosure

Published by WorldsDoor as educational editorial content for its readers and subscribing community. WorldsDoor is the sponsor/publisher of this paper. The paper is not represented as independent third-party research, and no external organization cited here is claimed to endorse WorldsDoor.

Appendix A - Underlying chart data

Source: Our World in Data transport-mode dataset (2022), based on UK Government conversion factors. These are comparative factors, not route-specific global averages; see methodology discussion and references.

Mode	g CO2e per passenger-km (2022 dataset)
Domestic flight	246
Petrol car	170
Short-haul flight	151
Bus	97
Electric car	47
National rail	35
Coach	27

References

[1] UK Department for Energy Security and Net Zero, GHG conversion factors 2026. Source link

[2] Our World in Data, Carbon footprint of travel per kilometer (2022 dataset). Source link

[3] Our World in Data, Which form of transport has the smallest carbon footprint?. Source link

[4] UK Department for Transport, Journey emissions comparisons: methodology and guidance. Source link

[5] European Environment Agency, Sustainability of Europe's mobility systems 2025 - Climate. Source link

[6] European Environment Agency, Rail and waterborne - best for low-carbon motorised transport. Source link

[7] ICAO, Non-CO2 Aviation Emissions. Source link

[8] ICAO Carbon Emissions Calculator. Source link

worldsdoor.com