NOVA SCHOOL OF BUSINESS & ECONOMICS

The High Speed 2 (HS2) Railway Project in England

Environmental Impact Report

Date:
12/05/2025

Authors:
Jakob Grøner (69683)
Halvor Femdal (69682)
Erlend Helland (69684)
Björn Taus (69390)

Group:
11

HS2 Is a High-speed Rail Linking London and Birmingham to Improve Capacity and Connectivity

What?

- **High-speed rail** connecting London (Euston) and Birmingham (Curzon Street) via Phase 1
- **Phase 2** (extensions to Crewe, Manchester, and Leeds) was **cancelled in 2023** due to cost concerns
- Trains designed for speeds up to 360 km/h to **cut travel time by around 50%**

Where?

- Phase 1 **route covers ~225 km** through urban, suburban, and rural landscapes
- Passes densely populated areas, posing **challenges for air quality and noise**
- Focuses on **integrating major city hubs** while managing rural and environmental challenges

Why?

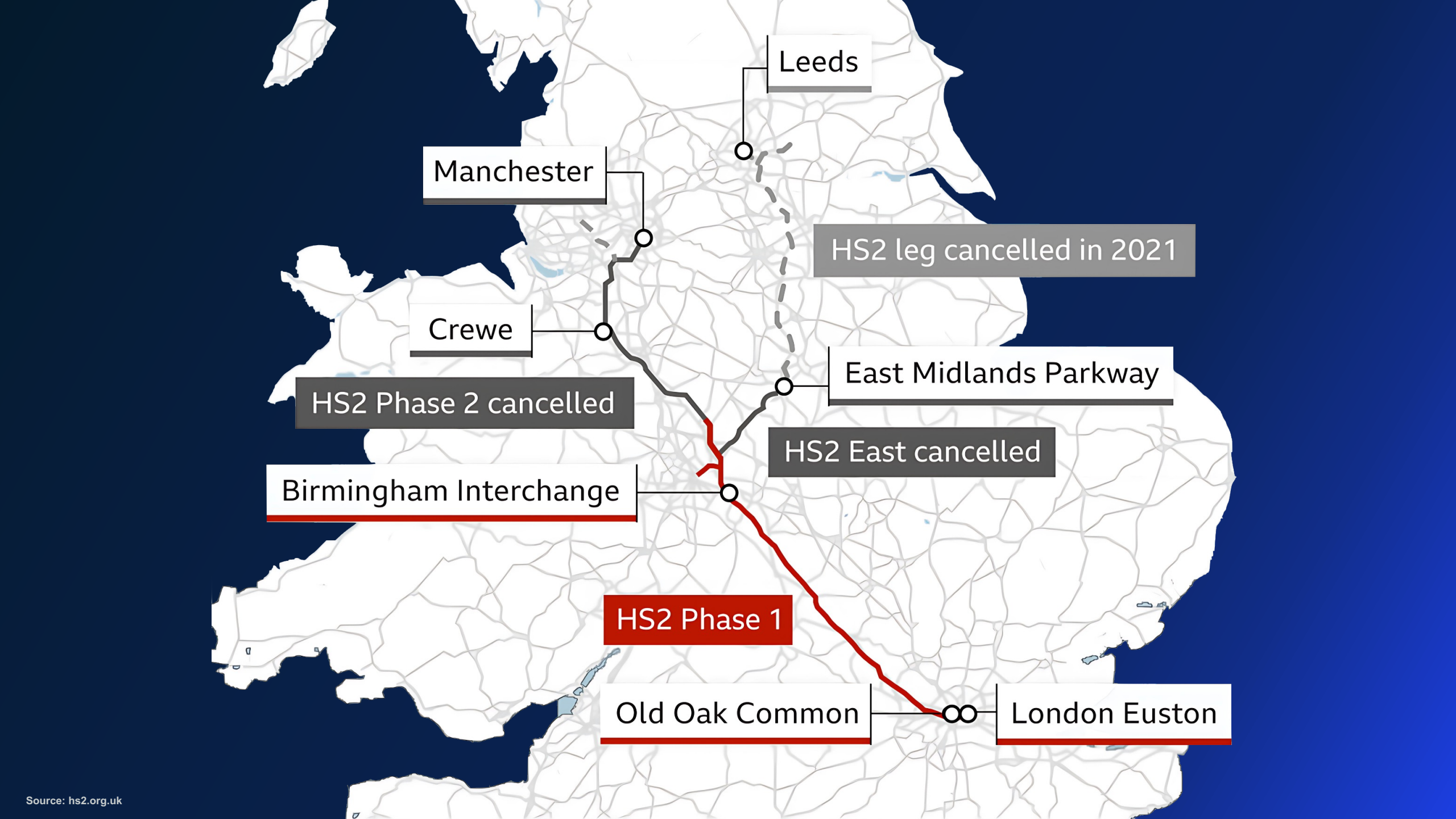
- **Shift journeys** from cars and domestic flights **to lower-carbon rail travel**
- **Free up capacity** for freight and regional passenger services **on existing lines**
- Strengthen national transport links and support balanced regional economic development

Who?

- Overseen and funded by the **UK Government** through HS2 Ltd.
- Delivered by **global contractors** responsible for tunnels, tracks, and stations
- Involves local communities, environmental groups, and commuters as **key stakeholders**

PUBLIC AND GOVERNMENT ARE CONCERNED WITH THE PROJECTS ENVIRONMENTAL AND ECONOMIC FOOTPRINT

- **5.8M - 6.2M tons CO_2e from and steel use in Phase 1 construction**
- **55 ancient woodlands directly or indirectly impacted**
- **£90 billion+ total estimated costs after overruns, creating public and political scrutiny**


Leeds
Manchester
HS2 leg cancelled in 2021
Crewe
East Midlands Parkway
HS2 Phase 2 cancelled
HS2 East cancelled
Birmingham Interchange
HS2 Phase 1
Old Oak Common
London Euston
Source: hs2.org.uk

Construction Impacts Are Mostly Controlled, While Operational Risks Depend on Land Restoration, Runoff Prevention, and Low-Impact Maintenance

	Area	Challenge	Risk	Mitigation Strategy
Construction Phase	**Deforestation & Habitat Loss**	Clearing of ancient woods and veteran trees ↳ Biodiversity loss & carbon release		▪ Deep tunnels in sensitive areas 🔄 ▪ Avoidance of key woodland sites where feasible ✓ ▪ Compensatory planting schemes ✓
	Soil Excavation & Waste Material	Large volumes of excavated earth ↳ Landscape disruption & waste handling		▪ Reuse of 95% excavated material for embankments ✓ ▪ Transport minimization strategies ✓ ▪ Embankments to reduce noise and visual impact ✓
	Soil Compaction & Degradation	Heavy machinery leading to chronic compaction ↳ Loss of soil health		▪ Minimize heavy machinery movements in sensitive zones ✓ ▪ Soil management best practices during construction ✓ ▪ Monitoring soil health post-construction ✕
Operational Phase	**Land Use Change & Bibiodiversity**	New infrastructure divides habitats ↳ Reduces ecological connectivity		▪ Wildlife crossings and green bridges 🔄 ▪ Restoration of construction sites ✓ ▪ Maintain natural corridors along tracks 🔄
	Chemical Runoff from Trains	Lubricants, oils, heavy metals ↳ Soil & groundwater contamination		▪ Use of low-toxicity lubricants and chemicals 🔄 ▪ Monitoring of soil and water quality ✕ ▪ Emergency spill response plans 🔄
	Increased Maintenance Activity	Regular track work ↳ Continuous soil disruption		▪ Use of low-impact machinery 🔄 ▪ Scheduling maintenance to reduce ecosystem stress 🔄 ▪ Post-maintenance restoration measures ✕

✓ *Executed* 🔄 *Planned* ✕ *Not planned*

Construction Impacts Are Largely Mitigated, Whereas Operational Risks Depend on Clean Electricity, Low Car Use, And Emission Control

	Area	Challenge	Risk	Mitigation Strategy
Construction Phase	**Heavy machinery emissions**	Diesel-powered equipment causes temporary pollution hotspots (NOx, $PM_{2.5}/_{10}$) near urban areas		▪ Electrification of machinery and equipment ✓ ▪ Use of alternative fuels/additives ✓ ▪ Enforcing strict low-emission standards ✓
	Transport of materials	Delivery routes lead to NO_2 & PM emissions near sensitive locations (schools, hospitals)		▪ Logistics hubs (e.g., Atlas Road) to reduce truck journeys ✓ ▪ Shift to rail transport for materials ✓
	Fugitive dust & land clearance	Land clearance and soil disturbance release PM_{10}, harming local air quality		▪ Minimize land clearance (reduced to 0.4% footprint) ✓ ▪ Dust suppression and monitoring ✓
Operational Phase	**Electricity demand**	High-speed rail consumes more electricity ↳ Indirect CO_2 depends on grid greenness		▪ Use 100% zero-carbon electricity from day one 🔄
	Car traffic to/from HS2 stations	Passengers may increase car usage to reach stations ↳ Offsetting of rail benefits		▪ Invest in last-mile and green mobility integration (e.g. bike, bus) ✓🔄
	Secondary emissions	Minor but persistent sources of particulate matter and No_x ↳ i.e. brake, wheel, pantograph and overhead line wear		▪ Modern train design and infrequent generator use ✓ ▪ Monitoring and maintenance of low-emission operations 🔄

✓ *Executed* 🔄 *Planned* ✕ *Not planned*

Construction Water Risks Are Managed, While Operational Impacts Rely on Sustainable Drainage Systems, Resilience and Monitoring

	Area	Challenge	Risk	Mitigation Strategy
Construction Phase	Water Consumption & Depletion	Extensive water use (concrete, dust suppression, tunneling) risks groundwater depletion		▪ Water treatment plant at Chiltern Tunnel ✓ ▪ Recycled water in TBMs ✓ ▪ Groundwater monitoring ↻
Construction Phase	Runoff & Sedimentation	Disturbed soils may cause runoff ↳ Pollution of streams and aquatic habitats		▪ Erosion and sediment control ↻ ▪ On-site water collection systems ↻ ▪ Rain event monitoring ✕
Construction Phase	Chemical Leakage & Drink Water Risks	Accidental leaks (fuels, lubricants) and aquifer pollution risk drinking water contamination		▪ £100m filtration and pumping (Chiltern) ✓ ▪ Enhanced treatment for water sources ↻ ▪ Public transparency/dashboard ✕
Operational Phase	Surface Water Runoff	New impermeable surfaces increase flood risks without proper drainage		▪ Sustainable Drainage Systems ✓ ▪ Drainage maintenance and monitoring ↻ ▪ Biodiversity runoff treatment ↻
Operational Phase	Long-Term Aquifer Disruption	Tunnels and embankments may disturb groundwater flow		▪ Tunnel/embankment design to reduce disruption ✓ ▪ Aquifer flow monitoring ↻
Operational Phase	Cumulative Small-Scale Pollution	Minor leaks and runoff from daily operation accumulate over decades		▪ Low-toxicity chemicals ↻ ▪ Inspections and pollution control ↻ ▪ Lifetime ecosystem monitoring ✕

✓ *Executed* ↻ *Planned* ✕ *Not planned*

Construction Disrupts Communities and Businesses, While Operation Risks Unequal Access and Regional Imbalances

	Area	Challenge	Risk	Mitigation Strategy
Construction Phase	Employment & Local Economic Activity	Construction boosts local jobs and spending but benefits are temporary and localized		▪ Apprenticeship programs (e.g. HS2 Skills College) ✓ ▪ Local hiring targets ↻
Construction Phase	Displacement of Communities & Businesses	Around 900 homes and 1,000 businesses face demolition or severe disruption		▪ Compensation and resettlement support ↻ ▪ Transparent communication ↻ ▪ Social cohesion restoration programs ✕
Construction Phase	Construction Nuisance	Noise pollution, dust, traffic, and access issues harm nearby residents and businesses		▪ Noise/dust control measures ✓ ▪ Construction site access management (i.e. reduce traffic, ensure fixed working slots, etc.) ↻
Operational Phase	Regional Economic Growth	Risk of overconcentration around major hubs (e.g. Birmingham, Old Oak Common)		▪ Local development plans with councils (e.g. regeneration zones) ↻
Operational Phase	Housing Market and Gentrification	Better connectivity may increase housing demand and prices, risking displacement		▪ Affordable housing policies near stations ✕ ▪ Community inclusion measures ✕
Operational Phase	Accessibility and Fare Affordability	Premium fares may limit access for lower-income populations		▪ Commitments to affordable pricing ✕ ▪ Discount schemes and modal integration ✕

✓ *Executed* ↻ *Planned* ✕ *Not planned*

Establishing Transparent and Accountable Water Governance Facilitates Mitigation of HS2's Risks and Secures Long-term Public Trust

Key Challenges and Opportunities

1 Significant short- and long-term water risks

- Groundwater depletion, aquifer contamination, and chemical runoff pose major threats to ecosystems and drinking water

2 Lack of transparency reduces public confidence

- Communities lack access to real-time water data
- Internal reporting alone fails to build trust

3 Limited stakeholder engagement and participation

- Water governance remains technical and top-down
- Few opportunities for meaningful public involvement

Recommended Actions

Expand monitoring and diversify metrics

- Increase sensors and track key indicators (pH, turbidity, nitrates, microbials, metals)
- Build a strong, transparent evidence base

Launch real-time public dashboard

- Share live water data openly with stakeholders
- Support trust and rapid issue response

Enable third-party oversight and certification

- Partner with AWS, WWF or similar for audits
- Move from compliance to ethical water stewardship

Implementing these governance measures will address public concerns, enhance stakeholder legitimacy, and strengthen HS2's long-term sustainability profile

Implementing Deep-bore Tunneling Can Protect Ancient Woodlands and Prevent Irreversible Ecosystem Disruption

Key Challenges and Opportunities

1 Irreversible damage to ancient woodlands

- Surface-level construction destroys habitats and biodiversity
- Loss of ecological networks is permanent and non-replicable

2 Deep-bore tunneling already proven feasible

- HS2 uses deep tunnels in sensitive areas (e.g. Chiltern Tunnel)
- Technology and expertise for deep tunneling are well established

3 Trade-offs and risks of deep tunneling

- Higher costs, energy use, and material excavation
- Potential impacts on groundwater and subterranean ecosystems

Recommended Actions

Expand use of deep-tunneling in sensitive zones

- Prioritize deep tunnels under ancient woodlands and biodiversity hotspots
- Ensure tunnels exceed root zones to protect ecosystems

Mitigate tunneling's environmental footprint

- Reuse excavated materials for embankments and landscaping
- Use low-carbon energy to reduce tunneling emissions

Balance costs with long-term benefits

- Accept higher upfront investment to prevent irreversible damage
- Communicate sustainability gains to reinforce public and stakeholder support.

Applying deep-bore tunneling in ecologically sensitive areas protects irreplaceable habitats and strengthens HS2's environmental credibility

Closing HS2's Carbon Gap Through Transparent Reporting, Clean Construction, Renewable Energy, and Modal Shift

Key Challenges and Opportunities

1 Construction emissions undermine climate goals

- Projected net carbon increase over lifespan without stronger reduction measures
- High embodied carbon from concrete, steel, and tunnelling

2 Lack accountability and renewables commitment

- Existing "Destination Net Zero" lacks binding reporting and procurement mechanisms
- No firm commitments to renewable energy sourcing for operations

3 Modal shift impact is uncertain and insufficient

- Some forecasts suggest minimal shift from car travel
- Without better integration and incentives, climate benefits may not materialize

Recommended Actions

Implement quarterly public carbon reporting

- Disclose lifecycle emissions via digital dashboard (Scope 1, 2, and 3)
- Ensure independent verification and benchmark against carbon budgets

Secure renewable electricity for operations

- Enter binding contracts (e.g. UK Contracts for Difference scheme)
- Ensure 100% renewable energy powers rail operations

Increase modal shift through policy & integration

- Adopt integrated ticketing and competitive pricing models
- Align with short-haul flight restrictions as done in France and Spain

Without robust reporting, clean construction, renewable energy and stronger modal shift, HS2 risks missing its climate targets

NOVA SCHOOL OF
BUSINESS & ECONOMICS

Thank You!