



Sustainable
Transport



Sustainable Houses & Transportation

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<http://www.ozgurzeydan.com/>

Sustainable Houses

1. Environmental sustainability

The house is designed to reduce greenhouse gas emissions, save water and energy and reduce waste during construction and the house's lifetime.

2. Social sustainability / universal design

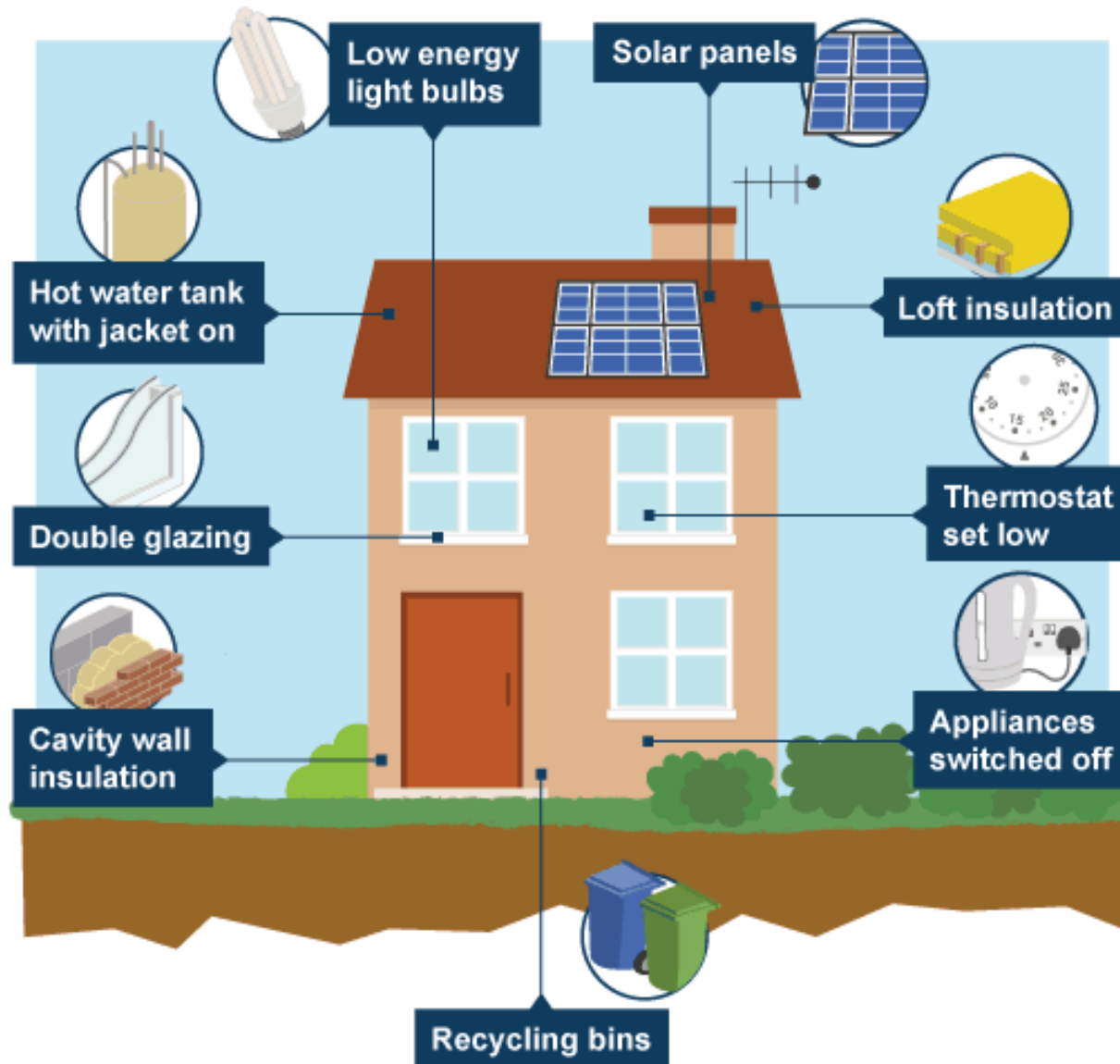
The house is designed to prevent injuries through built-in safety features. It has security elements to reduce crime and improve the occupants' sense of security. Features are also used to provide flexibility and comfort for people of varying abilities and at different life stages, including children and people with limited mobility.

Sustainable Houses

3. Economic sustainability

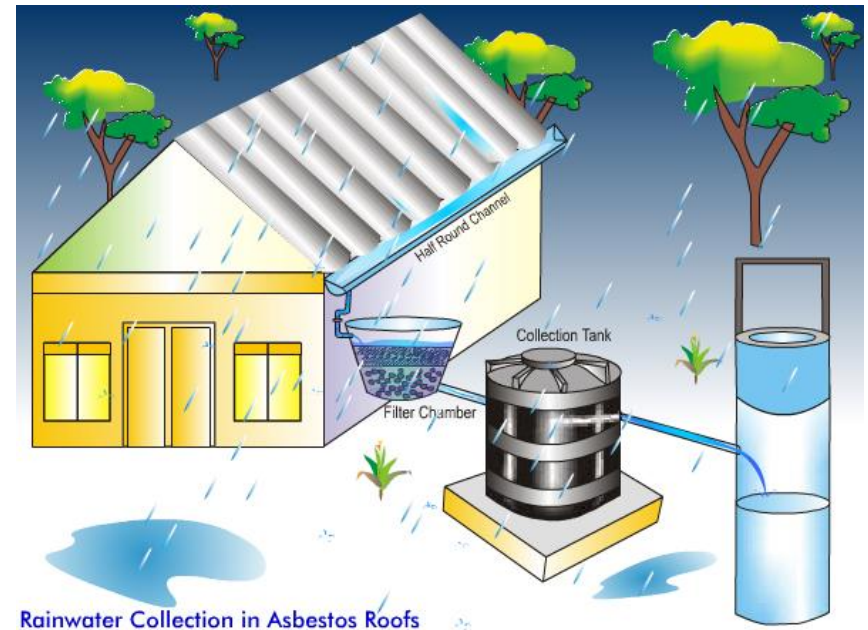
The house is designed to save money during construction and over the lifetime of the house. Careful planning avoids the need for major future renovations and reduces costs associated with energy use, water use and maintenance.

Sustainable Houses



Water Harvesting

- Reduces Stormwater Runoff
- Increases Available Water Supply
- Increases Groundwater Recharge
- Reduces Energy Use



<http://www.dipbuzz.com/water-crisis-and-rainwater-harvesting-every-drop-counts-how-can-we-make-it-count/>

Green Roofs

- Reduces Stormwater Runoff
- Reduces Energy Use
- Improves Air Quality
- Reduces Atmospheric CO₂
- Reduces Urban Heat Island
- Improves Community Livability
- Improves Habitat



<http://www.panacea-bocaf.org/sustainabledevelopment.htm>

Green Building Certifications



LEED Certification

LEED® for Commercial Interiors

Total Possible Points 110***

	Sustainable Sites	21
	Water Efficiency	11
	Energy & Atmosphere	37
	Materials & Resources	14
	Indoor Environmental Quality	17

* Out of a possible 100 points + 10 bonus points

** Certified 40+ points, Silver 50+ points,
Gold 60+ points, Platinum 80+ points

	Innovation in Design	6
	Regional Priority	4





Version 2.1 Registered Project Checklist

Project Name

City, State

Yes Y No

Sustainable Sites 14 Points

<input checked="" type="checkbox"/>	Prereq 1	Erosion & Sedimentation Control	Required
<input type="checkbox"/>	Credit 1	Site Selection	1
<input type="checkbox"/>	Credit 2	Urban Redevelopment	1
<input type="checkbox"/>	Credit 3	Brownfield Redevelopment	1
<input type="checkbox"/>	Credit 4.1	Alternative Transportation, Public Transportation Access	1
<input type="checkbox"/>	Credit 4.2	Alternative Transportation, Bicycle Storage & Changing Rooms	1
<input type="checkbox"/>	Credit 4.3	Alternative Transportation, Alternative Fuel Vehicles	1
<input type="checkbox"/>	Credit 4.4	Alternative Transportation, Parking Capacity and Carpooling	1
<input type="checkbox"/>	Credit 5.1	Reduced Site Disturbance, Protect or Restore Open Space	1
<input type="checkbox"/>	Credit 5.2	Reduced Site Disturbance, Development Footprint	1
<input type="checkbox"/>	Credit 6.1	Stormwater Management, Rate and Quantity	1
<input type="checkbox"/>	Credit 6.2	Stormwater Management, Treatment	1
<input type="checkbox"/>	Credit 7.1	Landscape & Exterior Design to Reduce Heat Islands, Non-Roof	1
<input type="checkbox"/>	Credit 7.2	Landscape & Exterior Design to Reduce Heat Islands, Roof	1
<input type="checkbox"/>	Credit 8	Light Pollution Reduction	1

Yes Y No

Water Efficiency 5 Points

<input type="checkbox"/>	Credit 1.1	Water Efficient Landscaping, Reduce by 50%	1
<input type="checkbox"/>	Credit 1.2	Water Efficient Landscaping, No Potable Use or No Irrigation	1
<input type="checkbox"/>	Credit 2	Innovative Wastewater Technologies	1
<input type="checkbox"/>	Credit 3.1	Water Use Reduction, 20% Reduction	1
<input type="checkbox"/>	Credit 3.2	Water Use Reduction, 30% Reduction	1

Yes Y No

Energy & Atmosphere 17 Points

<input checked="" type="checkbox"/>	Prereq 1	Fundamental Building Systems Commissioning	Required
<input checked="" type="checkbox"/>	Prereq 2	Minimum Energy Performance	Required
<input checked="" type="checkbox"/>	Prereq 3	CFC Reduction in HVAC&R Equipment	Required
<input type="checkbox"/>	Credit 1	Optimize Energy Performance	1 to 10
<input type="checkbox"/>	Credit 2.1	Renewable Energy, 5%	1
<input type="checkbox"/>	Credit 2.2	Renewable Energy, 10%	1
<input type="checkbox"/>	Credit 2.3	Renewable Energy, 20%	1
<input type="checkbox"/>	Credit 3	Additional Commissioning	1
<input type="checkbox"/>	Credit 4	Ozone Depletion	1
<input type="checkbox"/>	Credit 5	Measurement & Verification	1
<input type="checkbox"/>	Credit 6	Green Power	1

Yes Y No

Materials & Resources 13 Points

<input checked="" type="checkbox"/>	Prereq 1	Storage & Collection of Recyclables	Required
<input type="checkbox"/>	Credit 1.1	Building Reuse, Maintain 75% of Existing Shell	1
<input type="checkbox"/>	Credit 1.2	Building Reuse, Maintain 100% of Shell	1
<input type="checkbox"/>	Credit 1.3	Building Reuse, Maintain 100% Shell & 50% Non-Shell	1
<input type="checkbox"/>	Credit 2.1	Construction Waste Management, Divert 50%	1
<input type="checkbox"/>	Credit 2.2	Construction Waste Management, Divert 75%	1
<input type="checkbox"/>	Credit 3.1	Resource Reuse, Specify 5%	1
<input type="checkbox"/>	Credit 3.2	Resource Reuse, Specify 10%	1
<input type="checkbox"/>	Credit 4.1	Recycled Content, Specify 5% (post-consumer + 1/2 post-industrial)	1
<input type="checkbox"/>	Credit 4.2	Recycled Content, Specify 10% (post-consumer + 1/2 post-industrial)	1
<input type="checkbox"/>	Credit 5.1	Local/Regional Materials, 20% Manufactured Locally	1
<input type="checkbox"/>	Credit 5.2	Local/Regional Materials, of 20% Above, 50% Harvested Locally	1
<input type="checkbox"/>	Credit 6	Rapidly Renewable Materials	1
<input type="checkbox"/>	Credit 7	Certified Wood	1

Yes Y No

Indoor Environmental Quality 15 Points

<input checked="" type="checkbox"/>	Prereq 1	Minimum IAQ Performance	Required
<input checked="" type="checkbox"/>	Prereq 2	Environmental Tobacco Smoke (ETS) Control	Required
<input type="checkbox"/>	Credit 1	Carbon Dioxide (CO₂) Monitoring	1
<input type="checkbox"/>	Credit 2	Ventilation Effectiveness	1
<input type="checkbox"/>	Credit 3.1	Construction IAQ Management Plan, During Construction	1
<input type="checkbox"/>	Credit 3.2	Construction IAQ Management Plan, Before Occupancy	1
<input type="checkbox"/>	Credit 4.1	Low-Emitting Materials, Adhesives & Sealants	1
<input type="checkbox"/>	Credit 4.2	Low-Emitting Materials, Paints	1
<input type="checkbox"/>	Credit 4.3	Low-Emitting Materials, Carpet	1
<input type="checkbox"/>	Credit 4.4	Low-Emitting Materials, Composite Wood & Agrifiber	1
<input type="checkbox"/>	Credit 5	Indoor Chemical & Pollutant Source Control	1
<input type="checkbox"/>	Credit 6.1	Controllability of Systems, Perimeter	1
<input type="checkbox"/>	Credit 6.2	Controllability of Systems, Non-Perimeter	1
<input type="checkbox"/>	Credit 7.1	Thermal Comfort, Comply with ASHRAE 55-1992	1
<input type="checkbox"/>	Credit 7.2	Thermal Comfort, Permanent Monitoring System	1
<input type="checkbox"/>	Credit 8.1	Daylight & Views, Daylight 75% of Spaces	1
<input type="checkbox"/>	Credit 8.2	Daylight & Views, Views for 90% of Spaces	1

Yes Y No

Innovation & Design Process 5 Points

<input type="checkbox"/>	Credit 1.1	Innovation in Design: Provide Specific Title	1
<input type="checkbox"/>	Credit 1.2	Innovation in Design: Provide Specific Title	1
<input type="checkbox"/>	Credit 1.3	Innovation in Design: Provide Specific Title	1
<input type="checkbox"/>	Credit 1.4	Innovation in Design: Provide Specific Title	1
<input type="checkbox"/>	Credit 2	LEED™ Accredited Professional	1

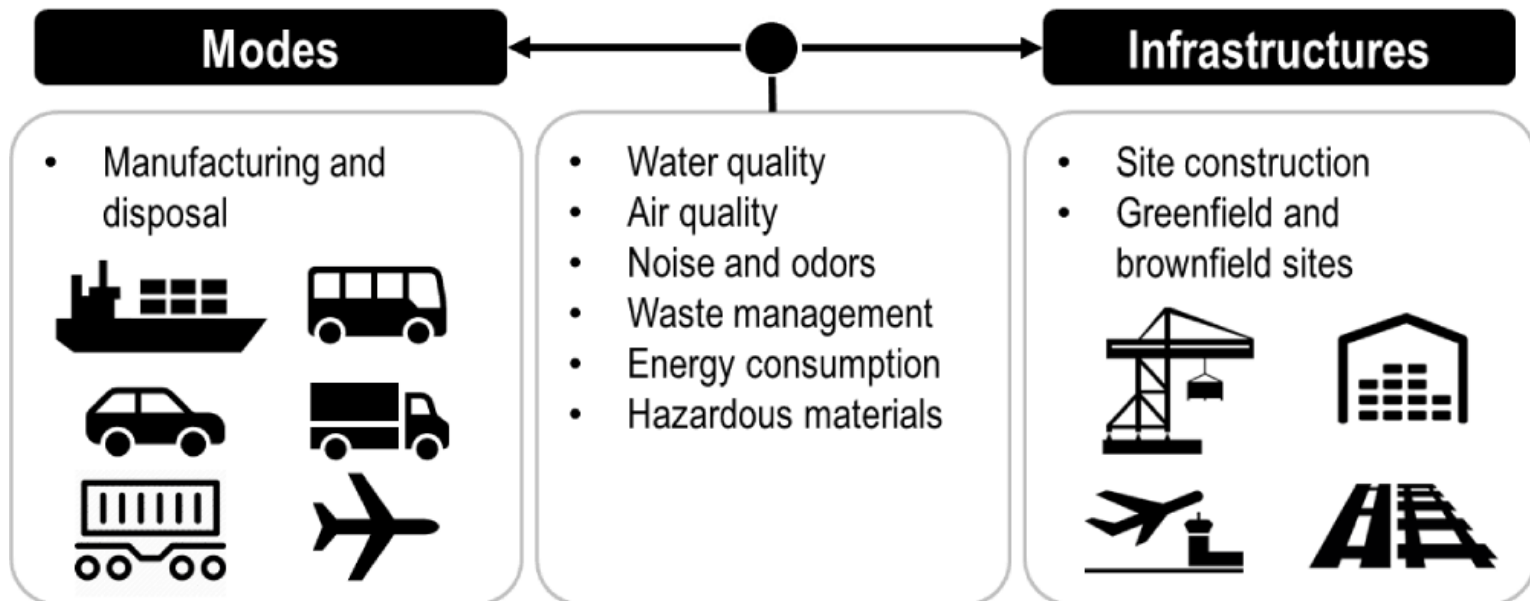
Yes Y No

Project Totals (pre-certification estimates) 69 Points

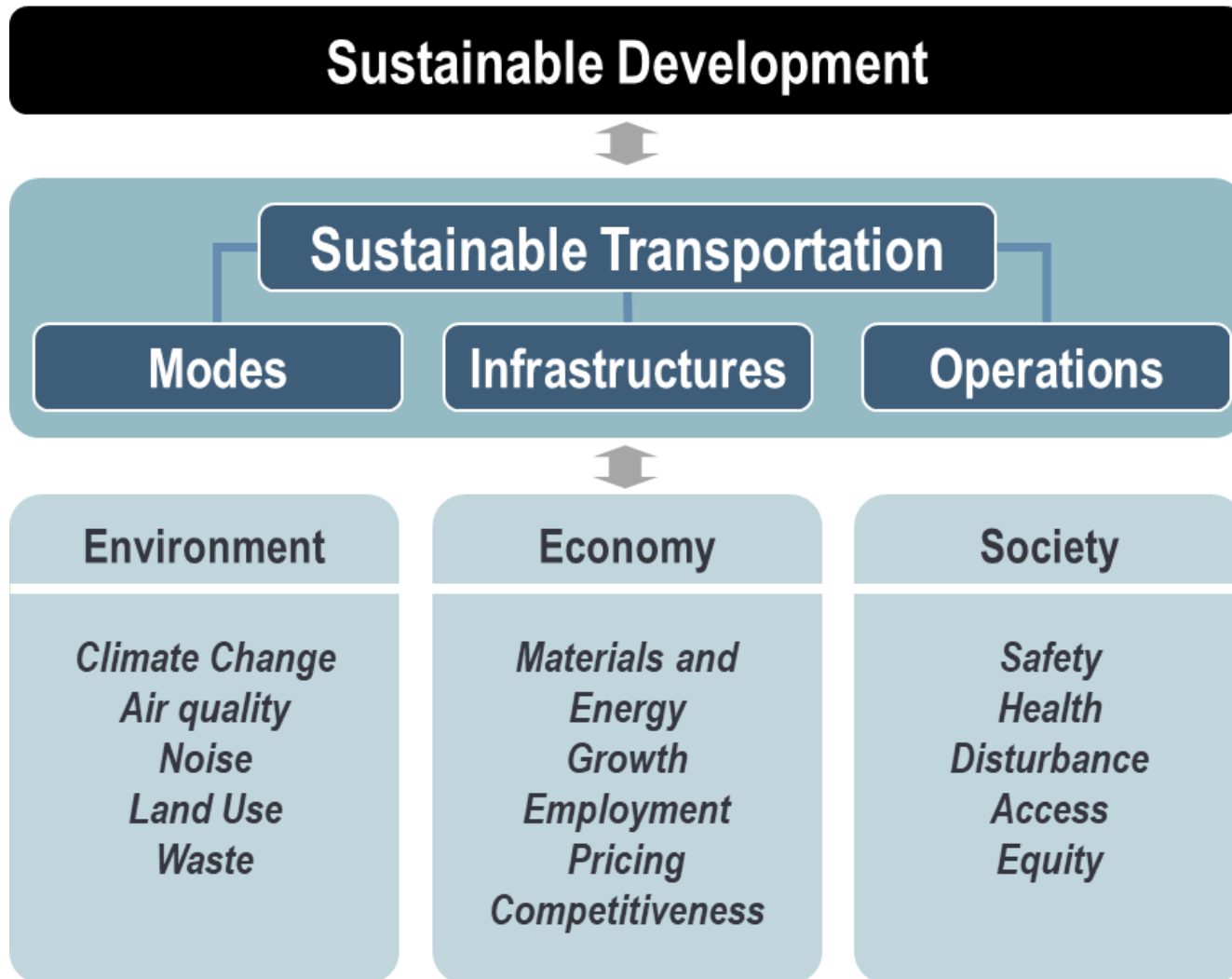
Certified 26-32 points Silver 33-38 points Gold 39-51 points Platinum 52-69 points

Sustainable Transportation

- *Sustainable transportation is the capacity to support the mobility needs of a society in a manner that is the least damageable to the environment and does not impair the mobility needs of future generations. (Dr. Jean-Paul Rodrigue)*



Sustainable Transportation



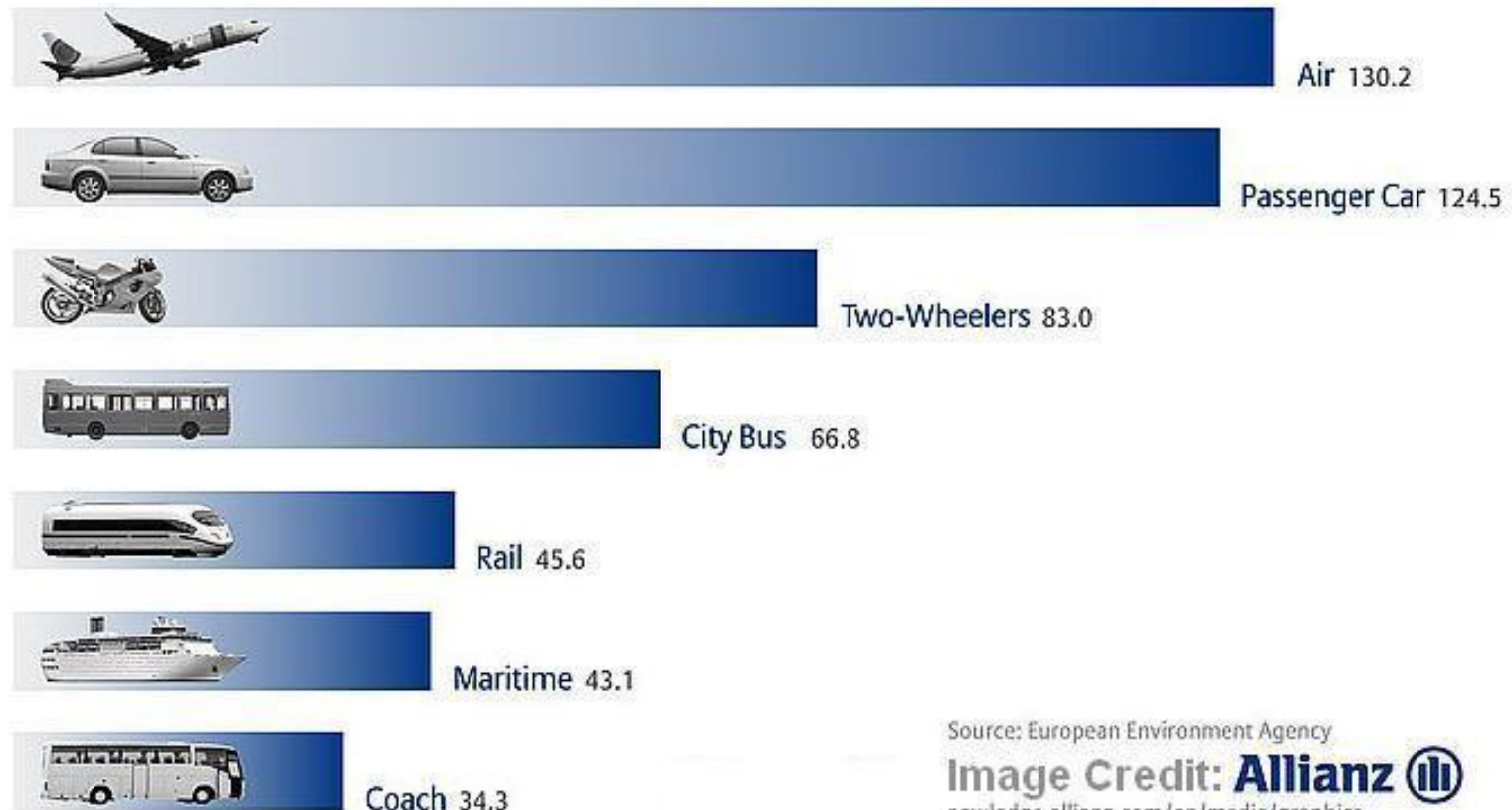
Sustainable Development Strategies for the Transport Sector

- Public transport
- Walking and cycling
- Land use and built environment
- Vehicle technologies
 - Hybrid cars, electric vehicles
- Fuel technologies
 - Biodiesel, bioethanol

CO₂ Emissions

TRANSPORTATION ACCOUNTS FOR 23 PERCENT OF CO₂ EMISSIONS

CO₂ Emissions Per Passenger (grams per kilometer)



Source: European Environment Agency

Image Credit: **Allianz** 
knowledge.allianz.com/en/media/graphics

Further Reading

International Journal of Scientific and Technological Research
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www.iiste.org



Sustainable Road Transport: Alternative Fuels, Electrical Vehicles and Environmental Effects

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<https://www.iiste.org/Journals/index.php/JSTR/article/download/46767/48296>

TRADE-OFFS

Bicycles

Advantages

Affordable

Produce no pollution

Quiet

Require little parking space

Easy to maneuver in traffic

Take few resources to make



Disadvantages

Little protection in an accident

Do not protect riders from bad weather

Impractical for long trips

Can be tiring (except for electric bicycles)

Lack of secure bike parking

TRADE-OFFS

Mass Transit Rail

Advantages

Uses less energy and produces less air pollution than cars

Requires less land than roads and parking areas for cars

Causes fewer injuries and deaths than cars

Reduces car congestion in cities



Disadvantages

Expensive to build and maintain

Cost-effective only along a densely populated corridor

Commits riders to transportation schedules

Can cause noise and vibration for nearby residents

TRADE-OFFS

Buses

Advantages

Can be rerouted
as needed

Cost less to develop
and maintain than
heavy-rail system

Can greatly reduce
car use and air
pollution



Disadvantages

Can lose money
because they need
low fares to attract
riders

Can get caught in
traffic and add to
pollution

Commits riders to
transportation
schedules

Noisy

TRADE-OFFS

Rapid Rail

Advantages

Can reduce travel by car or plane

Ideal for trips of 200–1,000 kilometers (120–620 miles)

Much more energy efficient per rider than a car or plane



Disadvantages

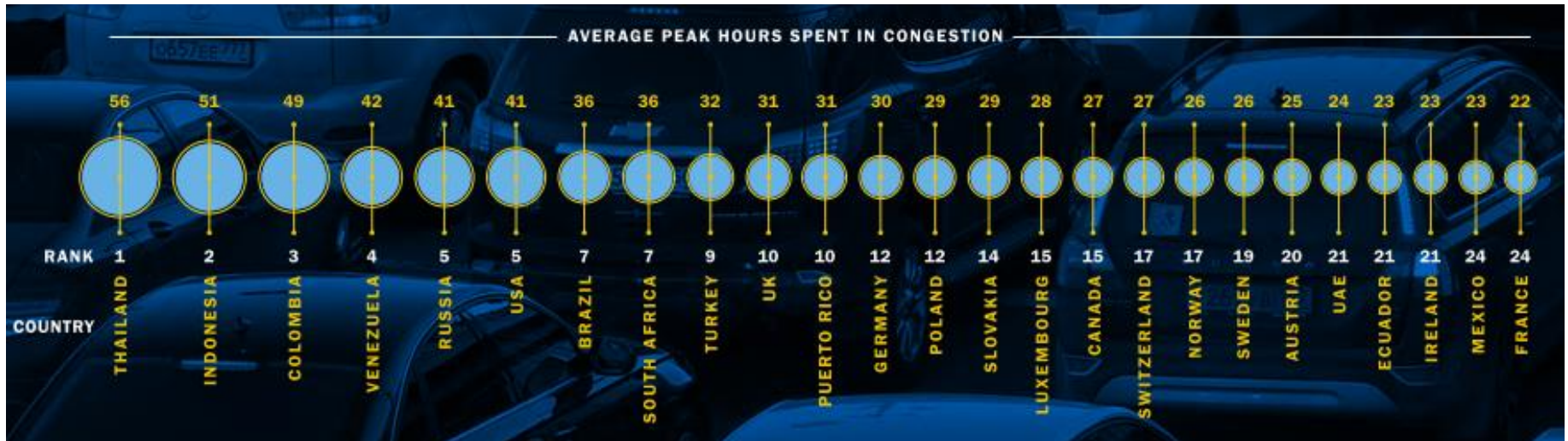
Expensive to run and maintain

Must operate along heavily used routes to be profitable

Causes noise and vibration for nearby residents

The INRIX Global Traffic Scorecard

- Peak hours spent in congestion in 2017:
- Turkey: 32 hours
- İstanbul: 59 hours



<https://inrix.com/resources/inrix-2017-global-traffic-scorecard/>

Boeing 787 Dreamliner



20% improvement in fuel use

Animal Bridges

