
Standard Practice for AASHTO Definitions for Sustainability Terms

AASHTO Designation: PP 118-24¹

First Published: 2024

**Technical Subcommittee: TS 5c, Quality Assurance
and Environmental**



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1. SCOPE

- 1.1. This standard practice is to provide standard definitions for terms used in material specifications, test methods, and various sustainable design procedures.

2. REFERENCED DOCUMENTS

2.1. *Federal:*

- 40 CFR 1508.9.
- FHWA Order 5520, Transportation System Preparedness and Resilience to Climate Change and Extreme Weather Events, 2014.
- National Environmental Policy Act. 1969. 42 USC 4321.
- U.S. EPA. Tool for Reduction and Assessment of Chemicals and Other Environmental Impacts (TRACI). Environmental Protection Agency. Available from <https://www.epa.gov/chemical-research/tool-reduction-and-assessment-chemicals-and-other-environmental-impacts-traci>

2.2. *International Organization for Standardization (ISO) Standards:*

- 14025:2006, Environmental Labels and Declarations - Type III Environmental Declarations – Principles and Procedures
- 14027:2017, Environmental Labels and Declarations - Development of Product Category Rules
- 14040:2006, Environmental Management - Life Cycle Assessment - Principles and Framework
- 14044:2006, Environmental Management - Life Cycle Assessment – Requirements and Guidelines
- 14067:2018 Greenhouse Gases - Carbon Footprint of Products - Requirements and Guidelines for Quantification
- 21930:2017, Sustainability in Buildings and Civil Engineering Works - Core Rules for Environmental Product Declarations of Construction Products and Services
- 21931-2:2019, Sustainability in Buildings and Civil Engineering Works - Framework for Methods of Assessment of the Environmental, Social and Economic Performance of Construction Works as a Basis for Sustainability Assessment - Part 2: Civil Engineering Works

2.3. *Intergovernmental Panel on Climate Change:*

- *Climate Change 1992: The Supplementary Report to the IPCC Impacts Assessment.* 1992.
- *IPCC Second Assessment Report: Climate Change 1995.* 1995.

- *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*. 1996.
- *Special Report on Emissions Scenarios*. 2000.

2.4. *Other Document:*

- “Kyoto Protocol to the United Nations Framework Convention on Climate Change.” Adopted December 11, 1997; corrected May 12, 2004; entered into force February 16, 2005; and amended April 17, 2007. United Nations. *Treaty Series*, Vol. 2303, 2008.

3. GENERAL PROVISIONS

- 3.1. It is recommended that AASHTO specifications and procedures, including standard practices, incorporate the following accepted terms as defined. These terms and their definitions are directed primarily to the various sustainable material design and construction standards. Where a definition conflicts with a standard, the standard will govern.

4. TERMINOLOGY

4.1. *Definitions of Terms Specific to This Standard:*

- 4.1.1. *acidification potential*—an index of air emissions that contribute to the process of acidification by increasing concentration of the hydrogen ion (H⁺) within a local environment. Acidifying pollutants are typically air pollutants (such as sulfur dioxide, SO₂) that are deposited on the earth’s surface (such as water, soil, plants, buildings) through either wet or dry processes. Acid rain is perhaps the best-known form of deposition of acidifying pollution. Acidification can damage ecosystems and human-made systems, such as buildings and structures.
- 4.1.2. *adaptation*—actions to prepare for and adjust to both the current effects of climate change and the impacts predicted in the future.
- 4.1.3. *agency costs*—costs accrued to an agency associated with initial construction and periodic maintenance and rehabilitation activities, including those that maintain an asset above some predetermined condition, performance, and safety level. These costs include those for preventative activities that are planned to extend the life of an asset, day-to-day routine maintenance intended to address safety and operational concerns, and rehabilitation or restoration activities.
- 4.1.4. *albedo*—a measure of a material’s solar reflectance which is the material’s ability to reflect sunlight (including the visible, infrared, and ultraviolet wavelengths) on a scale of 0 to 1. An albedo value of 0.0 indicates that the surface absorbs all solar radiation, and an albedo value of 1.0 represents total reflectivity.
- 4.1.5. *allocation*—within life cycle assessment, partitioning the input or output flows of a process or a product system between the product system under study and one or more other product systems.
- 4.1.6. *anthropogenic emissions*—emissions of greenhouse gases (GHG; see Section 4.1.85), greenhouse gas precursors, and aerosols associated with human activities. These include burning fossil fuels for energy, deforestation, and land-use changes that result in a net increase in emissions.
- 4.1.7. *anticipation*—a predictive or proactive response to climate change rooted in intentionality, action, agency, imagination, possibility, and choice; the opposite of adaptation (see Section 4.1.2), which is reactive.

- 4.1.8. *background data*—indirectly measured, calculated, or obtained quantified value of a unit process or activity and related information within a product system or organization, not based on specific original source measurements. This is also known as “secondary data” (see Section 4.1.151).
- 4.1.9. *benefit–cost analysis*—a systematic process for calculating and comparing benefits and costs of a project to (1) determine if it is a sound investment and (2) see how it compares with alternate projects.
- 4.1.10. *biogenic carbon*—carbon derived from biomass.
- 4.1.11. *blackbody*—a perfect emitter (emissivity of one; see Section 4.1.63).
- 4.1.12. *carbon capture, utilization, and storage (CCUS)*—a process that captures carbon dioxide emissions from sources like coal-fired power plants and either reuses or stores it so it will not enter the atmosphere. Carbon dioxide storage in geologic formations includes oil and gas reservoirs, unmineable coal seams, and deep saline reservoirs—structures that have stored crude oil, natural gas, brine, and carbon dioxide over millions of years. Also referred to as carbon capture, utilization, and sequestration.
- 4.1.13. *carbon dioxide equivalent (CO₂e)*—the number of metric tons of CO₂ emissions with the same global warming potential as one metric ton of another GHG.
- 4.1.14. *carbon footprint*—the sum of GHG emissions and GHG removals in a product system, expressed as CO₂ equivalents and based on a life cycle assessment using the single impact category of climate change. A carbon footprint includes the embodied carbon (see Section 4.1.59) and operational carbon (see Section 4.1.117).
- 4.1.15. *carbon negative*—a product or a process that sequesters or removes more greenhouse gas than emits into the atmosphere.
- 4.1.16. *carbon neutral*—a product or a process that reduces greenhouse gas emissions as much as possible and balances off the remaining emissions using carbon offsets.
- 4.1.17. *carbon offsets*—actions to reduce or avoid GHG emissions in one location in order to offset GHG emissions occurring in a second location.
- 4.1.18. *carbon sequestration*—the uptake and storage of carbon. Trees and plants, for example, absorb carbon dioxide, release the oxygen and store the carbon. Fossil fuels were at one time biomass and continue to store the carbon until burned.
- 4.1.19. *carbon sinks*—carbon reservoirs and conditions that take in and store more carbon (that is, carbon sequestration) than they release. Carbon sinks can serve to partially offset GHG emissions. Forests and oceans are examples of large carbon sinks.
- 4.1.20. *carbonation*—the reaction of atmospheric carbon dioxide with calcium oxide or calcium hydroxide-containing products to form calcium carbonate.
- 4.1.21. *characterization factor*—a number derived from a characterization model that is applied to convert an assigned life cycle inventory analysis result to the common equivalence unit for the impact category such as acidification (see Section 4.1.1), eutrophication (see Section 4.1.68), climate change (see Section 4.1.25).
- 4.1.22. *chronic climate stressors*—slow changes to climate variables over time such as gradual increases in temperature.

- 4.1.23. *circular economy*—an economy that uses a systems-focused approach and involves industrial processes and economic activities that are restorative or regenerative by design, enables resources used in such processes and activities to maintain their highest value for as long as possible, and aims for the elimination of waste through the superior design of materials, products, and systems (including business models).
- 4.1.24. *climate*—the average weather for a particular region and time period. The classic time period is 30 years, as defined and used by the World Meteorological Organization (WMO), though other periods may be thousands or millions of years. In contrast, weather describes the short-term state of the atmosphere. Climatic elements include precipitation; temperature; humidity; sunshine; wind velocity; phenomena such as fog, frost, and hail-storms; and other measures of the weather.
- 4.1.25. *climate change*—a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer). Climate change includes major variations in temperature, precipitation, or wind patterns, among other environmental conditions. Changes in climate may manifest as a rise in sea level, as well as an increase the frequency and magnitude of extreme weather events, now and in the future. Climate change may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use.
- 4.1.26. *climate emergency*—a situation in which immediate action is needed to reduce climate change and prevent serious and permanent damage to the environment.
- 4.1.27. *climate hazard*—an event or condition that may cause injury, illness, or death to people or damage to assets. Potential hazards are avalanches, coastal and riverine flooding, cold and heat waves, drought, hail, hurricanes, ice storms, landslides, lightning, strong winds, tornados, wildfires, and winter weather.
- 4.1.28. *climate impact*—the impact that a climate effect has on an asset (in this case, a transportation asset).
- 4.1.29. *climate model*—a numerical representation of the climate system based on the physical, chemical, and biological properties of its components; their interactions and feedback processes; and accounting for all or some of its known properties. The climate system can be represented by models of varying complexity—that is, for any one component or combination of components, a hierarchy of models can be identified, differing in such aspects as the number of spatial dimensions; the extent to which physical, chemical, or biological processes are explicitly represented; or the level at which empirical parametrizations are involved. Coupled atmosphere–ocean general circulation models (AOGCMs) provide a comprehensive representation of the climate system. There is an evolution towards more complex models with active chemistry and biology. Climate models are applied, as a research tool, to study and simulate the climate, but also for operational purposes, including monthly, seasonal, and inter-annual climate predictions.
- 4.1.30. *climate prediction (forecast)*—a probabilistic statement about future climate conditions on timescales ranging from seasons to decades. It is based on conditions that are known at present and assumptions about the physical processes that will determine future changes.
- 4.1.31. *climate projection*—description of the future and the pathway leading to emission or concentration scenarios of GHGs and aerosols, or radiative forcing scenarios, often based upon simulations by climate models. However, a more specific interpretation has been attached to the term “climate projection” by the Intergovernmental Panel on Climate Change (IPCC) when referring to model-derived estimates of future climate. Climate projections are based on assumptions concerning, for example, future socioeconomic and technological developments that may or may not be realized and are therefore subject to substantial uncertainty.

- 4.1.32. *climate risk*—the potential for adverse consequences of a climate-related hazard, or of adaptation or mitigation responses to such a hazard, on lives; livelihoods; health and wellbeing; ecosystems and species; economic, social, and cultural assets; services (including ecosystem services); and infrastructure.
- 4.1.33. *climate stressor*—variation in a climate variable that may lead to a climate impact (such as high temperatures, heavy rainfall, cyclical variations in temperature over a period of time).
- 4.1.34. *climate threshold*—the point at which external forcing (that is, natural or anthropogenic causes) of the climate system, such as the increasing atmospheric concentration of GHGs, triggers a significant climatic or environmental event which is considered unalterable, or recoverable only on very long time-scales, such as widespread bleaching of corals or a collapse of oceanic circulation systems.
- 4.1.35. *climate variability*—variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes) of the climate on all temporal and spatial scales beyond that of individual weather events. Variability may be due to natural or anthropogenic processes within the climate system.
- 4.1.36. *climate variable*—parameters used to measure and describe climate, for example, temperature, precipitation, wind, storm surge, waves, and relative sea level change.
- 4.1.37. *co-product*—any of two or more products coming from the same unit process or product system.
- 4.1.38. *construction element*—part of construction containing a defined combination of construction products.
- 4.1.39. *construction product*—item manufactured or processed for incorporation in construction works.
- 4.1.40. *construction service*—activity that supports the construction works or subsequent maintenance.
- 4.1.41. *construction works*—everything that is constructed or results from construction operations.
- 4.1.42. *coupled model intercomparison project (CMIP)*—a climate modelling activity from the World Climate Research Programme (WCRP) that coordinates and archives climate model simulations based on shared model inputs by modelling groups from around the world. The CMIP3 multi-model data set includes projections using *Special Report on Emissions Scenarios* (SRES) scenarios (IPPC, 2000). The CMIP5 data set includes projections using the Representative Concentration Pathways (RCPs). The CMIP6 phase involves a suite of common model experiments as well as an ensemble of CMIP-endorsed model intercomparison projects (MIPs).
- 4.1.43. *cradle-to-cradle*—a design protocol that supports the elimination of waste by recycling materials or products into new or similar products at the end of its intended life, instead of disposing of it.
- 4.1.44. *cradle-to-gate*—analysis of the impact of a product from the beginning of its source gathering processes through manufacturing. Thus, the following information modules are included: extraction and upstream production (raw material supply), transport to factory, and manufacturing. The life cycle assessment (LCA) results shall be reported based on a declared unit.
- 4.1.45. *cradle-to-grave*—analysis of the impact of a product from the beginning of its source gathering processes, manufacture, useful life, to disposal of all waste products. Cradle-to-cradle is a related term signifying the recycling or reuse of materials at the end of their first useful life.