

9 Glossary

The definitions for the following terms are those commonly used in the transportation industry and particularly by the Alaska DOT&PF. Although some of these terms may seem fundamental, we provide them so that everyone, regardless of field experience, can develop an understanding of this nomenclature from this quick reference guide.

AASHTO: The acronym for the American Association of State Highway and Transportation Officials. A “T” designates AASHTO tests (example: AASHTO T195). An “M” designates AASHTO specifications (example: AASHTO M156).

Agency costs – All costs incurred by the owning agency over the life of the project, including preliminary engineering, contract administration, initial construction, construction supervision, preservation, rehabilitation, administration, and the impact of salvage value.

Aggregate: Any combination of one or more hard granular mineral materials, either natural or crushed, from very fine to large rocks. It is selected because of its characteristics for a specific purpose, such as sand, gravel, crushed stone, ballast, etc., used for mixing in graduated fragments.

Alaska Renewable Pavement (ARP): Pavement layering system that is an acceptable alternative to stabilized base or can be used to amplify the benefits of a stabilized base. ARP can also be combined with a stabilized base or asphalt-treated base to satisfy requirements for pavement designs involving very high ESALs. The ARP system is similar to normal asphalt concrete pavement except that it is thicker and is composed of two sublayers. The ARP design provides for exceptionally long service life because the ARP concept anticipates periodic replacement of the upper ARP layer by mill-and-fill construction methods.

Analysis period – The time period over which alternative design strategies are analyzed.

Asphalt: A dark brown to black cementitious material in which the predominating constituents are bitumens that occur in nature or are obtained as residue in petroleum distillation. Asphalt imparts controllable flexibility to mixtures of mineral aggregates, with which it is usually combined. It is highly resistant to most acids, alkalis, and salts. Although it is a solid or semisolid at ordinary atmospheric temperatures, asphalt may be liquefied by applying heat, dissolving it in petroleum solvents of varying volatility, or emulsifying it.

Asphalt Cement: Asphalt that is refined to meet specifications for paving, industrial, and special purposes. The term is often abbreviated to AC or referred to as binder when used in an asphalt hot mix.

Asphalt Concrete: Also referred to as hot mix asphalt (HMA), and hot bituminous mix. It is the material most used for surfacing roadways and airports in Alaska that are subject to high traffic. It is a high-quality, controlled, hot mixture of asphalt cement and graded aggregate, thoroughly compacted into a uniform dense mass.

Asphalt Soil Stabilization (soil treatment): Treatment of naturally occurring non-plastic or moderately plastic soil with cutback or emulsified soil mixture produces water-resistant base or subbase courses of improved load-bearing qualities.

Asphalt-Treated Base: A base course constructed using hot asphalt cement as a binder, often referred to as ATB. See Treated Base Courses for further descriptions of types.

ASTM: The acronym for the American Society for Testing and Materials.

ATM: Stands for Alaska Test Methods. These tests were developed by the headquarters Design and Engineering Services/Materials section.

Annual Average Daily Traffic (AADT): The average volume for a 24-hour period for all traffic lanes. It is normally the annual total volume divided by 365, unless otherwise stated. The AADT may be reported as one-way or two-way traffic. Make sure it is clear which is being reported.

Axle Load: The total load transmitted to the pavement by all wheels of either a single or tandem axle, usually expressed in kips (1 kip = 1 kilo pound = 1,000 pounds of force).

Base Course (BC): The layer or layers of specified material of designed thickness placed on a subbase or a subgrade to support a surface course. Most base courses are constructed with crushed aggregates and therefore called crushed aggregate base course.

Binder Course: Where thick pavements are required, the asphalt concrete pavement is sometimes placed as two layers, each differing in composition but sharing approximately the same fatigue properties (see also **Wearing Course**). The binder course is the bottom portion of asphalt concrete pavement, “tuned” to provide maximum fatigue resistance (addresses fatigue cracking) and minimum plastic deformation

Cash flow diagram – A time-scaled visual means of representing cash flows as arrows at the points in time when they are expected occur, with in-flows and out-flows shown in opposite directions. Also called expenditure stream diagram.

Chip Seal: A chip seal or “single-shot” asphalt surface treatment is the spraying of emulsified asphalt material (CRS-2 or RS-2) followed immediately by a thin stone cover.

Design alternative/design alternative strategy – A combination of initial pavement design and necessary supporting pavement preservation and pavement rehabilitation activities.

Design Lane: The lane on which the greatest number of equivalent 18,000-pound single-axle loads is expected. Normally this will be either lane of a two-lane roadway or an outside lane of a multilane highway.

Deterministic LCCA – Life cycle cost analysis that utilizes a single, most likely value of each input parameter for each alternative strategy, resulting in a single output value for each strategy (see Probabilistic LCCA).

Discount rate vs. interest rate – Discount rate is the rate used for the life cycle cost analysis, when real (or constant) dollars are used; discount rate represents the real value of money over time and is used to convert future costs to present-day costs. A discount rate of 3% is recommended for LCCA. Interest rate (often referred to as market interest rate) is the cost paid to borrow money. The relationship between discount rate and interest rate is a function of inflation, with discount rate approximately equal to the difference between interest rate and inflation rate.

Equivalent Single Axle Loads (ESAL): Traffic on highways and streets varies in the number of vehicles and in the magnitude of loading. The cumulative effects of traffic loads factor in the structural design of pavement. The effect on the pavement performance of any combination of axle loads is equated to the number of standard 18,000-pound, dual tired, single-axle loads required to produce an equivalent effect (i.e., the single axle load). In design of pavement structural sections, the total number of ESALs is a summary of equivalent 18,000-pound single-axle loads expected from the combination of all vehicle classes for the design period.

Excess Fines: The fines content above the critical fines content ($P_{200} - P_{Cr}$).

Excess Fines Factor (EFF): A factor that includes the effects of the excess fines and the applied stress at a given depth $(\Delta SFR)(P_{200} - P_{Cr})^{0.8}$.

Falling Weight Deflectometer (FWD): A trailer-mounted device that drops a known weight from known heights on a pavement surface while automatically measuring the resulting peak stress and deflections. The drop stress is usually intended to simulate dynamic traffic loading. The data collected with the FWD back-calculates elastic moduli of the supporting layers. Once the elastic moduli are known, structural design can proceed to determine critical stresses and strains in the structure.

Fatigue Cracking: Interconnected cracks forming a series of small blocks resembling an alligator’s skin or chicken wire. They are caused by heavy traffic that is excessive for the given thickness of pavement and structural support provided by underlying layers

Fatigue Resistance: The ability of asphalt pavement to withstand repeated flexing or slight bending caused by the passage of wheel loads. As a rule, the higher the asphalt content and the lower the air void content in an asphalt mix, the greater the fatigue resistance. However, a mix with too high an asphalt content or too low an air void content will tend to rut under traffic loading.

Fines Content (P200): The average percentage by weight of material passing the No. 200 sieve (0.075 mm).

Flexibility: The ability of an asphalt pavement structure to conform to settlement of the foundation. It is also sometimes called the ability of asphalt pavements to heal themselves during warm weather. A high asphalt content can enhance flexibility of an asphalt paving mixture.

Flexible Pavement: Another term for asphalt concrete pavement.

Gradation: The relative size distribution of the particles in an aggregate sample. The percentages passing various sieve sizes, from the largest (100% passing) to the smallest (No. 200 sieve) show the gradation of the material.

Heavy Trucks: Two-axle, six-tire trucks or larger, including trucks with heavy-duty, wide-base tires. Pickup, panel, and light four-tire trucks are not included.

In Situ: In the natural or original position.

Intermediate Course (sometimes called binder course): An asphalt pavement course between a base course and an asphalt surface course.

Life cycle cost analysis (LCCA) – An analysis technique that builds on the well-founded principles of economic analysis to evaluate the over-all-long-term economic efficiency between competing investment options. It incorporates initial and discounted future agency, user, and other relevant costs over the life of alternate investments. It attempts to identify the best value (the lowest long-term cost that satisfies the performance objective being sought) for investment expenditures.

Net present value (NPV) is the combined present value of all cash flows for a given alternative design strategy. (See [Present value](#))

Nominal cost – Costs that include the effect of inflation or deflation over time. Also called current or data year costs.

Pavement Design Period (“n”): The number of years that a pavement is expected to carry a specific traffic volume and retain minimum serviceability without rehabilitation. This is optimized by the Pavement Management System.

Pavement Performance: The trend of serviceability in relation to load applications.

Pavement Rehabilitation: Work to extend the service life of an existing facility. This includes placement of additional surfacing material or other work necessary to return an existing roadway, including shoulders, to structural or functional adequacy. This could include the removal and replacement of the pavement structure.

Pavement Structure: The combination of select material, subbase, base, and surface course placed on a subgrade to support the traffic load and distribute it to the roadbed (42 inches below the asphalt concrete layer).

Percent Trucks (PTT): The percentage of annual average daily traffic (AADT) that is heavy truck traffic.

Performance Period: The time that an initially constructed or rehabilitated pavement structure will last before reaching its terminal serviceability; this is also referred to as the design period.

Predicted Deflection (D_p): The predicted maximum probable deflection of a proposed pavement structure due to an 18,000-pound, single-axle load.

Present value– The time zero equivalent of a single future cash flow, based on the discount rate and the number of years in the future at which the cash flow is expected to occur.

Probabilistic LCCA – Life cycle cost analysis in which some or all of the input parameters are described as probability distributions, resulting in a probability distribution of life cycle costs for each alternative.

Real cost – Costs that do not include the effect of inflation or deflation over time; they have the same purchasing power over time. Also called constant or time zero costs. Real costs are used in life cycle cost analysis in combination with the discount rate to calculate net present value of costs.

Reconstruction activities – The removal and replacement of a pavement structure, including but not necessarily limited to its base and wearing course. Reconstruction involves a complete rebuilding of the pavement structure to new condition. Accumulated fatigue and functional (rutting) damage in a newly reconstructed pavement structure is zero.

Rehabilitation activities – Structural enhancements that extend the service life of an existing pavement and/or improve its load carrying capacity. Rehabilitation activities for Life Cycle Cost Analyses are limited to the pavement structure, and do not include the other items or activities in a project.

Resilient Modulus (M_R): A measure of the repeated-load modulus, sometimes called “dynamic” modulus of elasticity of roadbed soil or other pavement material. Stresses and strains are generated on test equipment using repetitive loading conditions. M_R should not be confused with another measure of the dynamic modulus known as the complex modulus (E^*). E^* is not presently used in mechanistic design methods used by DOT&PF.

Roadway Structure: A combination of select subbase, base course, and surface course materials placed on a subgrade that supports the traffic load and distributes it to the elements of the roadbed.

Routine annual preservation – Work that is planned and performed on a routine annual basis to maintain and preserve the condition of the pavement or to respond to specific conditions and events that restore the pavement to an adequate level of service; the former term is routine annual maintenance.

Selected Material: A suitable native material obtained from a source such as a roadway cut or borrow area, having specific characteristics.

Sensitivity analysis – An enhancement of the deterministic analysis technique in which the value of a single input parameter is changed over a range of values, while holding all other input parameters unchanged, and determining the resulting changes in net present value.

Serviceability: The ability, at time of observation of a pavement, to serve traffic that uses the facility.

Salvage value – The value of an investment alternative at the end of the analysis period.

Stability: The ability of asphalt paving mixture to resist deformation from imposed loads. Stability depends on internal friction and cohesion.

Stress Reduction Factor (SRF): The factor by which the stress of an applied load at the surface of a pavement is reduced at a given depth below the surface course.

Subbase (SB): The layer or layers of specified or selected material of designed thickness placed on a subgrade to support a base course (or in the case of rigid pavements, the Portland cement concrete slab). If the subgrade soil is of adequate quality, it may serve as the subbase.

Subgrade: The top surface of a roadbed upon which the pavement structure and shoulders are constructed.

Subgrade, Improved: Subgrade, improved is a working platform achieved (1) by the incorporation of granular materials or stabilizers such as asphalt, lime, or Portland cement, prepared to support a structure or a pavement system, or (2) any course or courses of select or improved material placed on the subgrade soil below the pavement structure. Subgrade improvement does not affect the design thickness of the pavement structure.

Surface Course (SC): One or more layers of a pavement structure designed to accommodate the traffic load, the top layer of which resists skidding, traffic abrasion, and the disintegrating effects of climate. The top layer of

flexible pavements is sometimes called “wearing course.”

Tandem Axle Load: The total load transmitted to the road by two consecutive axles extending across the full width of the vehicle.

Traveled Way: The portion of the roadway for the movement of vehicles, exclusive of shoulders and auxiliary lanes.

User costs – Costs that are accrued by the users of the facility during the construction, preservation, rehabilitation and everyday use of a roadway section.

User work zone costs – Roadway user/vehicle time delay costs associated with using a facility during periods of construction, preservation, and rehabilitation activities that generally restrict the capacity of the facility and disrupt normal traffic flow.

Wearing Course: Where thick pavements are required, the asphalt concrete pavement is sometimes placed as two layers, each differing in composition but sharing approximately the same fatigue properties (see also **Binder Course**). The wearing course is the top portion of asphalt concrete pavement, “tuned” to provide maximum resistance to abrasion wear (addresses tire-stud rutting), minimum surface roughness (addresses ride quality), minimum plastic deformation (addresses displacement rutting), and minimum permeability (addresses premature weathering and aging of the asphalt concrete).

