



Designation: **E3210–19** **E3210 – 20**

Standard Practice for Infrastructure Management¹

This standard is issued under the fixed designation E3210; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

INTRODUCTION

Infrastructure disasters in Flint, Michigan (contamination of a water distribution system); London, England (highly flammable cladding material installed on a high rise building exterior, beyond the reach of firefighting equipment); and Miami, Florida (concrete of uncertain integrity placed above an in-use highway) suggest infrastructure management needs a more rigorous approach. In each case, people who lack professional competency for the potential impact of their actions made decisions that were not properly reviewed by an authority whose duty is to assure human safety. This practice establishes a standard process whereby an organization providing one or up to 15 types of infrastructure asset services (for example, water supply, housing, bridges, and roadways) engages with the community thereby served to assess the quality and frequency of those services through quantitative metrics (compared against benchmarks), so as to support a capital expenditure and operations, maintenance, monitoring, and repair plan such that those services (including disaster prevention) continuously improve.

1. Scope

1.1 This asset management practice establishes requirements of transparency and accountability for an assemblage of tangible and intangible infrastructure asset systems for a public or private organization.

1.2 This practice promotes the life safety-prioritized and cost efficacious delivery of 15 types of infrastructure assets to infrastructure asset service recipients. These services include direct uses (for example, water supply or police protection) and indirect uses (for example, preventing adverse impacts on the environment while minimizing nature's adverse impacts on infrastructure assets).

1.3 This practice may be used as the basis for training guides for infrastructure asset system employees and operators.

1.4 This practice provides an acceptability framework for 15 systems of infrastructure assets, including (1) potable water supply, (2) food systems, (3) sewage and storm water systems, (4) buildings, (5) healthcare, (6) security, (7) power, (8) communication, (9) transit and travel, (10) waste disposal, (11) education, (12) cultural heritage, (13) recreation and entertainment, (14) nature, and (15) financial systems.

1.5 This practice is composed of the following sections: referenced documents; terminology; significance and use; planning and scoping; integrated infrastructure system management process; and infrastructure system reporting and documentation.

1.6 The values stated in inch-pound units are to be regarded as standard. No other units of measurement are included in this standard.

1.7 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.8 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

¹ This practice is under the jurisdiction of ASTM Committee E53 on Asset Management and is the direct responsibility of Subcommittee E53.07 on Sustainable Property Management.

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**TABLE 1 Infrastructure System Report for 202x
Basic Infrastructure List**

Infrastructure Type	ASCE Scored	Practice E3210 Score	Golden Rule Condition ^A	Maximum Interest Paid for Capital ^B	Integrated Fiscal Administration Management System Factors
					Less Capital Outlays Improvement Revenue than Allocated Capital Outlay ^C
1 - Potable water supply	X				
3 - Sewage and storm water	X				
4 - Buildings	X				
5 - Healthcare	X				
8 - Communication	X				
9 - Transit and travel	X				
10 - Waste disposal	X				

^A In accordance with 3.1.27; $e + b > x$.

^B In accordance with 3.1.43; $z \geq 1.25 c - d$.

^C In accordance with 3.1.40; $c \geq w$.

2. Referenced Documents

2.1 ASTM Standards:²

[E2453 Practice for Estimating the Life-Cycle Cost of Ownership of Property Assets](#)

[E2876 Guide for Integrating Sustainable Objectives into Cleanup](#)

[E3033 Guide for Beneficial Use of Landfills and Chemically Impacted Sites](#)

[E3123 Guide for Recognition and Derecognition of Environmental Liabilities](#)

[E3136 Guide for Climate Resiliency in Water Resources](#)

2.2 Other Standards:

[ISO 37120 Sustainable cities and communities — Indicators for city services and quality of life³](#)

[ISO 55000 Asset management — Overview, principles and terminology³](#)

[10 CFR 436 Subpart A—Methodology and Procedures for Life Cycle Cost Analyses⁴](#)

3. Terminology

3.1 *Definitions of Terms Specific to This Standard*—Many of the terms used in this practice have specific regulatory meanings within existing federal, State, tribal, or local programs. The following terms are being defined to reflect their specific use in this practice. The user should not assume that this terminology replaces existing regulatory terms or definitions. Where the terminology or use of a term in this practice differs from an existing regulatory definition or use, the user should address these differences prior to proceeding with infrastructure management.

3.1.1 *acceptable, adj*—the finding by the user of the practice that the scores for each type of infrastructure asset type under review are improved since a prior assessment.

3.1.2 *accountability, n*—the preparation of an infrastructure system report and its release to recipients of the authority’s infrastructure asset services.

3.1.3 *advantageous incremental cost, n*—the additional outlay for completing a portion of a whole capital improvement project (for example, a phase) when the complete project cannot be afforded during the time period identified by the user. This cost includes an appropriate uncertainty multiplier and a contingency cost for each infrastructure asset system project.

3.1.4 *appropriate uncertainty multiplier, n*—a factor that increases a project cost due to circumstances that are possible but cannot be predicted (for example, extreme weather and other Acts of God, financial recession or depression, health epidemic or pandemic, or civil riot; also known as “black swan” events).

3.1.5 *assessment, n*—the evaluation of one or more systems of infrastructure assets that is documented and made available to the authority’s infrastructure asset service recipients, and includes revenues and outlays (and their relationships), and performance scores of those infrastructure assets identified in [Table 1](#), [Table 2](#), or [Table 3](#) as completed by the user.

3.1.6 *asset, n*—(1) anything owned having monetary value; (2) tangible or intangible items owned or controlled by the authority’s organization that have probable economic benefits or use value, or both.

3.1.7 *asset management, n*—the integrated, multidisciplinary (that is, financial, economic, health and safety, ecological, educational, architectural, and engineering) set of strategies for sustaining infrastructure assets and their systems.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard’s Document Summary page on the ASTM website.

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

⁴ Available from U.S. Government Publishing Office (GPO), 732 N. Capitol St., NW, Washington, DC 20401, <https://www.govinfo.gov>.

**TABLE 2 Infrastructure System Report for 202x
Sustainable Infrastructure List**

Integrated Fiscal Administration Management System Factors					
Infrastructure Type	ASCE Scored	Practice E3210 Score	Golden Rule Condition ^A	Maximum Interest Paid for Capital ^B	Less Capital Outlays Improvement Revenue than Allocated Capital Outlay ^C
1 - Potable water supply	X				
2 - Food systems					
3 - Sewage and storm water	X				
4 - Buildings	X				
5 - Healthcare	X				
6 - Security					
7 - Power					
8 - Communication	X				
9 - Transit and travel	X				
10 - Waste disposal	X				
11 - Education					
12 - Cultural heritage					
13 - Recreation and entertainment					
14 - Nature					
15 - Financial systems					

^A In accordance with 3.1.27; $e + b > x$.

^B In accordance with 3.1.43; $z \geq 1.25 c - d$.

^C In accordance with 3.1.40; $c \geq w$.

**TABLE 3 Infrastructure System Report for 202x
Custom Infrastructure List**

Integrated Fiscal Administration Management System Factors					
Infrastructure Type	ASCE Scored	Practice E3210 Score	Golden Rule Condition ^A	Maximum Interest Paid for Capital ^B	Less Capital Outlays Improvement Revenue than Allocated Capital Outlay ^C
1 - Potable water supply	X				
2 - Food systems					
3 - Sewage and storm water	X				
4 - Buildings	X				
5 - Healthcare	X				
6 - Security					
7 - Power					
8 - Communication	X				
9 - Transit and travel	X				
10 - Waste disposal	X				
11 - Education					
12 - Cultural heritage					
13 - Recreation and entertainment					
14 - Nature					
15 - Financial systems					

^A In accordance with 3.1.27; $e + b > x$.

^B In accordance with 3.1.43; $z \geq 1.25 c - d$.

^C In accordance with 3.1.40; $c \geq w$.

3.1.8 *authority, n*—the chief administrative officer of a unit of government or private sector organization who provides infrastructure asset services to service recipients (for example, individuals, homeowners, public and private organizations, and nature).

3.1.8.1 *Discussion*—

An authority may delegate tasks to subordinates who thereby speak and act for the authority during the period of delegation.

3.1.9 *buildings, n*—a tangible asset, any structure used or intended for supporting or sheltering any use or occupancy.

3.1.10 *capital improvement debt retirement outlay (z)*—outgoing periodic payment to retire capital expenditure debt.

3.1.10.1 *Discussion*—

The “z” is the shorthand designation of this outlay in the Integrated Fiscal Administrative Management System.

iTeh Standards
(<https://standards.itih.ai>)
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<https://standards.itih.ai/catalog/standards/sist/4ef9935d-f19d-4c91-af47-7bb724e0053c/astm-e3210-20>

3.1.11 *capital improvement funds/revenue (c)*, *n*—incoming wealth originating with exogenous financial instruments (for example, bonds, loans, grants, or credits) for the planning, design, and construction of either public or private sector organization-supplied tangible infrastructure assets.

3.1.11.1 *Discussion*—

The “c” is the shorthand designation of these revenues in the Integrated Fiscal Administrative Management System.

3.1.12 *capital improvement project-related outlay / exogenous wealth input (w)*—outgoing wealth for the planning, design, and construction of new or upgraded infrastructure asset systems—systems that originates from bonds, loans, grants, or credits, that is, the origin of this outlay.

3.1.12.1 *Discussion*—

The “w” is the shorthand designation of these outlays in the Integrated Fiscal Administrative Management System.

3.1.13 *capital project-generated revenue (d)*—incoming wealth associated with an infrastructure asset capital improvement, including tolls and capture of the periodic increment of land value as a result of the improvement.

3.1.13.1 *Discussion*—

The “d” is the shorthand designation of these revenues in the Integrated Fiscal Administrative Management System, and is used by the authority to retire capital improvement debt (*z*).

3.1.14 *communication*, *n*—tangible assets including telephone, cable TV, internet, and other wireless systems for transmitting voice, video, and other electronic data and installed along public easements and rights of way, using the electromagnetic spectrum commons.

3.1.15 *community engagement*, *n*—the proactive reaching out to infrastructure asset service recipients of the authority so that she/he can be transparent and accountable about infrastructure asset service anticipations and experiences, and the cost efficacy of that provision.

3.1.16 *contingency cost*, *n*—an amount added to an estimate to allow for items, conditions, or events for which the state, occurrence, or effect is uncertain and that experience shows will likely result, in aggregate, in additional costs.

3.1.16.1 *Discussion*—

ASTM E3210-20
<https://standards.iteh.ai/catalog/standards/sist/4ef9935d-f19d-4c91-af47-7bb724e0053c/astm-e3210-20>

There is always uncertainty (that is, risk) as to the precise content of all items in a cost estimate (for example, how work will be performed, and what work conditions will be like when the project is executed). Cost contingency is identified when an estimator is aware of the risk or can estimate probable costs, or both. The term does not include examples of ignorance, poor engineering, or poor philosophy, or combinations thereof. The contingency allowance covers items of cost which are not known exactly at the time of the estimate but which will occur on a statistical basis. Contingency cost excludes: (1) major scope changes such as changes in end product specification, capacities, building sizes, and location of the asset or project; (2) extraordinary events such as major strikes and natural disasters; (3) management reserves; and (4) escalation and currency effects.

3.1.17 *continuous improvement*, *n*—the recurring process of enhancing the quality or frequency, or both, of infrastructure asset services by periodic assessment, scoring, and system change for each infrastructure asset type as described in this practice.

3.1.18 *cost avoiding*, *v*—taking measures to lower the cost of infrastructure asset services and avoid a waste of wealth, including: scheduling activities to optimize labor workflow; just-in-time delivery of materials to avoid double handling and the need to stockpile soil or other materials; rest, sanitation, and food facilities for labor to minimize their need to leave a jobsite; and soil reuse to avoid disposal.

3.1.19 *cost efficacy*, *n*—the measure of the cost of achieving a non-standard result that an authority and her/his infrastructure asset service recipients desire (and agree was achieved) in contrast to the cost of pursuing a standard result.

3.1.20 *cultural heritage*, *n*—tangible assets including objects, locations, and natural geographic or geologic features associated with the history, politics, or sociology, or combinations thereof, of people, whether indigenous or colonial, or of dominant or non-dominant groupings.

3.1.21 *document*, *n*—information and its supporting media.

3.1.22 *document*, *v*—to gather, organize, craft (that is, present in a clear, comprehensive, and factual manner), and publish information for infrastructure asset service recipient (for example, individuals, homeowners, and public and private organizations) review.

3.1.23 *education, n*—intangible infrastructure asset type that includes: (1) all levels of primary, secondary, trade, graduate, and post-graduate training and experience opportunity publicly provided; or (2) a private sector organization’s complement (or substitution) of that publicly-provided training and experience opportunity, each provided by its respective authority.

3.1.24 *extraordinary outlays (y), n*—outgoing wealth expended for the periodic replacement and upkeep of capital infrastructure assets; the complement of ordinary expenses (current services outlays (*x*)).

3.1.24.1 *Discussion*—

These outlays comprise the capital budget that includes the (*w*) capital ~~improvement project-related outlays~~ outlay and the (*z*) capital improvement debt retirement ~~outlays~~ outlay.

3.1.25 *financial systems, n*—intangible infrastructure asset type that includes mediate (*e*) and immediate (*b*) revenues for current (ordinary) services outlays (*x*); and mediate (*c*) and mediate (*d*) revenues for capital improvement (extraordinary) outlays (*y*).

3.1.26 *food systems, n*—intangible infrastructure asset system type that concerns (for example) the issuing of permits for grocery stores, public kitchens, green markets, food handling operations, and restaurant and food cart businesses; all factors associated with bringing food to market (that is, crop production, transport, preservation, and storage); and food safety inspectors, operation of laboratories for purity assurance, and professional certifications concerning the nutrient and non-nutrient chemical content of food items and urban garden soil.

3.1.27 *golden rule of government finance (a relationship)*—keeping capital budget outlays (*w*) and (*z*) separate from current asset service outlays (*x*) in an operating budget.

3.1.27.1 *Discussion*—

Involves the matching of current revenue (*e*) and (*b*) to spending on current services (*x*), but borrowing only to support capital spending (*w*) and (*z*) and thereby maintaining the net worth of infrastructure asset systems. This is the condition when $(e) + (b) > (x)$. Although the phrase was coined to apply to public infrastructure asset management, the principle also applies to private infrastructure asset management.

3.1.28 *governance system, n*—the methodology used by an authority to assure the establishment and maintenance of transparent and accountable practices such that effective and equitable systems of infrastructure assets are provided to her/his service recipients (individuals, homeowners, or public and private organizations, or combinations thereof); the use of this practice is an example of a governance system.

3.1.29 *government, n*—a social, economic, military, or political, or combinations thereof, unit of management over a specified geographic space, that is obligated to engage with infrastructure asset service recipients (individuals, homeowners, or public and private organizations, or combinations thereof).

3.1.30 *healthcare, n*—intangible infrastructure assets associated with (but not necessarily limited to) hospitals, medical doctors, physicians, mental health service providers (especially for homeless persons and at-risk youth), counselors, health agencies, disease and poison control, ambulance services, and 911 operators that are publicly or privately provided, or franchised by local, State, or federal governments.

3.1.31 *immediate revenue (b), n*—incoming wealth that originates from individuals rather than a public or a private infrastructure asset services provider; the complement of mediate revenue (*a*).

3.1.31.1 *Discussion*—

The “b” is the shorthand designation of these funds in the Integrated Fiscal Administrative Management System. This revenue includes tax payments (of various kinds) by individuals (primarily used for current services outlays) but does not include individual user fees, tolls, or penalties. This revenue (that may include tax increment financing revenue) may also be used by the authority for retirement of capital improvement debt (*z*).

3.1.32 *infrastructure, n*—a tangible or intangible asset that comprises the means and methods of a public or private sector organization in the provision of services that infrastructure asset service recipients (individuals, homeowners, or public and private organizations, or combinations thereof) desire.

3.1.32.1 *Discussion*—

Infrastructure assets may belong to a government, even though a private entity operates and maintains tangible assets and systems for that government. Such asset systems may be privately supplied through a public franchise and delivered through public easements or rights of way, or both. In the latter case, the authority would be the head of a private sector organization.

3.1.33 *infrastructure asset management, n*—intentional actions planned, sequenced, and executed to continuously improve use values of tangible and intangible assets with a minimum adverse impact on the environment while minimizing nature’s adverse impact on those assets in collaboration with those who receive and benefit from asset services (that is, individuals, homeowners, or public and private organizations, or combinations thereof).

3.1.34 *infrastructure asset service, n*—the existence or use value of a tangible or intangible asset, or both.

3.1.35 *infrastructure system report, n*—the final product of the authority following completion of an evaluation cycle of this practice, that is certified by a professional engineer (PE) who is licensed in the geographic location of the infrastructure asset systems being evaluated, using professional judgment.

3.1.36 *intangible asset, n*—a component of an infrastructure asset service that requires trust between the provider and recipient; includes the services of food systems, healthcare, security, education, and financial systems.

3.1.37 *intangible infrastructure, n*—delivered services (that is, of food systems, healthcare, security, education, and financial systems) that require trust between provider and recipient that is always associated with one or more tangible infrastructure assets (that is, potable water, sewerage, buildings, power, communication, transit and travel, or waste disposal, or combinations thereof).

3.1.38 *integrated fiscal administrative management system, n*—programs and procedures ~~offor~~ an authority designed to assure the cost efficacious management of her/his public or private sector organization such that the following three relationships are demonstrated acceptable, failed, or uncertain: (1) golden rule condition; (2) maximum interest paid for capital; and (3) less capital outlays than allocated-improvement revenue than capital outlay.

3.1.38.1 *Discussion—*

The user has achieved accountability and transparency upon documenting these relationships in the Infrastructure System Report and making the document available to infrastructure asset service recipients (that is, individuals, homeowners, or public and private organizations, or combinations thereof).

3.1.39 *land value capture, v*—recouping invested wealth in infrastructure asset provision following an actual increase in land value due to the investment.

3.1.40 *less capital outlays than allocated-improvement revenue than capital outlay (a relationship)*—the condition when capital improvement revenue (c) revenue is greaterless than capital improvement project-related outlay (w)(w). ~~outlay.~~

3.1.40.1 *Discussion—*

(w) is simultaneously capital outlay and exogenous wealth input.

3.1.42 *life cycle cost, n*—the sum of all known or expected material and non-material costs associated with an asset or group of assets; these costs include not only the acquisition value, but also activities related to an asset from acquisition through utilization and disposition.

3.1.41.1 *Discussion—*

Life cycle cost assumes that an infrastructure asset has a known or predicted useful life. The user should be aware that some tangible infrastructure assets continue to operate and meet performance standards long after the originally planned or anticipated useful life (for example, interstate highway system, bridges, waste water treatment plants) and that other infrastructure assets have finite life spans due to permitting or capacity limits. The user may use several publicly-available tools to calculate life cycle costs.

3.1.42 *life safety-priority, n*—a project selection criterion that advances projects with reductions in risks to human health and safety over other projects that reduce those risks to a lesser extent, subject to professional judgment.

3.1.43 *maximum interest paid for capital (a relationship)*—the condition when capital improvement retirement debt (z) outlays are moreless than 1.25 times capital improvement revenues (e)(c), funds, minus capital project-generated revenues (d)(d), revenues.

3.1.44 *mediate revenue (a), n*—incoming wealth that originates from the activities of government or private sector organization in the performance of the infrastructure asset provision duties of the authority; the complement of immediate (b) revenue.

3.1.44.1 *Discussion—*

These revenues are the capital budget that includes the (c) capital improvement funds, the (d) capital project-generated revenue, and the (e) non-private source of revenue.

3.1.45 *nature, n*—tangible assets that concern natural opportunities (that is, Earth, vegetation, life forms, air, wind, sunlight, water, precipitation, and the electromagnetic spectrum commons) that are managed (or not managed, as in passively stepping back) in terms of not only the ecological services they provide to humans, but also in terms of the ecological functions they provide for their continued existence and ability to sustainably provide infrastructure asset services in the future.

3.1.45.1 *Discussion*—

Note that beneficial use of wastes (composting), recycling, control of farm chemical runoff, and materials substitution is part of nature infrastructure assets, because loss of nature is reduced in those ways.

3.1.46 *non-private source of revenue (e), n*—incoming wealth to an authority generated by activities associated with infrastructure asset services provision, primarily for current services outlays.

3.1.46.1 *Discussion*—

The “e” is the shorthand designation of these revenues in the Integrated Fiscal Administrative Management System; includes user fees (for example, payments for delivery of potable water, natural gas, and electricity) and tolls, penalties, or captured locational land values, or combinations thereof. This revenue may also be used by the authority for retirement of capital improvement debt (z).

3.1.47 *ordinary outlays (x), n*—outgoing wealth expended for ongoing, current services such as waste collection, sewage treatment, street cleaning, emergency and non-emergency police patrols, and subway operations and maintenance; the complement of extraordinary (y) outlays.

3.1.47.1 *Discussion*—

The “x” is the shorthand designation of these funds in the Integrated Fiscal Administrative Management System. These are also referred to as outlays for operations, maintenance, monitoring, and repair.

3.1.48 *outlays, n*—outgoing wealth from a unit of government or private sector organization for the provision of infrastructure services; includes ordinary outlays (for current services (x)) and extraordinary outlays (for capital improvements (y)).

3.1.49 *potable water systems, n*—tangible assets including surface or ground water supply, or both, that meets public health standards.

3.1.50 *power, n*—tangible assets including electricity, natural gas, or other energized systems.

3.1.51 *private sector organization, n*—a non-public entity led by an authority who provides infrastructure asset services to infrastructure asset service recipients. Such an organization includes private colleges/universities and other non-public organizations that supply infrastructure asset services to employees or other service recipients.

3.1.52 *procedure, n*—specified way to carry out an activity or a process.

3.1.53 *professional judgment, n*—the active involvement of the authority or PE, licensed in the geographic location of the infrastructure asset system being evaluated, who is knowledgeable of the subject matter (for which the Infrastructure System Report documents) and how unacceptable infrastructure asset system conditions are identified.

3.1.53.1 *Discussion*—

The PE shall be current in her/his knowledge of the construction and operation, maintenance, monitoring, and repair of infrastructure assets, and when expertise is lacking, consults with other professionals who have the requisite knowledge or skills, or both (for example, in the fields of architecture, construction cost estimating, microbiology, medicine, disease prevention and treatment, crime prevention, public safety, school administration, pedagogy, anthropology, landscape architecture, the arts, ecology, ecological technology and administration, economics, public administration, accounting, and ethics). The authority also uses professional judgment when making decisions about which projects to triage when revenue is insufficient to do all that is planned.

3.1.54 *public, adj*—that which is owned, operated, maintained, or repaired by a public (non-private) entity.

3.1.55 *recreation and entertainment, n*—tangible assets used by people in sports play; art appreciation; enjoyment of a natural area experience or music, singing, or other types of performance; and, the projection of recorded programming on a large screen for enjoyment by multiple people at a specific time.

3.1.56 *revenue, n*—incoming non-private and private wealth to an authority for use in the provision of infrastructure asset services; includes mediate (a) revenue and immediate (b) revenue.

3.1.57 *score, n*—an attribute describing the current state of an infrastructure asset system type (or the average of two or more types) regarding the quality or frequency, or both, of infrastructure asset services delivered by the authority.

3.1.57.1 *Discussion*—

Table 4 identifies eleven sources of information from which a score can be derived for each type of infrastructure asset. Note that ASCE uses the word “grade” with an identical meaning.⁵

3.1.58 *security, n*—intangible infrastructure type that includes keeping infrastructure asset service recipients (that is, individuals, homeowners, or public and private organizations, or combinations thereof) safe from illness or life-threatening conditions, including the proper management of and a community’s protection from hazardous or toxic chemicals stored by or regulated by public or private sector organizations.

3.1.59 *sewage and storm water systems, n*—tangible assets including those involved with the transmission of domestic sanitary sewage and storm water from private dwellings, and public and private buildings; to storage, treatment, and discharge structures; and systems for waste solids removal.

3.1.59.1 *Discussion*—

TABLE 4 Referenced Standards to be Reviewed Before Using Practice E3210

Standard	Section	Description	Practice E3210 Infrastructure Nexus
Guide E3033	2.1	Beneficial Use of Landfills and Chemically Impacted Sites	Waste disposal; healthcare; potable water supply; recreation and entertainment; nature; food systems; liability transfer to user who alters land use from pre-beneficial use
Guide E2876	2.1	Integrating Sustainable Objectives into Cleanup	Community engagement; waste disposal; nature; recreation and entertainment; financial systems
Guide E3136	2.1	Climate Resiliency in Water Resources	Waterfront infrastructure and other flood prone properties; infrastructure systems and components
Guide E3123	2.1	Recognition and Derecognition of Environmental Liabilities	For determining current book value of an entity (for example, infrastructure tangible or intangible asset); financial systems; also, uses Guide E3033 to allow certain environmental liabilities to be derecognized
Practice E2453	2.1	Estimating the Life-Cycle Cost of Ownership of Property Assets	Banking and finance, cost analysis, financial management, and life cycle cost estimating; and asset procurement and acquisition, utilization, reutilization, logistics, and disposal
AACE	N/A	Cost Estimating Technical Resources ^A	Methodology for life cycle and contingency cost estimates
ANCR	N/A	Alliance for National & Community Resilience ^B	Benchmarks for housing, local government, governance, business, and neighborhoods
ISO 55000	2.2	Asset Management	Use of Fig. 1 as the outline for an ISO 55000 Strategic Asset Management Plan
ISO 37120	2.2	Sustainable Cities and Communities	Benchmarks for city services and quality of life, including: economy, education, energy, environment, finance, fire/emergency response, governance, health, recreation, safety, shelter, solid waste, telecommunications, transportation, urban planning, waste water, and water/sanitation
U.S. Federal Highway Administration	N/A	Life Cycle Cost	Life-Cycle Cost Analysis RealCost User Manual; ^C traffic data and time value of commuters
Code of Federal Regulations 10 CFR 436 Subpart A	2.2	Life Cycle Cost	Methodology and Procedures for Life Cycle Cost Analyses; building energy conservation, water conservation

^A Professional Development & Technical Resources of the American Association of Cost Estimators, Association for the Advancement of Cost Engineering (AACE International), Morgantown, WV, <https://web.aacei.org/resources/publications/downloads>.

^B *Developing a Whole-Community Resilience Benchmark*, Alliance for National & Community Resilience (ANCR), 2019, <http://www.resilientalliance.org>.

^C *Life-Cycle Cost Analysis RealCost User Manual*, U.S. Department of Transportation, Federal Highway Administration, Washington, DC, 2019, <https://www.fhwa.dot.gov/infrastructure/asstmgmt/rc210704.pdf>.

⁵ *Infrastructure Report Card*, American Society of Civil Engineers (ASCE), Reston, VA, 2017, <https://www.infrastructurereportcard.org>.

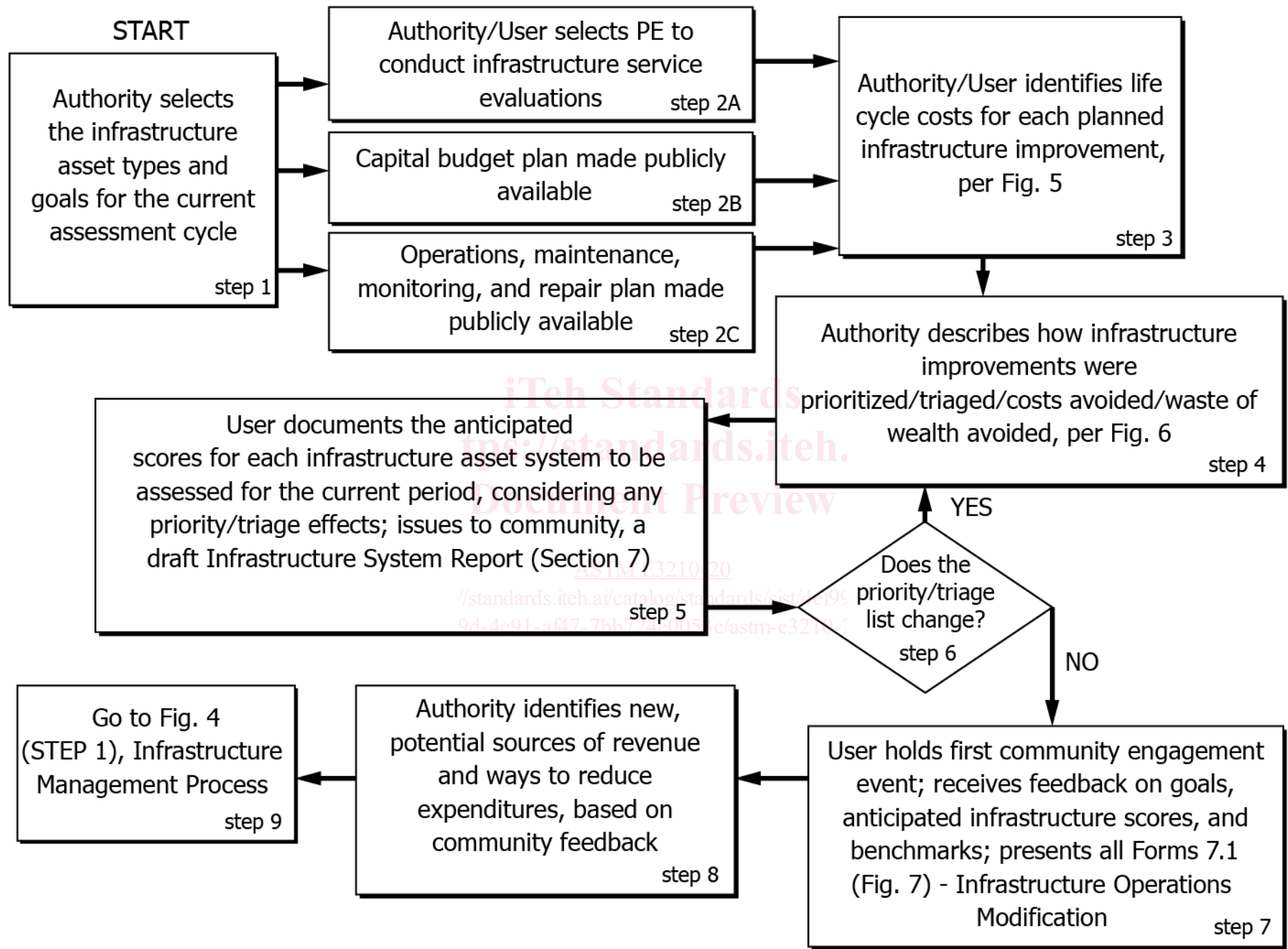


FIG. 1 Infrastructure Planning Process

Also includes the management of storm water through catch basins, green infrastructure, pipelines, sedimentation ponds, reservoirs, freshwater lakes, and riverine or coastal levee systems.

3.1.60 *sustainability, n*—the achievement of institutional arrangements of human actions today, guided by a vision of desired future arrangements that allow present societal needs to be met without compromising the ability of future generations to meet theirs.

3.1.60.1 *Discussion*—

Sustainability is not a reachable state but a multidimensional (that is, time and space) and multigenerational dynamic process (involving aspects of economy, society, and the environment) achieved through taking actions that minimize disorder or maintain an ecological balance, or both. **Table 2** includes 15 infrastructure asset types (listed in **Table 5**) and is therefore considered a sustainable listing (if and when these infrastructure types are being assessed in a current evaluation cycle) in that it is inclusive of each type of infrastructure asset service that is commonly encountered.

3.1.61 *tangible asset, n*—that portion of a non-human component of an infrastructure asset service that has an existence that can be perceived (that is, it can be touched or measured during installation or operation, or both, and is documented as installed, either above or under ground); it includes system elements that generate, transmit, or receive signals through the electromagnetic spectrum commons.

3.1.62 *tangible infrastructure, n*—the set of tangible assets combined with human labor that yields asset services that benefit asset service recipients (that is, individuals, homeowners, or public and private organizations, or combinations thereof) of an authority; included are systems of potable water supply, sewage and storm water systems, buildings, power, communication, transit and travel, waste disposal, cultural heritage, recreation and entertainment, and nature.

3.1.63 *tax increment financing, n*—a subsidy to capital improvement contractors and firms (that is, real estate developers) that originates with the diversion of a portion of their property taxes or consumers’ subsequent commercial sales taxes to finance development in an area or project site.

3.1.64 *transit and travel, n*—tangible assets involved in commerce or personal satisfaction, using various means of motion, by land, river, lake, sea, or air.

3.1.64.1 *Discussion*—

Often, a special State or multistate/regional authority or State-owned enterprise is designated to plan, design, operate, maintain, and invest in transit and travel systems, especially ports, inland waterways, and aviation. In those cases, the authority shall request those entities (within the region of the authority’s operations) to follow this practice for those infrastructure asset systems so as to coincide with the completion cycle she/he has adopted.

3.1.65 *transparency, n*—the public availability of documents related to all revenues and outlays (for the unit of government or private sector organization) for each assessed infrastructure asset system, and on the acceptability of how well those infrastructure asset systems are being managed.

TABLE 5 Infrastructure^A Asset Types^B

Type No.	Name	Includes
1	Potable water supply	Surface water, ground water, desalinated water, reservoirs, and all pipelines, treatment plants, and pumps to supply it
2	Food systems	Sanitary codes, public health agency, green markets
3	Sewage and storm water	Flushing systems and all pipelines, treatment plants, and pumps to remove and dispose of sewage; storm water systems; flood levees; dams
4	Buildings	Structures used for public administration and private use (includes building codes)
5	Healthcare	Basic or advanced care of individuals and groups of people; for example, 911 emergency operator, ambulances, hospitals
6	Security	Policing and fire services; homeless shelters
7	Power	Energy and transmission systems; includes conservation, hydropower, solar, wind, and geothermal systems
8	Communication	Phone, internet, cable TV, social/news media
9	Transit and travel	Airports, rail, roads, ports, inland waterways, tunnels, bridges, bike paths, governmental vehicles
10	Waste disposal	Trash collection, garbage transport, disposal
11	Education	Publicly-funded institutions; pre-K, K-12, colleges, trade schools
12	Cultural heritage	Statues, monuments, museums, libraries, historic sites, modern-day continuity of culture
13	Recreation and entertainment	Sports fields, parks, auditoriums, arenas, theaters
14	Nature	Maximization of protection and enjoyment of the environment, resource extraction and use, materials reuse, and recycling and materials substitution; minimization of adverse environmental impacts
15	Financial systems	Sources of governmental income as revenue, taxes, public credit, municipal bonds, state revolving funds, land and resource rents

^A Note that infrastructure assets are the non-human component of an asset service; types 1, 3, 4, 7, 8, 9, 11, 12, 13, and 14 are tangible assets, and types 2, 5, 6, 10, and 15 are intangible assets; together with the human labor, infrastructure assets become infrastructure asset services.

^B This list is not inclusive of every type of infrastructure asset system; the ones that appear in this list are representative of commonly known types.