Infrastructure Planning

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Infrastructure Planning

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I
INTRODUCTION

A. Scope and Purpose

This course presents the main concepts of infrastructure planning in the public sector including the environmental, social, and institutional assessments and discusses many planning methodologies and approaches.

The purpose of this course is to provide practitioners involved in planning public infrastructure projects with guidelines to be considered and applied in the planning process.

B. Infrastructure Projects

The term “public works” is applied to facilities that require substantial capital investments; provide public services or solve problems perceived to be the public’s responsibility; and are planned, designed, constructed, and operated by or under the auspices of governmental agencies. The public works also constitute the physical infrastructure of an area.

The following types of infrastructure facilities and systems are generally referred to as public works. Most of these facilities have generally accepted methods for estimating needs, and many may also be valued in terms of their tangible benefits.

- Land transportation facilities
- Water supply, treatment, and distribution
- Wastewater collection, treatment and disposal
- Solid waste collection, treatment and disposal
- Aviation facilities
- Marine facilities
- Water resources development
- Electric power generation and supply
- Parks and recreational or cultural facilities
- Buildings for governmental agencies

The first four of these types of infrastructure are the principal ones involved in the normal planning and budgeting process of federal, state, and local public works agencies. They also constitute the principal elements of municipal engineering. Many other types of public works, while they are also planned and approved in the annual, budgeting processes of the public works agencies are often planned and implemented as the result of special initiatives. Their adoption may be greatly influenced by participants in the political process, and they may also require specific enabling legislation.

The environmental movement has encouraged governmental agencies to adopt policies to plan and manage resources for the preservation and enhancement of:

- Natural water and land areas
- Archeological, historical, biological, and geological resources
- Ecological systems
- Water, land and air quality

Governmental agencies also carry out policies for planning, development, and management of the infrastructure that may also be used to further the general welfare of the public, including:

- Local and regional economic development
- Income distribution
- Health and safety
- Educational and cultural opportunities
- Emergency preparedness
- Other measures to improve the quality of life

The foregoing two categories-measures related to environmental concerns and the general welfare are often reported upon in “environmental assessments”, which generally also include studies of social impacts. An assessment for a project or program with significant environmental impact is called an Environmental Impact Statement, or EIS, and is prepared in accordance with federal, state, or local legal requirements.

Public infrastructure projects are planned for the following four broad categories:

- The development of new projects or the provision of additional capacity or capability to an existing system
- The rehabilitation, reconditioning and / or reconstruction of an existing facility without changing its capacity
- The routine maintenance and operation of infrastructure systems
- Projects that modify the operation and management of an existing facility to improve its efficiency, extend its useful life, introduce alternate strategies or incorporate new technologies to maximize the operational capacity of the facility

C. Infrastructure Planning

Public works planning methodologies range from fairly simple approaches to sophisticated mathematical optimization techniques depending primarily on the scope and magnitude of the project or projects being evaluated. There are many different planning protocols for different types of infrastructure and the public agencies responsible for them. Typically, a public infrastructure planning process will include the following eight (8) steps:

- Establishment of goals and objectives
- Problem identification and analysis
- Solution identification and impact assessment
- Formulation of alternatives and analysis
- Recommendations, including implementation schedules
- Decisions, including financing
- Implementation, including final design and construction
- Operation and management

The terms “goals and objectives” are generally interchangeable. An “objective” is generally considered a more basic concept and is preferred when evaluating projects and programs in terms of tangible values and other measures of positive and negative effects.

D. Programming and Budgeting

Programming means the process of prioritizing proposed projects and developing either a single year or multi-year program of projects, usually within a defined monetary amount. Budgeting refers to the procedure that actually produces funding and authority to incur costs and allocate funds. The budget is usually an annual governmental authorization for expenditures and may follow multiyear guidelines established by the same governmental body.

The participants in the programming and budgeting process start with an understanding of the infrastructure agency’s mission and general policies; an assessment of the infrastructure system conditions and plans; and estimates of available funding and staff resources.

The following outline lists the key elements of this process:

- Setting program goals and objectives.
  Establish clear and measurable statements of what the agency wants to accomplish to meet policy goals.
- Establish program performance measures.
  Set criteria to enable the agency to measure the progress of the program implementation and to evaluate the results of its program in terms of system performance, costs and benefits.
- Assessing needs and identifying projects
  Identify and measure deficiencies, problems, and needs.
- Project evaluation
  Evaluate proposed projects according to consistent criteria.
- Priority setting and program development
  Organize the agency’s work into program areas and set priorities for projects within (or across) each program area using established criteria.
- Program trade-offs
  Evaluate what the proposed program will achieve and possible alternative programs which might be considered to produce similar results.

- Budgeting
  Develop an expenditure plan based on available resources and project and program costs.
- Program implementation and monitoring
  Implement the program. Monitor progress in program delivery. Track system performance over time and evaluate results in terms of established performance measures.

E. Infrastructure Strategies

While infrastructure projects have been constructed for hundreds of years, modern public works planning has evolved over only the second half of the twentieth century. In the United States, infrastructure planning has largely been a local responsibility and carried out almost entirely by engineers. More recently, with the advent of the need for financial planning, environmental assessments, addressing socio- economic issues and other issues required in a comprehensive plan, persons having expertise in many disciplines are usually involved in infrastructure planning. From engineering and economic standpoints, the planning of public works projects in a multi-objective regional context is a logical evolution from the method consistent with the development of modern techniques such as systems analysis and computer programming. The major changes, in addition to these technological developments, have resulted from the inclusion of additional areas of consideration (particularly environmental and social factors) that are usually not quantifiable in the traditional sense (as are structural, cost, service, and other engineering factors).

A summary of the development of the infrastructure planning process that has occurred over the last 50 to 75 years for typical projects or programs follows:

Level1.
The approach used by infrastructure planners throughout most of the country's history and that still controls most local infrastructure planning, particularly for projects in the annual budgets of local public works agencies. The principal factors influencing project plans are location, function, and capabilities as well as costs and revenues (if applicable).

Level 2
This level includes Level 1 activities plus additional consideration of economic benefits when comparing alternatives and justifying projects.

Level 3
This level includes the activities contained in Levels 1 and 2 plus the additional consideration of environmental and social impacts and the input from the public and political involvement process.

Level 4
This level includes the activities of Levels 1, 2, and 3 plus the additional consideration of relatively "new" objectives and policy issues of sustainability and environmental quality.

A study on "Infrastructure Strategy" performed by the U.S. Army Corps of Engineers in the 1990s identified certain public works goals as primary objectives to guide the development of the strategy; to wit (1) efficiency, (2) reliability, (3) equity, (4) sustainability, (5) innovation, and (6) revenue. The report further stated that these goals are complemented by two outcome-based performance indicators, namely: (7) productivity growth and (8) competitiveness and jobs. In assessing the state of the infrastructure, the study identified a number of barriers that inhibit action on improving the infrastructure. These barriers are:

- Public works maintenance is often one of the first spending cuts made in times of a tight budget
- Capital investment in public works continues to be viewed skeptically by many as "pork barrel" spending
- Constrained budgets at all levels of government seem to render even modest programs and projects unaffordable
- Significant advances in technology are prevalent yet liability, regulatory, and contracting concerns have resulted in relatively few innovative public works applications
- The accumulation of federal and state regulations and mandates threatens to distort local budgets and priorities
- The implementation of necessary environmental statutes has created a complex series of public works decision making processes that often appear gridlocked.

The report included six principles of a recommended policy agenda for agencies involved in infrastructure planning. They are:

1. Adopt and encourage cost effective management and maintenance priorities
2. Make high quality infrastructure investments by obtaining maximum benefit as compared to cost
3. Achieve budget-sensitive financing through the preparation of financial plans and affordable analysis early in the process
4. Develop a R&D strategy that will encourage the use of innovative techniques
5. Encourage regulatory reform that more equitably and flexibly distributes the costs of meeting environmental and other performance requirements
6. Achieve an integrated environmental decision making process that results in a one-stop review of public works projects.

II
PLANNING CONCEPTS

A. Planning Aids

Useful information for studies of infrastructure facilities is available from many government agencies and non-government entities. Certain types of data are published on a regular basis. The types of data needed will vary with the location and type of the project and may include physical data such as; physical geography, land resources, geology and hydrogeology, meteorology, hydrology and environmental and socio-economic data such as; demographic, institutional, social, geographic, and economic, financial and legal issues.

The United States Geological Survey (USGS) is the primary collector of information on land and water covering almost all of the country. The USGS produces maps by the method of aerial photography and photogrammetry, most often at a scale of 1:20,000. USGS 7.5 minute quadrangle maps have been produced for virtually the entire country. There are numerous mapping techniques available for infrastructure planning.

Population projections and other demographic studies are usually obtainable from local and regional planning councils. Population projections are made in order to estimate needs for infrastructure facilities and services. The core source of data obtained from planning agencies is usually the United States Bureau of Census which is the most comprehensive source of demographic information in the United States. For almost every public works project, population projections are needed to accomplish one or more of the following objectives:

- Estimate demands (capacities) for specific outputs of the project
- Assess the likelihood that a project built to exploit a public works opportunity involving revenues will find an adequate market
- Schedule the implementation, including stage development of a public works project
- Provide the population component in a regional economic model

B. Basic Contexts

The responsibility for public infrastructure planning, development, implementation, and operation and management, generally rest with an agency that has been granted statutory authority for a particular type of facility or system of facilities. The planning work may be

performed in-house or with the aid of outside consultants having expertise in the particular type of infrastructure involved.

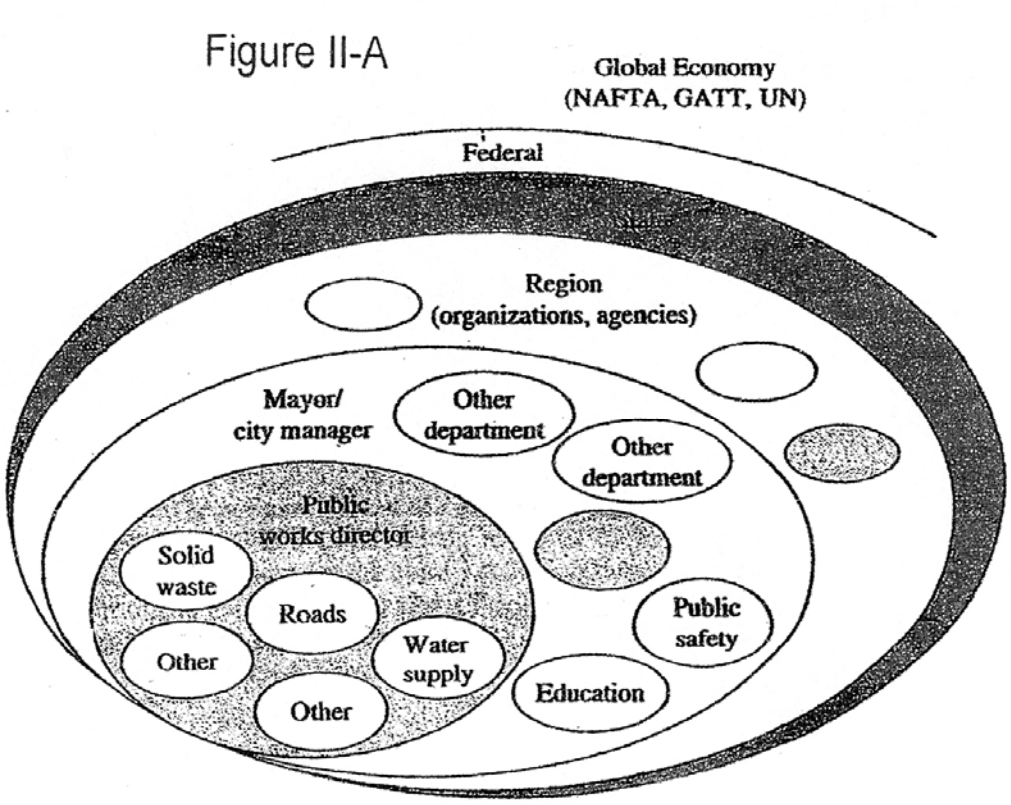
The objectives of a project must be viewed from several standpoints, depending on the nature and extent of the project. Several different contexts may be considered with geographic or political boundaries; global, national, state and local. Since the vast majority of practitioners are involved in either state or local infrastructure planning, these will be the primary focus of this course.

State objectives are generally expressed in enabling legislation pertaining to specific infrastructure facilities. For example, the Florida Department of Transportation (FDOT) is responsible for a portion of the highways in the state that are designated by law as state highways. The objectives and goals of FDOT may relate not only to the functional performance of the transportation system but also to the broader problems such as storm water management, loss of environmental resources and pollution.

Regional and local objectives, like state objectives, may target additional concerns. For the transportation sector, there is a federal requirement that every metropolitan region in the country must have adopted a long range transportation plan (including transportation and land use objectives) for the region, a short range plan of fundable projects, and a planning and decision making organization that includes principal elected officials of the major municipallities and the heads of relevant transportation agencies within the planning area.

Performance based planning and the use of outcome driven performance measures has become increasingly important for public infrastructure projects. Practitioners must recognize and work within a vested set of stakeholders, such as those shown within figure II-A, with their different objectives and values, and attempt to meet the expectation of the users and customers of the infrastructure systems. The agencies and elected officials for a specific project may represent some or all of the interests shown in Figure II-A. Other interested parties may be persons and/or organizations representing beneficiaries of project services, those potentially harmed by a project, environmental and social interest organizations and the general public.

Figure II-A



In most cases, decisions to provide public physical infrastructure will be made within the political decision making process. While the responsibility for detailed project analysis and development may be delegated to government agencies, the process must still be publicly accountable. Political decisions are made through the different funding and regulatory contexts, and through the decision processes of governing entities such as mayors, city and county councils, governors, state legislators and appointed agency heads and boards. For any project, practitioners must understand the political decision making process that will govern the implementation of the project, the current concerns and objectives applicable to that process, and the best ways to communicate project information to those charged with making decisions.

C. Important perspectives

The majority of the principles of infrastructure planning, implementation and management has evolved over time and are summarized herein:

1. Objectives and values change over time. There are many examples of programs that have been implemented with full public support but in later years have been reversed because of unforeseen impacts or changes in the way the public values certain objectives. A prime example, in Florida, is the Kissimmee River, which was channelized in the second half of the 20th century but now is being restored to its original meandering route to the Everglades. In addition, planning approaches have become more sensitive to various economic, environmental and social concerns which, in some instances, served to reduce previously implemented programs.

2. Infrastructure planning may involve the formulation of alternative plans to meet different objectives and a methodology of trade-offs to select an acceptable plan. Often, an acceptable plan is one that most closely meets the various criteria that have been established.

3. Infrastructure planning involves the concept of a system approach to installation, operation and management. It includes both specific functional modes, such as highways and streets and the combined systems the various modal elements compose (utilities, storm water, etc.)

4. The different infrastructure systems need to be integrated

5. Infrastructure planning involves the provision of physical facilities and their operation and management. The challenge in satisfying demand for services relate first to the initial installation and then to its functioning.

6. The planning of infrastructure is vital to the economic future of a political entity. It is obvious that the physical infrastructure is critical to our existence and quality of life, and that an adequate infrastructure is crucial to the economic development of a region.

7. The infrastructure is expensive; therefore the planning process must be thorough.

8. Many different levels of government are usually involved depending upon the nature and extent of the project (s) being planned.

9. Infrastructure planning is an interdisciplinary process. Professionals having expertise in a variety of both technical and non-technical disciplines are necessary to determine project feasibility and acceptability.

10. A successful project usually requires the support of elected officials and agency officials since the organizational structure that facilitates public works planning is usually political in nature.

11. Public participation in planning is vital. It is essential that those affected by the beneficial and adverse effects of projects be given the opportunity to provide input and comments and be involved in the planning process.

12. Projects may have multiple purposes and objectives. Projects may be either single or multi-purpose and they may also be single unit or multi-unit. When a number of projects are staged over a time period to meet needs up to a point in time called a planning horizon, this constitutes a development program.

13. Financial considerations are almost always an important component of infrastructure planning. Project financing may be guaranteed by tax revenues or by revenues derived by sales to users of the system in the case of revenue bonds. In some cases it may be necessary to establish a public authority to provide a legal means to effect project financing.

14. Many factors are involved in a successful project. These include engineering feasibility, economic and financial viability, as well as environmental and socio-economic impacts, legal and institutional constraints, and political acceptability.

15. Planning objectives and constraints should be identified and considered together.

16. Planning should involve a systematic and logical process. Practitioners, in adopting a general approach and detailed methodologies in the development of a plan, should recognize that a diversity of issues and constraints exist for different projects and that conventional planning techniques can serve only to guide the planning of future projects.

D. Planning Objectives

Certain issues are embodied in the decision making stages of planning, implementation, and evaluation of a project, to wit:

- Planning
  What will it cost to take action needed to achieve the desired performance, that is, to meet specific objectives, satisfy stated goals, or conform to specific regulations?
- Implementation
  Given the fixed resources of a project budget, how can action best be carried out to achieve the desired performance?
- Evaluation
  Given that resources are expended to take certain actions, are the outcomes of the actions consistent with stated and subsequent goals?

In the recent past, certain “new” objectives and issues have arisen in connection with infrastructure planning. These are:

- Sustainability
  The ability of a project to meet present needs without compromising the ability of future generations to meet their own needs.
- Environmental quality
  These issues have expanded along several dimensions, to include time frame, scale and scope.
- Environmental economics
  Environmental benefits and costs need to be included in the benefit-cost analysis in order to reach the concerns of the maximum number of constituents.
- Environmental justice
  Infrastructure planning should be administered to identify and avoid discrimination and avoid disproportionately high and adverse effects on minority and low income populations
- Project uncertainties
  Project uncertainties need to be identified and addressed.
- Risk benefit analysis
  Risk factors associated with a project need to be identified and estimates made of their consequences.

Several economic objectives have been identified which serve to assist practitioners in ranking projects for implantation. The following is a summary of these objectives:

Objective	Ranking Criterion
Growth in employment	Projects creating the most employment
Growth in productivity	Projects with the highest rate of return
Economic growth	Projects with the highest rate of return
Economic welfare	Projects with the highest net present value per dollar of capital invested
Distribution of income	Projects with the highest net present value per dollar of capital invested, where benefits and cost to lower income groups are weighted more highly
Regional transfers	Projects with the highest net present value per dollar of capital invested, where benefits and costs beyond regional boundaries are not counted
Sectional transfers	Projects with the highest net present value per dollar of capital invested, where benefits and costs to other sectors are not counted

III
PLANNING OF MAJOR INFRASTRUCTURE PROJECTS

A. Scope

Many projects of a routine nature and that meet obvious needs are scheduled within the normal budgeting process of a public works agency. Major engineering projects, however, usually undergo detailed studies before they are authorized and implemented. The studies consist of preliminary and/or feasibility studies which describe, in detail, the nature of the project and the steps that are needed to plan and implement it.

B. Preliminary Report

A preliminary report consists of both office and field studies and the preparation of a report to answer the following questions:

- Is a feasible project likely?
- What are approximate estimates of capacity and cost?
- What additional studies are needed to confirm feasibility?

The preliminary report is prepared using existing available information such as maps and surveys, geologic and soils data, information on environmental conditions, and population and socio-economic data. Data and forecasts are also needed that are pertinent to the project such as water supply requirements, waste water treatment capacity, etc. Office studies are usually adequate to initially determine the general arrangements of the project components, the capacity of the project or the services it can provide, and its cost. Sometimes the office studies need to be supplemented by field reconnaissance and surveys, but these should be kept to a minimum, consistent with the nature of the preliminary report. The principal personnel involved in the preparation of the preliminary report are normally engineers; however, other specialists may be involved, depending upon the specific types of infrastructure facilities being considered.

C. Feasibility Report

Based on the premise that satisfactory conclusions were reached in the preliminary report, the project sponsor (s) may authorize the preparation of a feasibility report. The feasibility report should contain enough information to permit a decision on whether or not to implement the project. The technical studies must be more detailed than those for the preliminary report and must include financial, economic, and environmental / analyses and a plan for project implementation. A comprehensive feasibility report should include the following elements:

1. Descriptions and analyses of the data

2. Confirmation of construction feasibility based on a thorough analysis of all project elements

3. Recommendations for arrangement of project works

4. Construction schedule showing the timing and cost of project features

5. Financial analyses projecting the periodic costs, revenues, and project subsidies (grants, assessments, etc.)

6. Economic analyses of the project, if appropriate

7. Plans for financing construction, construction administration, and operation

8. Institutional and legal requirements

9. Assessments of the environmental and social impacts of the project

10. Plan for public participation

Depending on the extent of the drawings and analyses needed to confirm construction feasibility and to make reliable estimates of projects cost, the work in this phase may consist of designs in addition to planning studies.

The feasibility report provides the basis for the examination by decision makers in a governmental entity and for a financial institution to determine whether a project should be implemented and / or financed. If the project is to be financed by either ad-valorem or revenue bonds it is essential that potential bond holders know exactly how and when they will be repaid.

D. Subsequent Project Stages

Subsequent project stages include the preparation of final contract documents, construction activities, and project start-up. Normally, the preparation of final contract documents is not authorized by the project sponsor until project financing has been secured and agency approvals have been granted. In some instances, project sponsors may desire to have contract documents “on the shelf” in cases where unforeseen project funding may become available (economic stimulus funds are an example). When project financing has been secured and all permits have been received, the project can be let for construction bids and, after evaluation of the bids received, a contract award is made. The construction phase and project start-up follow the scheduled times set forth in contract documents.

E. Project Formulation

The formulation of a project emphasizes physical (structural) details, costs, project services, reliability, safety, and other engineering elements. Practitioners must also consider the impacts of a project that are not primarily

of an engineering or cost nature. It is essential to ensure the environmental, sociological, institutional, and other relevant factors are adequately taken into account. Otherwise, projects may be proposed that cannot be implemented or will function poorly. At the early stages of planning, impact analysis can be limited to identifying the most obvious problems, but later studies, conducted by specialists, need to be more comprehensive. As the project formulation proceeds, the practitioner gains an improved understanding of project intricacies and can communicate with the sponsor possible alternative strategies. The considerations that affect a selection among alternatives and a decision to proceed with implementation of a project have increased in number and complexity. Sometimes, practitioners will utilize what has been referred to, as a “Decision Matrix” to assist in project selection. This involves the listing of all project elements and scoring their ability to meet project objectives. Depending on the magnitude of the objective, scores may be weighted to reflect their relative importance. The following special factors affect selection of a preferred alternative and its subsequent implementation;

1. Ability to respond to purposes and needs
2. Engineering / design feasibility or restriction
3. Severity of environmental impacts
4. Uncertainty in impact prediction
5. Irreversibility of impacts
6. Degree of beneficial impacts
7. Costs
8. Funding availability and commitment
9. Public opinion
10. Political support
11. Ability to meet statutory requirements
12. Permitting agencies concurrence

In the comparison of alternatives, practitioners need to recognize that alternatives may be favored or not favored, or even ruled out, depending upon other practical considerations. For example, legal limitations on the amount of debt that a municipality can assume may favor an alternative with lower initial capital expenditures despite its higher annual O&M expenses.

F. Project Cost

There are two major cost elements involved in the implementation of an infrastructure project. These are investment or capital costs and annual costs. Investment costs are estimated based on prevailing market prices for labor, materials, and equipment in the geographical area in which the project is situated. Investment costs include:

- The cost of the physical facilities proposed
- Land, easements, and rights-of-way
- Construction contingencies (usually 15% of direct construction cost)
- Engineering, legal, and administrative costs (usually 10% of direct construction costs and contingencies)
- Interest during construction, if interim project financing is required

The total investment cost should be reduced by the amount of any grant and / or “front end” funds that might be available and the resulting balance is the amount to be financed. Most often, project sponsors will retain financial consultants to assist in procuring long term financing for their project. Debt services covers interest and amortization based upon repaying the investment cost of the project within a specified time (not longer than the useful life of the project).

A capital recovery factor is determined based on the terms and interest rate of a loan. The annual debt service is found by multiplying the total investment cost by the capital recovery factor.

Annual costs include:

- Operation and maintenance of the system
- General administrative expenses
- Renewal and replacement
- Annual debt service
- License fees (if applicable)

Once the annual cost of a project has been determined, a suitable user rate structure can be developed to produce revenues sufficient to meet the annual cost plus any coverages that lenders may require. The foregoing briefly covers project cost. A more detailed accounting is presented in Section V, Financial Analysis.

IV
MUNICIPAL INFRASTRUCTURE SYSTEMS

A. Scope

Depending on the size of a municipality and its form of government, a single agency, such as a Department of Public Works, or group of agencies will have responsibility for planning, constructing, maintaining, and operating the following six systems:

1. Transportation systems, principally roads and bridges

2. Water supply, treatment, and distribution

3. Sewage collection, treatment, and disposal

4. Storm water collection and disposal

5. Solid waste collection and disposal

6. Electrical supply and transmission

Cities have many infrastructure problems, both routine and complex, particularly when systems are aging or inefficient or when they directly impact either commercial interests or the general citizenry. The degree to which infrastructure provides the services that the community expects of that infrastructure may be defined as a function of effectiveness, reliability, and cost. Effectiveness, or the ability of the system to provide the services the community expects, is generally described by: (1) capacity and delivery of services; (2) quality of services delivered; (3) the system's compliance with regulatory mandates, and (4) the system's broad impact on the community. Reliability, a recognition of the various uncertainties inherent in infrastructure services, is the likelihood that infrastructure effectiveness will be maintained over an extended period of time. Infrastructure that reliably meets or exceeds community expectations, at an acceptably low cost, is performing well.

The most pervasive problem affecting the nation's infrastructure is physical deterioration resulting in mounting needs for repair, rehabilitation, and replacement. Many components of infrastructure systems show the effect of aging, and some are approaching the end of their design life. Aging problems are compounded by the cumulative effects of inadequate maintenance and repair.

There are six major reasons why infrastructure improvements might be needed.

1. Growth:
   To serve new or expanded service areas in a system.

2. Functional:
   Due to changes in demand or changes in amount and type of service requirements

3. Technological:
   Occurring when better approaches and /or technology are available to carry out the functions of the facility

4. Physical:
   Due to ordinary wear and tear or deterioration from age or use of a system

5. Casualty related:
   Arising from hurricanes, earthquakes or other natural man-made disasters

6. Legal / Environmental:
   From changes in either legal or environmental requirements relating to a system.

B. Comparison of Alternatives
   Infrastructure planning is multi-dimensional. It involves multiple ideas, multiple tasks, the identification of alternatives and the comparison of alternatives. A total of nine (9) methods for comparing and prioritizing projects have been identified and are discussed hereinafter in an approximate increasing level of sophistification.

   1. Simple Cost Basis
      Considers construction investment and annual costs, cost per unit of constructed infrastructure and cost per unit of service or output. The method compares present value, future value or annual value of a stream of costs over a specified period of services for an infrastructure facility, often the useful life.

2. Simple Cost Basis plus Consideration of Other Specified Engineering Factors.
   This method takes into account such factors as; (a) length of useful life; (b) quality of construction and durability of facilities; (c) associated problems of operation and maintenance of facilities; (d) susceptibility to unforeseen problems of construction and / or O&M; (e) flexibility of facilities for expansion and / or replacement.

3. Life Cycle Cost Basis
   Considers costs only, including costs offset by savings to beneficiaries of facilities and costs offset by savings and by values of other types of benefits.

4. Cost Basis Including Adjustments made for Additional Screening Criteria.
   Consists of adjustments of estimates made by others:
   a) Of cost, capacity, outputs, etc., to meet consistent design criteria and construction methods
   b) To reflect sponsor's special requirement
   c) To reflect analyses for local and regional infrastructure systems

5. Additional Primarily Cost-Driven Methodologies for State and Local Infrastructure Systems
   Considers routine maintenance and replacement decisions based upon engineering judgments as to priorities and availability of funds analyses based upon cost effectiveness and functional sufficiency based upon a rating system and comparing alternatives based upon additional measures of performance including effectiveness in providing services, reliability, and cost.

6. Full Financial Analyses
   Consist of the development of arrangements to implement the project with terms and conditions of financing, cost per unit of service or product, and comparison with prevailing market prices in the project area and yearly analyses of all monetary inputs and outputs at market prices.

7. Economic Analyses
   Includes a year-by-year analyses of all cost and benefits in which monetary amounts are stated in terms of their economic values and extended analyses that consider regional benefits that are in addition to direct benefits to users of project services and products.

8. Multi-dimensional Analyses
   This analytical method utilizes multiple modeling techniques to compare alternatives such as matrices, enhanced display techniques, mathematical models and other decision oriented methodologies.

9. Special Studies
   Other studies as required to conform to governmental agency formal protocols, regional simulations and other types of system analyses having outputs in such terms as economic impact and / or degrees of attainment of specified goals or objectives.

Comparisons of infrastructure alternatives is usually depicted in spreadsheet format. Using spreadsheet programs, such as MS Excel, enables the analyst to solve complex problems more easily than in the past. Spreadsheets permit the display of data and the results of calculations in formats that are clear to the parties that will be reviewing the work. Calculations are generally made in terms of monetary quantities such as cash flows. A formula basic to the development of a spreadsheet is:

$F=P\ (1+ i)^{n}$ where

F= future sum of money at the end of “n” periods

P= present sum of money

i= interest rate

n= number of interest periods

As an example, a project having a total project cost of one million dollars financed over a 20 year period at an interest rate of 7% will require a total payback of $3.87 million dollars.

$F=1.0\ (1 + .07)^{20} = 3.87$

The use of spreadsheets has several advantages including: (1) reduction of time needed for solutions, improvement of accuracy, and reduction of errors; (2) formatting of tables that clearly describe the methods and results and; (3) ability to re-run programs with different assumptions, corresponding to sensitivity analysis.

V
FINANCIAL ANALYSIS

A. Types of Analyses

Financial analyses are needed for most public and private projects that involve capital investments. They include the preparation of the following types of documents:

1. Estimates of the capital and annual cost of the project in terms of monetary requirements.

2. Schedule showing the costs by years needed to bring the project into operation.

3. Plan for financing the costs of the project investment, including the sources of funds and the terms of repayment of each category of borrowing.

4. Estimates of cost; revenue from sale of products and services; and required subsidies on a year-by-year basis extending from the completion of construction to the date when the repayment of all borrowed funds is completed.

5. Plan for the required annual subsidies, if any, during the early years of operation.

6. Additional statements of a financial nature depending on the regulatory agencies and financial institutions involved in the project.

B. Example

The following example illustrates the documentation required to support a revenue bond issue offering for a small water supply and distribution system for a hypothetical community. Exhibit V.1 is a summary of the estimated cost of the system. The detailed estimates of cost of the system components would be contained in the Preliminary Engineering Report which would have been prepared for the project. Exhibit V.2 is a cash flow projection for the project. It assumes construction commencing in mid 2010 and being completed by the end of 2011. The first full year of operation is 2012. The annual debt service is based on financing $4.159 million for 20 years at a rate of 5.8%. It should be noted that “front end” income such as revenue derived from front-foot assessments to benefited abutting property owners, project grants, developer contributions, etc., can be used to reduce the amount to be financed. The annual growth rate for connections used in this example is 4% for residential and 2% for commercial property. Actual growth rates would be determined from data obtained from regional planning councils, population growth projections from the U.S. Census Bureau and other similar sources. Annual increases in O&M and

G&A costs would be based on the inflation rate selected as determined by historical data.

Note, in this example, cash flow is negative for the first two years of operation. As a result, lenders may want the municipality to pledge an additional source of revenue to support the bond issue. Alternatively, the municipality may slightly revise the rate structure upward to increase gross revenue and avoid a negative cash flow. There are a number of ways to structure the cash flow projection once the basic data is known. Other financial data which would be required includes a suitable bond ordinance enacted by the local government pledging revenues from the system to repay the bonds, financial statements for the community for the past predetermined number of years and such other financial data as the fiscal consultant may deem necessary.

The example is typical for both small and medium size infrastructure improvement projects for local government in Florida. Larger project will probably require more comprehensive data to support their financing.

Exhibit V.A

Mayberry, USA
Water Supply and Distribution System
Summary of Cost

	Item	Estimated Cost
1.	Land and Easements	$ 300,000
2.	Water Supply Wells	$ 400,000
3.	Treatment and Storage	$ 880,000
4.	Distribution System	$1,584,000
5.	Construction Contingencies @ 15%	$ 429,600
6.	Engineering, Legal and Administrative @ 10%	$ 329,400
7.	Interest During Construction	$ 236,000

Total Estimated Cost $4,159,000

Exhibit V B

Mayberry, USA
Water Supply and Distribution System
Cash Flow Projections

Year	Number of Connections		Gross Revenue	Annual Cost				Net Operating Income / Loss	Cumlative Income
	Res.	Comm.		Operation & Maintenance	General & Administration	Renewal & Replacement	Annual Debt Service		
2012	1200	60	$ 1,584,000	$ 760,000	$ 80,000	$ 148,000	$ 642,000	$ (46,200)	$ (46,200)
2013	1248	62	$ 1,646,400	$ 775,200	$ 81,600	$ 148,000	$ 642,000	$ (600)	$ (46,800)
2014	1298	64	$ 1,211,200	$ 790,000	$ 83,250	$ 148,000	$ 642,000	$ 47,050	$ 250
2015	1350	66	$ 1,778,400	$ 806,500	$ 84,900	$ 160,000	$ 642,000	$ 84,800	$ 85,050
2016 to 2032							2016 to 2032		

VI
ECONOMIC ANALYSES

Various criteria that may be used to determine the economic viability of a project include the comparison of economic benefits and economic cost on an annual or present value basis, and the determination of a benefit-cost ratio or other measure of the economy. These criteria may be used to justify the approval and / or the implementation of a project or to rank various projects. Benefit-cost analyses are generally considered microeconomic analyses, since they focus on the persons, organizations and other entities that are directly affected by a project, and estimate the positive or negative net benefits. It is recognized, however, that investments in public works may have additional economic effects extending beyond those directly affected by infrastructure projects.

Economic analyses are needed, in addition to financial analyses, for many public projects, especially when they are analyzed at a regional level. Economic analyses treat all economic costs and benefits. The basic analyses that are needed to define the economic worth of an individual project focus on the direct user benefits, and these are the benefits generally referred to when the term "benefit-cost analysis" is used.

When the broader impacts of an individual project or a group of projects are considered, the economic analyses may be extended to consider some or all of the following: (1) the indirect impacts; (2) the entire geographic area affected by the project, which may extend beyond the project limits, and; (3) the induced impacts that may result from direct or indirect impacts.

Economic effects of public works may involve beneficial or adverse effects in addition to construction and operating costs and user benefits. Economic feasibility implies that the discounted benefits of construction and operating the project will exceed the discounted costs over its useful life. Indicators such as benefit cost ratio, discounted net benefits, and internal rate of return may be calculated in order to demonstrate economic feasibility. All costs and benefits that can be accounted for being attributable to the project should be included in these analyses. It should be noted that a benefit is not the same as revenue, since the actual or perceived beneficial effects of a project may be greater or less than the revenue needed to recover the project costs.

Certain special considerations in economic analysis deserve mention and are enumerated below:

- Sunk Costs
  It is a general rule of economic analysis that costs already committed, and for which the sponsor is liable, do not enter into a comparison of alternatives or a decision as to whether or not to proceed with a project.

These costs would apply to both the project “go or “no go” options and therefore cancel out.

- Inflation
  In economic analysis, calculations are made in terms of constant dollars. In practice, the analysis is usually made in terms of prices in effect during the planning phase. This assumes the general inflation would have an equal effect on future benefits and costs.

- Willingness To Pay
  The concept presumes the individuals would, in theory, be willing to pay up to the full increase in real income and other benefits that an investment would generate rather than have the investment not take place.

- Project Lifetime
  It is essential that life-cycle analysis be performed which involves an estimate of future conditions, including future demand for the facility or service.

Several methodologies exist for an economic analysis of a public works project. Some of these are also pertinent for financial analyses. The following paragraphs describe some of the approaches used in typical project analyses.

1. Analysis of Alternatives
   Most analyses require the comparison of alternatives. This may include comparisons of: (1) two or more projects; (2) projects of varying scale [size], or; (3) no project.

2. Tangible Values
   For public works, both financial and economic analysis may be needed.

3. Comparison When Cost Are Specified
   When two or more projects have essentially equivalent costs, a comparison of the benefits or services is required.

4. Comparison When Benefits Are Specified
   When two or more alternatives provide essentially equivalent benefits or services, a thorough comparison of cost is required. The cost may be in terms of the investment required or on a life cycle basis.

5. Comparison When Alternatives Have Varying Benefits and Costs
   When two or more alternatives differ in both benefits and cost, they can be compared by a variety of methods including: (1) determining present worth of net benefits; (2) benefit-cost ratio; (3) rate of return on investment; (4) pay-back period, and: (5) other recognized methods.

6. Comparison on Present Worth or Annual Basis
   Benefits and costs computed in terms of present worth (or present value) is generally recognized by economists as the conceptually correct method of comparing benefits and costs over time.

7. Interest Rate
   The comparison of alternatives usually involves mathematical operation with formulas containing an interest or discount rate expressed on an annual basis. It is used in both present worth calculations and determination of future worth.

8. Period of Analysis
   The period of analysis should be at least as long as the period to pay back the funds borrowed to construct the project, but should not exceed the economic life of the project.

9. With and Without Analysis
   The effects of the project are the differences with and without the project, which is not the same as “before” and “after”. Substantial changes may be expected in the regional economy, for example, whether the project is constructed or not.

10. Values Based on Prices
    Market prices are relevant to financial and economic analyses in different ways. In financial analyses, prices represent financial flows while in economic analyses, market prices may represent a good estimate of economic value.

Various studies and surveys have been conducted over the years to identify deficiencies that have occurred in economic analyses of infrastructure projects. Some of the more common errors include the following:

1. A failure to specify increased productivity, growth, or living standards as principal economic objectives for infrastructure.

2. A failure to apply relevant decision criteria to productivity, growth, or increased living standards. Unless these tests are applied, planners have no way of knowing whether or not proposed policies are meeting their objectives.

3. A failure to apply tests that reveal whether employment and income in the region would expand by as much or more in the absence of the infrastructure investment.

4. A failure to develop an efficient and productive base case as a basis for assessing major improvements.

5. A failure to identify all of the benefit categories attributable to investment proposals.

6. A failure to apply proper discounting techniques, which means that planners lack information regarding the comparative merits of alternative policies and investments.

7. A failure to use some form of sensitivity or risk analysis.

VII
ASPECTS OF INFRASTRUCTURE PLANNING

A. Environmental and Social

Prior to the 1960's very little attention was paid to recognition and evaluation of the environmental and social impact that occurred as a result of infrastructure projects. This situation was changed in the latter part of the 1960s with enactment of legislation by federal, state and local governments formalizing requirements for environmental assessments, including formal "Environmental Impact Statements" (EIS), which also include social impact assessments applying to the "human" environment. In 1969, Congress enacted the National Environmental Policy Act (NEPA) and similar acts subsequently adopted by state and local governments have produced an enormous impact on the modern practice of infrastructure planning. Engineers and planners must be familiar with legally mandated requirements for planning, analyses, review and reporting, which are established by legislative acts and implemented through the rules and guidelines of governmental agencies.

For many infrastructure projects of a routine nature, the objectives driving the planning process will be related to the perceived needs for infrastructure facilities and services and to costs, but with modifications when potential environmental and social impacts are encountered (especially when they are adverse and must be mitigated). This is the case for many municipal infrastructure systems managed by public works agencies. For larger projects and programs that extend over several political jurisdictions, intrude on neighborhoods, or upset the environmental or social character of an area, a more formal approach is needed for dealing with environmental and social impacts and the many stakeholders interested in them.

Pursuant to the NEPA of 1969, the planning process must include the preparation of an environmental impact assessment (EA or EIA). This is a concise public document prepared by an agency prior to undertaking a major action that serves to:

1. Provide sufficient analysis for determining whether an environmental impact statement (EIS) or finding of no significant impact (FONSI) is needed.

2. Aid in the agency's compliance with the act when no EIS is necessary

3. Facilitate preparation for an EIS when one is necessary

Its format is similar to that of an EIS except that the level of detail required is less than that of an EIS. Its content includes detailed information for assessing

environmental feature in the categories of air, water, land, ecology, sound, human aspects, economics, and resources.

Its content should include the following:

1. Purpose and need for the project

2. A description of each alternative considered including the selected alternative and any “no action” alternative

3. A description of the affected environment

4. The environmental consequences, including mitigation measures

In evaluating the environmental and social impacts of a project, several factors have been identified for determining whether an impact is significant. These include, but should not be restricted to, the following:

- Probability of Occurrence
  Quantitative or qualitative estimate of the likelihood that the impact will occur

- Magnitude
  Quantitative or qualitative estimate of the size and extent of the impact

- Duration
  The period of time the impact, if it occurs, can be expected to last.

- Reversibility
  Whether the impact can be reversed through human action or naturally

- Relevance to Legal Mandate
  The existence of local, state, or national laws that specifically promote or disallow this type of impact

- Social Distribution of Risks and Benefits
  Whether the impact (adverse or beneficial) contributes to (or mitigates against) the equitable sharing of environmental risks and benefits.

Once, as a result of an evaluation of the EA, it is determined that significant environmental and / or social impacts will occur as a result of the project, the preparation of an EIS is required.

Pursuant to guidelines established by the Council on Environmental Quality (CEQ), the following eight (8) elements must be addressed in the EIS.

1. A description of the proposed action, a statement of its purpose or purposes, and description of the environment affected.

2. The relationship of the proposed action to land use plans, policies, and controls for the affected area.

3. The probable impact of the proposed action on the environment.

4. Alternatives to the proposed action.

5. Any probable adverse environmental effects that cannot be avoided.

6. The relationship between local short term uses of the environment and maintenance and enhancement of long term productivity.

7. Any irreversible and irretrievable commitments of resources that would be involved in the proposed action should it be implemented.

8. An indication of what other interests and consideration of (federal) policy are thought to offset the adverse environmental effects of the proposed action indentified pursuant to items #3 and #5 above.

It should be noted that the term “sustainability” was mentioned in Section II. While planning guidelines often state that adequate attention should be paid to sustainability in the planning and implementation of infrastructure projects, no formal requirements currently exist to encourage or insure sustainability. This situation is expected to change in the future, when more of a consensus exists as to how to deal with sustainability in planning methodologies.

B. Legal and Institutional

Public works planning depends primarily on laws and regulations. The regulations of federal, state, and local government agencies are pertinent to almost every action involving the infrastructure. State legislatures delegate certain lawmaking authority to local governments. At this level, rules, laws, and regulations are promulgated by local elected bodies and exercised through local municipal agencies, such as public works departments. The agencies deal with various infrastructure planning, operation and maintenance functions and with applying regulations such as those pertaining to land use, buildings, and environmental quality. Public works projects, such as highway systems, may be planned and constructed by state, regional, or local agencies. Whatever the entity sponsoring the project, it is usually subject to the regulatory and permitting

authority of the applicable state agencies. Federal statutes, such as those relating to water and or air quality and the treatment of solid and hazardous waste, establish federal-state regulatory programs whereby the states enact and enforce laws, meeting federally mandated criteria, to achieve regulatory objectives that the U.S. Congress has established. Local governments have broad powers to control the location and operation of facilities or other public works that are within their jurisdiction. This may include; (1) water supply, treatment, and distribution facilities; (2) waste water collection, transmission and treatment facilities and; (3) solid waste collection and disposal facilities. A strong measure of local government control is through zoning and land use ordinances that can define permitted uses and types of construction in different parts of their jurisdiction. Other ordinances may relate to nuisances such as noise, smoke, dust, odors, other airborne pollutants, water pollutants and hazardous substances.

The sponsor of a public works project, whether governmental or private entity may need to obtain rights to lands or waters owned by others before implementing the project. Land required may be in the form of fee simple title for treatment plant sites or easements for utilities, access, or recreational purposes. Much of the time, following legitimate appraisals of value, the government entity is able to acquire the necessary property rights through negotiations with the owner. If the necessary property cannot be obtained through negotiation, it may be obtained by eminent domain. Where the property is require for public purposes, this legal procedure may be used to obtain property rights through the courts when an owner will not cede them voluntarily.

Despite the long-standing interest by various entities in preservation and conservation of natural resources, and an awareness of the short-term and long-range effects of infrastructure facilities on the environment (both beneficial and adverse) it is only relatively recently that they have been translated into legislative directives and planning procedures. Federal and state legislation now deal with many specific aspects of protection, conservation, and enhancement of environmental quality. In addition to laws relating directly to environmental quality, there are many other acts that affect planning, construction, and operation of public works, such as those providing for the protection of rare or endangered biological species, controlling development on public lands, and protecting wild and scenic rivers.

The system of common law that prevails in the United States encourages sponsors of infrastructure projects to use methods such as mediation to settle conflicts and avoid the expense and delay of litigation. Studies which have been conducted for such approaches by both federal and state governmental entities have increased the use of mediation and other less formal ways of resolving disputes arising out of project planning and construction activities. The group of techniques is known as “alternative dispute resolution” or ADR and is

increasingly being used by governmental agencies to expedite projects and reduce the conditions that result in litigation.

Benefits claimed for the use of ADR are:

1. Voluntary nature of the process
2. Expedited procedures
3. Non-judicial decisions
4. Control by managers
5. Confidential procedures
6. Greater flexibility in terms of settlement
7. Savings in time
8. Cost savings

A total of eight (8) ADR processes may be utilized to resolve contractual differences. These include:

1. Arbitration
2. Disputes Review Board
3. Facilitation
4. Fact Finding
5. Mediation
6. Mini-trial
7. Negotiations
8. Partnering

Many types of institutions may be involved in the public works development process. An appropriate structure of an institution is an important determinant of its ability to plan, construct, or operate an effective project. The criteria for assessing institutional effectiveness includes the following:

1. Public Acceptability
   Is the institutional structure directly accountable to the constituency for its needs?

2. Political Feasibility
   Are elected and appointed officials willing to refer plan implementation to recommended organizations that are willing to implement the plan?

3. Adequate Legal Authority
   Do the organizations and agencies have the legal authority to finance and implement the plan?

4. Adequate Financial Resources
   Do assigned participants have sufficient access to financial resources to implement the recommended plan?

5. Fairness and Equitability
   Are implementation costs fairly and equitability distributed among participating agencies and beneficiaries of public services?

6. Technical Capabilities
   Do the organizations assigned responsibilities have appropriate technical staff?

7. Stability / Reliability / Flexibility
   Are the organizations being assigned responsibilities already established and can they be expected to remain in authority for the planning period?

8. Conservation Suitability
   Will the institutional structure adopted be suitable for implementing equitable conservation measures?

9. Efficiency
   Is the size of the implementing agency sufficient to realize economies of scale that will result in efficient operation and avoid duplication of services?

10. Enforcement Authority
    Do the organizations assigned responsibilities have the authority to enforce policies?

C. Uncertainty and Risks
Infrastructure planning invariably involves a certain degree of risk. Some general comments regarding them include:

- Uncertainty arising from inadequate information is a major problem
- Many problems in projects are characterized by the hazards that arise from random natural processes and systems.
- Planners face substantial problems of identifying analyzing, and mitigating the various sources of risk and uncertainty. Decision makers must weigh the trade-offs presented by the analysis and decide or resolve issues of dispute among them. Then public must live with the decisions made on the basis of these analyses.
- Each group of analysts has its unique perspective on what is risky and uncertain, and professional differences exist in applying and interpreting the results of the various analytical procedures.
- Risk and uncertainty lie along a continuum of knowledge, with its extremes of complete certainty and complete vagueness. Accordingly, there are no clear boundaries or well defined limits.

Generic methods of dealing with risk and uncertainty include a numner of common sense methods as follows:

1. Collecting more detailed data to reduce measurement error
2. Using more refined analytical techniques
3. Increasing safety factors in design
4. Selecting alternatives or components of alternatives with better known performance characteristics
5. Avoiding or reducing irreversible or irretrievable commitments of resources
6. Using both sensitivity and risk analysis methods in the evaluation of the estimated benefits and costs of alternatives
7. Account for the attitude of both the decision makers and the public toward risk

8. Explicitly present assumptions used in the analysis and some justification for their use

9. Indentify all key variables

10. Use creative display techniques to help analyze risk and uncertainty.

Practitioners involved in infrastructure planning are routinely faced with making decisions involving project implementation. Scholars having professional credentials in the field of decision research have identified six (6) criteria for an effective decision making process.

The process must:

- Focus on what is important
- Be logical and consistent
- Acknowledge both subjective and objective factors and blend analytical with intuitive thinking
- Obtain only as much information and analysis as required to resolve a particular issue
- Encourage and guide the gathering of relevant information and informed opinion
- Be straight forward, reliable, easy to use and flexible

Decision making researchers have identified eight (8) ingredients for effective decision making which are presented as follows:

1. Work on the right decision problem
   Acknowledge the complexity of the problem and avoid unwarranted assumptions and option limiting prejudices.

2. Specify objectives
   Determine what is to be accomplished and which elements are most relevant to achieving the goal.

3. Create imaginative alternatives
   The final decision can be no better that the best alternative.

4. Understand the consequences
   How well do alternatives satisfy the objectives?

5. Carefully evaluate the tradeoffs
   In most complex decisions, there is no perfect alternative. Different alternatives fulfill different ranges of objectives. The task is to choose intelligently among less-than-perfect possibilities and to address the need for trade-offs among competing objectives.

6. Clarify the uncertainties
   What could happen in the future and what is the probability it will.

7. Carefully consider the risk tolerance
   When the decisions involve uncertainty, the desired outcome may not be the one that actually results.

8. Consider linked decisions
   What is decided now could influence the choices in the future, and goals for the future should influence the choices made now. Thus, many important decisions are linked over time.

VIII
PUBLIC INVOLVEMENT

Public involvement is a process by which interested and affected individuals, organizations, agencies, and general government entities are consulted and included in the decision making process of a planning effort. It is intended to both inform the public and to be informed by them by actively soliciting public response to the proposed plan. Public participation is vital for successful infrastructure planning. The trend in planning is toward a more open, or transparent, process in which the organization sponsoring a plan or project and its staff seek an increasing level of interaction with all entities that have an actual or perceived interest in the plan or project. Public involvement has been formalized by federal, state, and local mandates for public participation in public works planning.

Increased public participation in public works planning and decision making is, at least partly, due to mounting public pressure on decision makers. Opposition to some proposals has resulted in long delays or abandonment of projects that have been perceived as unacceptable. Engineers and planners have recognized that big or complex projects need the support of many groups. Effective public participation is the way to gain acceptance of worthwhile projects, or alternatively, to recognize early which projects are not likely to be acceptable. Public involvement in planning may also be considered as good management practice, since it often presents opportunity to:

- Identify legal requirements, funding limitations, or other constraints and ensure that the plan is acceptable
- Take advantage of technical expertise that may be available in the various public entities involved
- Identify and clarify positions of different groups and individuals affected by the plan
- Indentify sensitive issues and ways of preventing or reducing adverse impacts
- Overcome conflicts and reach a consensus when there are differing points of view with respect to plan components
- Gain support for the project and its implementation

Many factors should be considered in designing a public participation program. These factors should relate to the dissemination of information, the interaction of the sponsoring organization and the public, and the establishment of credibility.

The program must conform to legal requirements and consider availability of personnel and funds. A successful public participation program will usually depend on eight (8) factors which are described below:

1. Preplanning
   An early step in the planning process should be to define the scope of the public involvement program and the main issues of concern to the public. Some basic research on the affected project area should be carried out and information regarding its demographics and characteristics should be obtained. Detailed information on the proposed plan should be collected and organized. Using information concerning the project area, and the nature of the project and planning process, the planner can determine the scale of public involvement needed.

2. Agency Policy
   Agencies (project sponsors) should fully define their expectations and procedures for public participation. Policies should be established concerning citizen involvement and representation, channels of communications to be established, and what decision making power citizens will have. Public attitudes about the project sponsor may influence acceptance of the planning process and the project.

3. Resources
   A project sponsor should be willing to allocate sufficient resources, in the form of trained staff, money, and time, to ensure that the public involvement activity is successful. Although many staff members may be involved with citizens, each project should be managed by one person, the project manager, to insure program responsibility and continuity.

4. Outreach
   A public involvement program involves the participation of stakeholders which, in the context of planning, has come to mean a person or group of persons who can stop a project or whose support is necessary for success. A stakeholder is someone with something to lose or gain from the recommended course of action. Identification and notification of appropriate groups and individuals is a critical element of successful public participation At least five (5) groups, constituting stakeholders, should be involved in coordination, review, and input concerning the planning concepts and process. They are:

   - Public agencies and officials that have a legal mandate for consultation and / or approval of the project

- Elected officials in the project area

- Organizations and or individuals that have an economic interest the project

- Public interest groups that have particular programs or policies that bear on the project

- Other organizations and individuals who may be interested in the project

5. Effective Communications
   Good communication between planners and the public is essential. Information should be transmitted through individual, group, and media contacts. Suitable written materials, effective presentations with good graphics, and productive discussions all contribute to good communication.

6. Techniques
   The techniques that are employed in the public information process should focus on the identification and resolving of problems, especially when they involve value judgments. They may also depend on certain other factors including; (a) applicable legal requirements; (b) nature of the planning organizations, and; (c) institutions and other stakeholders involved.

7. Responsiveness
   During the planning process, many citizens may contribute many opinions and ideas. These inputs may vary widely in terms of value reflected and of relevance to the planning alternatives or process. Some will be usable in formulating new alternatives or in restructuring existing work. All citizens comments should be reviewed and considered. Legal requirements may mandate a formal response to all comments. It is also important to public relations and the credibility of the agency and the planning process that citizens are aware that their contributions did receive attention, and that their ideas and concerns were heard.

8. Monitoring and Evaluation
   All phases of the planning program should be evaluated to determine not only if the program has met its goals, but also whether the perception of the agency by the public has been strengthened. The latter is particularly important, since the credibility of the plan and the agency will be affected by its public image.

Examination

Infrastructure Planning

1. A type of infrastructure that would not be involved in the normal planning and budgeting process of a local public works agency is…

    a. A roadway improvement project
    b. A water distribution system
    c. A new regional airport
    d. A waste water treatment plant

2. An assessment for a project having significant environmental impacts is called…

    a. An environmental assessment
    b. An environmental impact statement
    c. An environmental planning report
    d. An environmental analysis

3. The process of prioritizing proposed projects is termed…

    a. Budgeting
    b. Assessing needs
    c. Setting program goals and objectives
    d. Programming

4. The responsibility for public infrastructure planning rests with…

    a. Elected officials
    b. Regional planning councils
    c. Appointed authorities
    d. An agency having statutory authority for a facility

5. The implementation of a project is usually governed by…

    a. The political decision making process
    b. The availability of project financing
    c. The desires of the public
    d. All of the above

6. A number of projects staged over a time period to meet needs up to a point in time is called…

    a. A long rang plan
    b. A development program
    c. A planning horizon
    d. A multi-purpose project

7. The ability of a project to meet present needs without compromising the ability of future generations to meet their needs is known as…

    a. Environmental Quality
    b. Effective planning
    c. Sustainability
    d. Environmental economics

8. A Feasibility Report…

    a. Precedes a Preliminary Report
    b. Is used primarily to support project financing
    c. Contains enough information to permit a decision on whether or not to implement the project
    d. Should not be amended

9. A methodology that is sometime used to assist in project selection is called a…

    a. A decision matrix
    b. Project formulation
    c. Comparison of alternatives
    d. Project development

10. The most pervasive problem affecting the nation's infrastructure is…

    a. The inability to keep up with growth
    b. Keeping up with technological improvements
    c. Satisfying environmental requirements
    d. Physical deterioration

11. Infrastructure planning involves…

    a. Multiple tasks
    b. The identification of alternatives
    c. The comparison of alternatives
    d. All of the above

12. Where, in the initial years of operation of a new infrastructure project, cash flow is not sufficient to support its financial obligations, a public entity may…

    a. Pledge additional sources of revenue to repay the bonds
    b. Revise the rate structure
    c. Reduce the scope of the project
    d. Any of the above

13. A study that concentrates on the persons directly affected by an infrastructure project is considered…

    a. An economic analysis
    b. A benefit-cost analysis
    c. A financial analysis
    d. A present worth analysis

14. A cost already committed by a sponsor to an infrastructure project is…

    a. A budgeted cost
    b. A “front end” cost
    c. A sunk cost
    d. Not included in an economic analysis

15. When two or more alternatives provide essentially equivalent benefits or services…

    a. A thorough comparison of cost is required
    b. Benefits should be compared over time
    c. A benefit cost study should be conducted
    d. Either alternative may be selected

16. When planning for an infrastructure improvement project, the preparation of an environmental impact assessment (EIA) …

    a. Is required for larger projects that extend over several political jurisdictions
    b. Is optional at the discretion of the project sponsor
    c. Depends of the size of the project
    d. Is mandatory

17. A technique utilized by government agencies to expedite projects and reduce conditions that result in litigation…

    a. Is called eminent domain
    b. Is through zoning and land use ordinances that can define permitted use of property
    c. Is known as alternative dispute resolution
    d. Is known as public acceptability

18. When planning an infrastructure project, one of the methods that can be used to mitigate risk and uncertainty is…

    a. Focus on what is important
    b. Collect more detailed data and reduce measurement error
    c. Clarify the uncertainties
    d. Avoid unwarranted assumptions

19. Public participation in infrastructure planning enables project sponsors to…

    a. Identify and clarify the positions of different groups and individuals
    b. Identify sensitive project issues
    c. Gain support for the project
    d. All of the above

20. One of the primary goals of public participation programs is …

    a. Establish effective communications
    b. To establish credibility
    c. Ensure that all stakeholders participate
    d. Focus on the identification and resolving of problems.