# Sustainable Infrastructure: A Toolkit for Planners

# Sustainable Infrastructure: A Toolkit for Planners

*This Toolkit was produced by a team of volunteers working under the auspices of the 'Ten Big Ideas Initiative' of the American Planning Association's Washington State Chapter. 'Big Ideas' is designed to bring about far-reaching and fundamental changes to address the critical social and economic challenges faced by Washington communities. We do hope, though, that this Toolkit will be useful to planners everywhere.*

## Produced By:


Rhys Roth, Director, Center for Sustainable Infrastructure at The Evergreen State College

Richard Conlin, Richard Conlin Consulting

Marty Curry, Curry Consultants

Tye Ferrell, Resilience Collaborative

Stacia Jenkins, City Councilmember, Normandy Park

Jill Sterrett, FAICP, Affiliate Instructor, University of Washington

Karmen Martin, Senior Planner, Environmental Science Associates

Lynn Schneider, MIPM—University of Washington

Nicholas Matz, AICP, Senior Planner, City of Bellevue

Steve Moddemeyer, Principal, CollinsWoerman

David Yeaworth

# Table of Contents

## Sections

# Section 1: Introduction

*Infrastructure systems in Washington are the backbone of our society and economy, and the biggest, most enduring capital assets that communities invest in. Over the next decade, we will make billions of dollars in infrastructure investment decisions across Washington State. These investments will have a tremendous impact on the economic vitality, social equity, resilience, and public and environmental health of our communities. This workbook demonstrates how we can ensure that they effectively achieve all of those values.*

Local governments build and manage some of the infrastructure systems serving their communities, but are often not actively involved in the infrastructure building activities of outside utilities and agencies. Given how central infrastructure investments are to the future well-being of our communities, local governments may want to play a much more active and strategic role in guiding and coordinating the investments made by other entities. Such activities can ensure that these investments can support community goals and aspirations.

***This Toolkit is for local government planners who want to help their communities take a more pro-active role*** in shaping the future of local infrastructure systems. If they are planned and constructed with careful attention to our shared values, investments in energy, water, transportation, and waste management can deliver more value, manage risk better, and cost less than past approaches. At the same time, smarter infrastructure investment can help to address our most pressing environmental challenges and foster healthy, prosperous, beautiful, resilient, and cohesive communities.

A growing 'infrastructure deficit', reflected in aging systems, escalating O&M costs, and declining revenues poses an increasingly serious challenge to our communities. Climate change has emerged as a powerful driver for rethinking infrastructure that is built around our society's reliance on carbon-based fuels and that can also be potentially vulnerable to extreme weather. Technological innovation and economies-of-scale are beginning to disrupt long-standing infrastructure approaches, opening up new strategies with the potential to deliver greater environmental, social, and economic value streams.

This Toolkit has been created under the auspices of the 'Ten Big Ideas Initiative' of the American Planning Association's Washington State Chapter, though our hope is it will prove useful to planners everywhere. 'Big Ideas' is designed to bring about far-reaching and fundamental changes to address the critical social and economic challenges faced by Washington communities. These include addressing climate change, rebuilding our infrastructure, developing sustainable agriculture, supporting economic development, and restoring and protecting our eco-systems—challenges shared by many communities worldwide.

The Toolkit has been produced by a team of volunteer planners and professionals:

- Richard Conlin, Richard Conlin Consulting
- Marty Curry, Curry Consultants
- Tye Ferrell, Resilience Collaborative
- Stacia Jenkins, City Councilmember, Normandy Park
- Jill Sterrett, FAICP, Affiliate Instructor, University of Washington
- Karmen Martin, Senior Planner, Environmental Science Associates
- Lynn Schneider, MIPM—University of Washington
- Nicholas Matz, Senior Planner, City of Bellevue
- Steve Moddemeyer, Principal, CollinsWoerman
- Rhys Roth*, Director, Center for Sustainable Infrastructure at The Evergreen State College
- David Yeaworth

*Rhys Roth served as Coordinator for the Rebuild Our Infrastructure team.

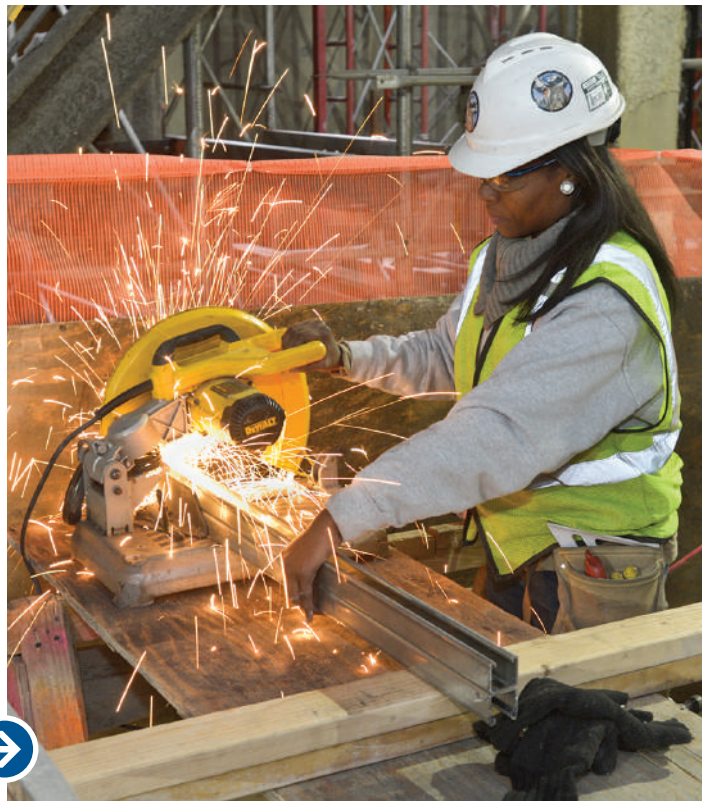
# Section 2: Rebuild Our Infrastructure: A Checklist Tool for Planners

*This checklist was developed to assist planners in developing proactive collaboration for community infrastructure planning. This tool will be useful in a community's capital facilities planning and comprehensive planning, as well as when large infrastructure projects affecting the community are in early development.*

**Who This Tool is For:** Local planners who are either involved in capital facilities and comprehensive planning or who must respond when outside entities propose large infrastructure projects that will impact the community. It will also be helpful to planners with infrastructure agencies seeking to develop infrastructure projects that harmonize well with local community development goals and aspirations.

**What Community Needs Might Trigger Use of this Tool:** This checklist tool is designed to be valuable in a variety of situations, including:

- New development or redevelopment in urban areas;
- Growth in demand on infrastructure systems;
- Aging or poorly performing infrastructure systems;
- Identified need to increase reliability of infrastructure systems or adaptability in the face of changing conditions; and
- Advances in technology enabling better performing (more affordable, sustainable, resilient) infrastructure systems.



*Work on the Fulton Center in Lower Manhattan in 2013. Photo: Patrick Cashin. (By Metropolitan Transportation Authority of the State of New York. "FultonSt_4039" uploaded by tm. Licensed under creativecommons.org/licenses/by/2.0)*

## Checklist

*The checklist below provides a handy reference for the major concepts described in this Toolkit. This checklist will be useful as a reminder to the planner of the various steps in the process and as a tracking tool to help assure that each step is completed.*

| Guiding Principles | Toolkit Checklist |
|---|---|
| **Go for the Triple Crown: Affordable, Resilient and Sustainable FISCAL POLICY**<br>Decision-making for infrastructure must account for affordability, resilience and sustainability benefits. | |
| Were the costs, benefits, and risks of distinct project approaches quantified and compared on a lifecycle basis? | |
| Was the resiliency of each project approach to changing conditions and extreme events evaluated and compared? | |
| Was each project approach shown to significantly improve environmental and social performance of the system and contribute to long-term community sustainability goals? | |
| **Consider Broader ALTERNATIVES**<br>Smart investors seriously consider alternatives as part of their due diligence before they write a check. | |

## *Rebuild Our Infrastructure: A Checklist Tool for Planners*

| | |
|---|---|
| Does the capital budgeting process prompt thinking outside the box to develop integrated, cross-departmental infrastructure alternatives? | |
| Does it identify and draw on best practices? | |
| Does it perform benefit/cost analysis on a portfolio of options, including demand reduction? | |
| **Connect the Silos for a CULTURE OF COLLABORATION**<br>Virtually all communities are heavily invested in multiple infrastructure systems –streets and bridges, electricity and telecommunications, natural gas and heating services, water supply, sewer, stormwater, and waste collection, recycling and disposal. Too often, each type of infrastructure system is planned, constructed, and operated separately. | |
| Were infrastructure systems considered as parts of a larger interacting whole to avoid compartmentalization and missed opportunities for increasing overall value? | |
| **Build a Better BUSINESS CASE**<br>Once infrastructure planners narrow the project or program options to those which will achieve the intended outcome, it's crucial to weigh the full benefits and costs over the life-cycle of the project -- construction, operations, and maintenance over its projected period of use, as well as decommissioning. | |
| Was a business case developed for the proposed project or program that identifies efficiencies, manages risk, and aligns broader community goals? | |
| Did the capital investment process consider adaptability to future change and quantify risks of system failure in the event of foreseeable disasters? | |
| Did the benefit-cost analysis consider life-cycle costs, including planning, construction, operations, maintenance, replacement, and decommissioning? Were these calculated in net present value? | |
| **Educate, Engage and Inspire PUBLIC SUPPORT**<br>Infrastructure systems are the most costly and enduring capital assets a community invests in. With legacy systems aging and under stress, and significant constraints on public funds, community support for needed infrastructure investment is crucial to ensuring successful projects. | |
| Was an effective communication and public engagement program built around a compelling vision of what, where, and why this infrastructure is necessary? | |
| Were community partnership strategies considered to add broad public support? | |
| **ADAPT INFRASTRUCTURE to a Changing World**<br>Infrastructure decision-makers must increasingly be future-casters. Capital projects this year will often be paid for over decades and in operation even longer. | |
| Do major infrastructure system managers routinely identify factors to proactively adapt infrastructure to changing technology, environmental stresses, shifting residential patterns, lifestyles, and generational change? | |
| **Integrate SMART SYSTEMS**<br>Advanced technologies are transforming every industry. Infrastructure managers can harness low-cost monitoring and real-time management technologies to improve service and achieve cost-saving efficiencies. | |
| Were monitoring and real-time management technologies adapted to achieve service improvements and cost-saving efficiencies? | |
| **PARTNER With Nature and Enhance the Community**<br>The most cherished community places are often those where beautiful, functional structures and nature come together and enhance each other. | |
| Did project designers fully consider green infrastructure strategies to complement traditional gray infrastructure investments? | |
| Were the aesthetics of the design intentionally addressed as a component of hard infrastructure projects? | |

## *Rebuild Our Infrastructure: A Checklist Tool for Planners*

| | |
|---|---|
| **Build Community PROSPERITY**<br>Infrastructure spending is paid for and benefits the whole community. It is widely recognized as a job generator and important to local workforce, businesses, and economic vitality. | |
| Were capital investment strategies for infrastructure aligned with goals for economic development for all segments of the community? | |
| Does the project strategically in-source infrastructure jobs and develop opportunities for technical training and advanced degree programs? | |
| **Value Capacity and Expertise ALIGNMENT**<br>Successful infrastructure innovation that delivers long-term cost savings and a host of better outcomes requires sophistication and deep expertise. Policy change at the top is key, but not enough. | |
| Are job descriptions, procedure, protocol, and training aligned with sustainable infrastructure efforts? | |
| Do Requests for Proposals/Qualifications emphasize procurement strategies that incentivize private sector innovation and reward performance over time? | |

For more on the principles described in this Toolkit, see the report, *Infrastructure Crisis, Sustainable Solutions—Rethinking Our Infrastructure Investment Strategies* **(http://www.evergreen.edu/sustainableinfrastructure/docs/CSI-Infrastructure-Crisis-Report.pdf)**

# Section 3: Go for the Triple Crown: Affordable, Resilient, and Sustainable

**By Rhys Roth**

*There are growing constituencies calling for change in how we plan and design infrastructure. Some are focused most urgently on how we can finance a ballooning 'infrastructure deficit' and deal with increasing operating costs. Others strive to make our systems able to recover more quickly in natural disasters and emergencies. Many focus on the crucial environmental performance of infrastructure systems. The good news is that there is a rich array of opportunities and new infrastructure strategies that offer strong and simultaneous affordability, resilience, and sustainability benefits.*

**Why affordable + resilient + sustainable together?**
Infrastructure systems are the biggest, most enduring capital assets a community invests in. How we prioritize and focus our infrastructure investments can have a tremendous impact on local economic vitality, social equity, public and environmental health, and community resilience.

Infrastructure decisions must solve more than one problem and serve more than one community goal at a time. If we do it right, our investments in energy, water, transportation, and waste management will deliver more value, manage risk better, and cost less than past approaches. At the same time, smarter infrastructure investment will effectively address our most pressing environmental challenges and foster healthy, prosperous, beautiful, resilient, and cohesive communities.

> *"Sustainable and Resilient Infrastructure consists of flexible and adaptable physical systems, e.g. water, energy, and transportation, needed for the operation of private or public enterprises and services. Sustainable and resilient infrastructure is characterized by a broad diversity of nested semi-autonomous agents, processes, and systems at each scale. It typically includes modular and repeatable strategies that can proliferate; maintains and enhances connectivity up, down, and between scales to share resources, information, insights, and strategies; restores and stores capacity at each scale so isolated elements can survive for a period on their own; and, creates signals and feedback loops to moderate behavior and adapt to change."*
>
> —Applying Resilience to Puget Sound Recovery, Steve Moddemeyer, 2015

**Affordable**—For many infrastructure systems, a growing gap between available resources and the funds required to keep infrastructure in working order poses an increasingly serious challenge. The 'infrastructure deficit' has two faces. First, capital funding is lagging to replace and restore aging facilities and accommodate growth. Traditional state and federal funding sources are shrinking, and many infrastructure agencies are not setting aside funds at the pace needed to replace aging facilities. Second, many budgets for operating and maintaining (O&M) infrastructure are under serious strain as systems age and costs escalate. Many infrastructure systems rely on revenue sources that are inadequate to meet their ongoing O&M needs, let alone allow for future capital investments. For example, much of the funding for road infrastructure comes from gas tax revenues which continually decline with higher fuel efficiency standards, declining use of private automobiles, and the nascent but growing electric vehicle fleet.

**Resilient**—Infrastructure systems are vulnerable to a variety of natural and human hazards, from extreme weather events, landslides and earthquakes to terrorist attack and large-scale accidents. Most of our current infrastructure systems were not designed for the deep uncertainties we now face from a changing climate. Water-related systems, in particular, have been designed based on records of past weather patterns and extremes that are no longer a valid guide to what is likely to be the weather of the future. In an operating environment of significant uncertainty, resilient infrastructure investments add flexibility to the system, enabling adaptation in later years as natural and social conditions change.

Resilient systems are more flexible and adaptive to changing circumstances, less vulnerable to catastrophic failure than standard systems, and recover more quickly to restore service in the event of disruption. For example, a neighborhood scale wastewater treatment system in Battery City Park in Manhattan not only provides clean water for non-potable purposes, it reduces the need for water and wastewater services in the city-wide system. When Hurricane Sandy disabled large parts of New York City's infrastructure, the systems at Battery City Park continued to perform.

**Sustainable**—Sustainable infrastructure investments foster excellent environmental performance. Sustainable infrastructure investments move our communities toward:

- Primary reliance on locally-sourced and renewable resources;
- Clean water, clean energy, and the efficient use of materials to maximize lifespan and recycling;

## *Go for the Triple Crown: Affordable, Resilient, and Sustainable*

- Little or no greenhouse gas emissions;
- Little or no release of toxic compounds and other pollutants; and
- Enhanced and restored natural systems.

Sustainable systems can provide impressive efficiencies, lower lifecycle costs, and a range of compelling co-benefits for the community. These co-benefits have real economic value across other sectors, such as improving results from public health programs, reducing costs for environmental compliance, and fostering job opportunities accessible to lower-income residents.

**How to go for the infrastructure investment 'Triple Crown'**
Infrastructure strategies that combine affordability, resilience, and sustainability can help build the public support and trust necessary to marshal the resources needed to address our growing infrastructure deficit.

**Long-range Plan Development**

1. **Adopt the principle—*Affordable, Resilient and Sustainable Infrastructure*—as policy.** It is the responsibility of planners to recommend actions that shape growth and direct investments in infrastructure. Consider including the principle as policy in all planning processes that affect regulatory and investment decisions, such as comprehensive plans and functional plans (e.g. Transportation and Capital Improvement Plans), hazard mitigation plans, and more. Land Use and Utilities elements of a local comprehensive plan are obvious places to start.
2. **Develop a long-range Sustainable Infrastructure Strategic Plan.** An infrastructure strategic plan that encompass all of the community's infrastructure systems can provide a central pillar aligning implementation efforts and local planning documents. It can also provide a platform for agencies and utilities managing different infrastructure systems to harmonize their plans with overarching community goals.

**Capital Facilities Planning**

1. **Build now toward a future of affordable, sustainable and resilient infrastructure systems.** Ensure that the Capital Facilities Plan within the community's Comprehensive Plan puts the pieces in place to realize the future systems envisioned by the long-range Sustainable Infrastructure Strategic Plan.
2. **Thoroughly analyze alternatives.** In addition to consideration of economic, environmental and social concerns in assessments of project costs and benefits (the "Triple Bottom Line" approach), include a thorough analysis of alternatives. A broader consideration of alternatives must occur before an adopted project's pre-design phase, when alternatives evaluation is more narrowly focused to design issues. For more information on this topic, see Section 4.
3. **Conduct Life Cycle Analysis and Cost-Benefit Evaluation for large investments.** These tools can help support the analysis of alternatives by considering and anticipating impacts associated with project alternatives over their entire lives. A life cycle cost analysis encompasses not only construction, but operations and maintenance costs anticipated over the project's useful life. Looking at total project costs over the entire life cycle improves long-term economic efficiency and performance risk management. For more information on this topic, see Section 6.

## Case Studies:

**The City of Freiburg, Germany** is world-renowned for its forward-thinking infrastructure planning and investment. This legacy is reflected in the city's multi-modal transportation system, human-scale mixed use development, walkable streets, reliance on renewable and district energy systems, and protection of both green spaces and the historic character of its buildings. In 1993, Freiburg received the City of Vision Award from the International Making Cities Livable organization, and was featured in the **2013 City of Vision Study Tour** (http://www.livablecities.org/articles/freiburg-city-vision).

**Dockside Green,** a planned community for 2,500 people in Victoria, British Columbia's Inner Harbour, redeveloped 15 acres of former industrial land, setting out to achieve the highest green building standard. To this end, their infrastructure strategy sought to design integrated utility systems that use waste from one system to fuel another. A district energy system provides space heating and hot water to local buildings. The system is fueled to a large extent by local wood waste—from sawmills, construction, and local tree trimmings. All wastewater is managed by an onsite plant, which combines harvested rainwater with reclaimed treated water to supply local toilets, landscaping, and a waterway that provides both beauty and wildlife habitat to the neighborhood. **(http://www.docksidegreen.com)**

# Section 4: Consider Broader Alternatives

**By Steve Moddemeyer and Tye Ferrell**

*Building infrastructure is typically a complex and costly activity. Examining broader alternatives provides an opportunity to create more value for each dollar spent. Decision-making that follows a thorough process, generates a full range of alternatives, and applies rigorous and fair evaluation can uncover savings and increase performance. Expanding the number of both traditional and non-traditional options can help to avoid confirmation bias, narrow framing, or lack of input.*

Consider a range of alternatives that includes multi-faceted options that meet both the project purpose and fulfills other complementary purposes, either within the same department or within other departments or agencies. When done carefully, considering broader alternatives increases the likelihood that a community achieves the broadest possible range of values for each dollar spent on infrastructure systems and services.

**General guidelines on how to generate and consider broader alternatives:**

1. **Take a holistic approach.** Draw a broad boundary around the relevant costs and benefits of an infrastructure system. Account for total capital, operations, and maintenance (O&M), and risk costs over the lifespan of system investments. Consider broad environmental and social equity outcomes and their potential monetary, social, and political costs (triple-bottom-line analysis), including those that accrue both in and outside the planner's jurisdiction. Consider non-monetary and qualitative effects of projects, such as contributions to community gathering spaces or aesthetic benefits.

2. **Consider both centralized and decentralized solutions.** With centralized infrastructure systems, it is common to automatically default to alternatives that follow that basic approach. Sometimes this is appropriate, but decentralized solutions can provide superior solutions and should be considered during the alternatives analysis. For example, decentralized solutions for stormwater include controlling rainwater onsite rather than downstream through a pipe system, and centralized combined sewer overflow systems can be coupled with decentralized green stormwater infrastructure to save money and reduce the size of expensive underground facilities. As efficiency increases and costs fall for distributed energy generation, utilities are looking to a combination of onsite and central station energy generation solutions. This blend of decentralized and centralized solutions can add to the overall resilience of the system, while at the same time freeing precious capacity in the larger component for baseload use that would otherwise be built as expensive hedge that would only be required during peak events.

3. **Test green alternatives as well as traditional solutions.** Some "green" alternatives can cost the same or less than traditional solutions, yet staff may reject them without much investigation because they assume that "green" costs more or does have the same track record of proven capability, and therefore carries higher risk. While green solutions are still evolving, they are already reaching levels of service that outcompete business-as-usual, and are rapidly becoming standard practice. They are likely to become even more cost effective in the future. In the meantime, both green and traditional alternatives should be thoroughly evaluated. An example is provided by the **Yesler Terrace Sustainable District Study** (http://www.collinswoerman.com/images/PDF/Yesler-Terrace-Sustainable-District-Study.pdf).

4. **Consider both supply enhancement and demand management solutions.** As demand increases, we often assume that we need more supply to meet that demand. However, reduction in demand through efficiency gains can often be more cost effective than increasing supply. Whether in energy conservation, water conservation, transportation planning, or waste recycling, sometimes the better solution is demand management. Examples include demand management approaches for **on-site capture of stormwater runoff** (http://www.seattle.gov/util/MyServices/DrainageSewer/Projects/GreenStormwaterInfrastructure/RainWise/index.htm), financial incentives to decrease use of limited resources such as energy, and street planning options that encourage shifts from single occupancy vehicles to other travel modes.

5. **Consider cross-silo solutions.** Sound alternatives can be generated by considering interdepartmental and public/private partnerships, going beyond traditional department-only solutions. Too often, we let the "silo" of our scope or level of expertise lead us away from better alternatives. Individual departments tend to focus on service requirements and solutions that can be managed within their respective field of activity. However, alternative opportunities may be available if that constraint is loosened and departments actively seek solutions that involve coordinating schedules, co-locating infrastructure, or making choices in one department that improves the performance or lowers the cost of projects or operations within another department. Consider solutions that provide the best overall outcome, and

## *Consider Broader Alternatives*

provide the community with the greatest overall benefit. See Section 9: Connect the Silos.

6. **Check for capital-intensive alternatives versus operations and maintenance (O&M)-intensive alternatives.** It used to be a rule of thumb in utility planning that it is always best to spend money on "things" (capital costs) than on people who are paid salaries year after year. It was assumed that ongoing costs for staff would be more expensive than buying equipment once every 30 years. That logic is turned on its head with some of the most sustainable solutions. For example, the City of Seattle invested in green stormwater infrastructure systems that use less costly vegetated swales than the more expensive piped drainage systems. The costs to maintain these systems created new jobs and better long-term value for the utility. The net result was beautiful vegetation in communities, improved water quality, new jobs, and significant cost savings. Comparing the net value of spending money on capital or on O&M can help determine which alternative is most attractive for a particular project over the long run.

7. **Publicly-planned and managed versus privately planned, managed, or constructed approaches.** Evaluate alternatives that include public, private, or a blend between the two. There are many solutions where government is the first and best choice, but not always. Likewise, it is not always true that private investment and operations are superior. Making a clear-eyed evaluation of public vs. private vs. public-private alternatives can provide policy-makers with a broader range of viable options.

8. **Use resilience as a broader conceptual framework for analysis and planning.** Resilience is an important conceptual framework for planning and designing infrastructure, particularly where uncertainty about the future is high. Uncertainty comes from the unknown impacts of climate change, shifts created by new technologies and their impact on local employment and residency, or the occurrence of extreme events such as earthquakes that follow no predictable schedule. A resilient infrastructure solution will increase the capacity of the system to recover from and adapt to both predicted and unpredicted changes in conditions. When evaluating infrastructure alternatives, consider which alternatives do a better job of accommodating uncertainties, including both sudden/abrupt and long-term change. The enhanced capacity to accommodate change has a value that may or may not be readily quantified. If decision-makers know which alternatives provide the most adaptive capacity, they can make informed choices based on community values and the willingness of communities and decision makers to accept or manage risk.

Infrastructure planning for resilience includes both structural and social aspects. Key resilience principles include:

- Multi-scale solutions;
- Alternatives that provide similar functions at different scales and/or with different drivers;
- Adaptability and flexibility to changing conditions;
- Diversity of processes, factors and functions;
- Increase in social connectivity across income, geography, and culture;
- Balance between institutional memory & innovation; and
- Recognition of history, community, and equity.

By developing broader alternatives that use these tools, project planners enhance the value of infrastructure investments. Fairly considered alternatives consistently create more overall value for each dollar spent. When planners fail to look for all the options, they waste opportunities to allow scarce infrastructure dollars to do more work. Agencies with a broad alternatives approach will outperform their neighbors who simply remain in the status quo.

To train staff and systematize this kind of thinking, some agencies assemble a team of experts with deep knowledge in one field and a broad integrative outlook across the silos. These invaluable experts can coach staff on how to identify and evaluate wider alternatives, and guide the planning and development process for multiple entities across many areas of government practice.

### Case Studies:

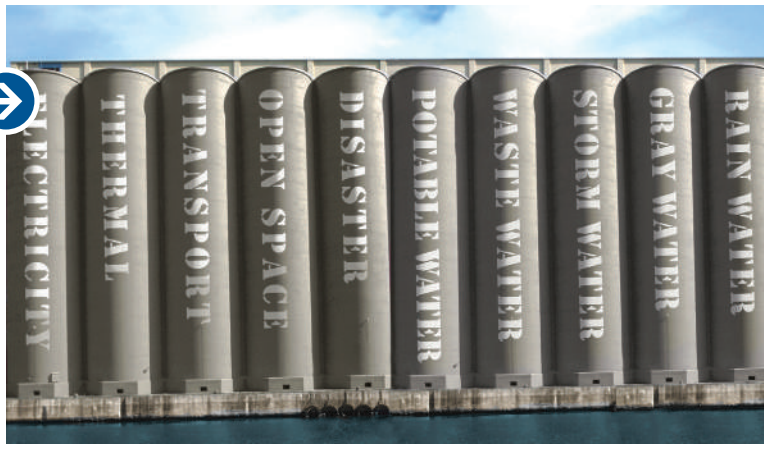
**The 2010 Yesler Terrace Sustainable District Study** for Seattle Housing Authority identified sustainable infrastructure practices suited to the redevelopment of 32 acres of housing and office space adjacent to downtown Seattle. The study by CollinsWoerman and Gibson Economics included a broad review and analysis of the potential for district-level designs and conservation savings for energy, water, solid waste, and transportation systems. A diverse and comprehensive set of possible solutions and integrated strategies were identified that would reduce the environmental footprint of the Yesler Terrace redevelopment and deliver greater efficiencies to the owner, future residents, and the City as a whole. **(http://www.collinswoerman.com/images/PDF/Yesler-Terrace-Sustainable-District-Study.pdf)**

See also Section 6: Build a Better Business Case

# Section 5: Connect the Silos

**By David Yeaworth**

*Both private and public utilities tend to focus on their own infrastructure needs rather than seeking opportunities to achieve extra value or social goals through their projects. Utility districts and governmental agencies are held accountable for public spending, and resources spent on another department's or institution's objectives may be perceived as wasted resources. Private agencies generally lack the mandate or incentive to address social goals and collaborate with other institutions. Unfortunately, such single-minded investing often means opportunities are lost.*




*Our communities are heavily invested in many infrastructure systems but for the most part they are managed separately and are uncoordinated. Courtesy of CollinsWoerman.*

"Connect the Silos" means fostering collaboration between two or more institutions to achieve financial, environmental, social, and/or economic benefits that may not be attainable through a single institution's independent actions or activities. In some instances, institutions can collaborate as a team, to accomplish more than the sum of their parts. In others, institutions can collaborate when the byproduct of one institution is offered as resource to another. An example of 'team collaboration' was the action taken by the City of Portland to combine its sewer, stormwater, and transportation strategies in the Division Streetscape Project, jointly funded and managed by the Bureau of Environmental Services and the Bureau of Transportation. By combining forces, the project not only achieved efficiencies and cost savings in addressing sewer and stormwater needs, but also gave the neighborhood an attractive main street with improved safety and access for pedestrians, bicyclists, and transit users, better traffic operations through the corridor, and improved air and water quality.

**Why connect silos?**

Over the next several decades, government departments and public and private utilities in the United States will spend trillions of dollars upgrading, building, and installing infrastructure. Roads, rail, electric grids, water systems, sewers, telecommunications, and parks infrastructure will all require investment. Typically, each of the institutions overseeing any one of these systems would create its own plan, raise its own funding, and dispatch its own crew to complete its capital project. Through collaborating instead, these typically siloed institutions can experience mutual benefits, including:

- Infrastructure that is more resilient to environmental threats;
- Efficiencies from adaptive reuse that can diminish waste;
- Saving money for utilities, ratepayers, and customers;
- Better and upgraded infrastructure;
- Higher quality infrastructure that can enable increased economic development;
- Less traffic and other disruption during construction when multiple projects are completed at one time; and
- Infrastructure that can be adapted to better meet broader societal objectives.

**How can silos connect?**

Connecting silos creates enormous opportunities. The following approaches are gaining momentum and rising to the forefront:

1. **Platform.** Sometimes the obstacle preventing institutions from connecting is that they weren't invited to collaborate. A third-party institution, such as a nonprofit organization or a public utility, can serve as the platform or convener, bringing institutional silos together in ways they hadn't yet conceived, brokering projects that provide greater benefits to all stakeholders.
2. **Incentives.** Government regularly provides tax breaks to companies that contribute to broader social goals. For example, housing developers are offered property tax incentives on new multi-family buildings that provide a percentage of housing for low-income citizens. For-profit corporations, such as internet and telephone utilities, may receive tax breaks or expedited permitting for collaborative projects with public institutions.
3. **Funding.** Government and private foundations can provide grant funding to incentivize silo-connecting projects. The rationale underlying this strategy is to

## Connect the Silos

establish replicable projects that demonstrate how to collaborate and build trust and relationships among siloed institutions.

4. **Matchmaking.** Research and analysis by advocates, planners or academics can help identify opportunities where siloed institutions can help meet each other's needs, for example, finding a company or agency that creates a by-product they consider a waste that another company or agency can use as a resource. Once the opportunity is identified, intermediaries help to negotiate a trade for the resource.

5. **Twofers.** In some instances, one agency may be able to accomplish the objectives of another by simply rethinking or redesigning their infrastructure methodology. This is best accomplished early in the planning phase.

### Case Studies:

**Platform: Chicago Project Coordination Office.** The City of Chicago created a Project Coordination Office in their Department of Transportation which uses a scheduling database along with interdepartmental team meetings to find opportunities for multiple utilities and city departments to collaborate on construction projects in CDOT right of ways. In 2012, they saved the City $10 million. **(http://www.cityofchicago.org/city/en/depts/cdot/provdrs/construction_information/news/2013/apr/city_s_project_coordinationofficeenterssecond-constructionseasoni.html)**

**Incentives: Seattle's Multi-Family Tax Exemption Program.** The City of Seattle's Office of Housing has a Multi-Family Tax Exemption program through which housing developers receive a property-tax exemption on the improved portions of their property in exchange for making 20% of their units affordable for income-eligible residents. **(http://www.seattle.gov/housing/incentives/mfte.htm)**

**Funding: Port Alberni Integrated Municipal District Energy System.** Using funding from the Federation of Canadian Municipalities' Green Municipal Fund, the City of Port Alberni is developing an Energy Centre, which will burn construction and demolition waste to create energy for a new district heating system. The new infrastructure is expected to reduce energy and fossil fuel consumption by 56%, compared to the buildings' current uses. **(http://www.fcm.ca/home/programs/green-municipal-fund/funded-initiatives.htm?lang=en&project=b071dc30-1159-e311-9ea6-005056bc2614&srch=)**

**Matchmaking: Qualco Energy.** Tribes and the farming and fishing industries had been at odds over land-use issues for generations in northwest Washington. Through conversation and collaboration they formed Qualco Energy and developed an anaerobic digester to burn methane gas from cows to create electricity and keep pollution out of salmon habitat. **(http://qualco-energy.org/about-qualco/)**

**Twofers: Santa Cruz Transportation Plan.** Using the Sustainable Transportation Analysis and Rating System (STARS) created by the North American Sustainable Transportation Council, the Santa Cruz County Regional Transportation Council approved a 2014 plan that works to achieve triple-bottom-line goals, such as health, economic development and greenhouse gas emission reduction. **(http://www.sccrtc.org/funding-planning/long-range-plans/rtp/2014-plan/)**

# Section 6: Build a Better Business Case

**By Jill Sterrett, FAICP and Steve Moddemeyer**

*Infrastructure decision-makers have to deal with increasing demands on aging infrastructure and increasing costs for new construction. Consequently, it is more important than ever to build infrastructure systems that use our limited funds wisely and resolve multiple issues concurrently.*

### The Game Is Changing

Local governments are realizing that they have to adapt to the game-changing triple-threat of climate change, urban growth, and spiraling infrastructure costs. Reducing carbon emissions and minimizing ecological harm is increasingly an imperative. At the same time, local governments are adapting our water, sewer and drainage systems to the added uncertainty in local climate variability and sea level rise.

Accommodating accelerating urban growth and a changing climate can be done simultaneously in cost-effective ways that build upon and replace our current infrastructure systems with new integrated and sustainable infrastructure.

### Why build a better business case?

The challenges above highlight the need for integrated Sustainable Infrastructure strategies. This approach can help build a better business case by: 1) defining infrastructure investments that do more work across multiple lines of business; 2) nesting decentralized solutions within centralized infrastructure systems to buffer demands on the system while increasing its reliability; and 3) using triple-bottom-line economics to compare and generate alternatives. Incorporating these themes into capital facility planning is a transition that will help cities move from the current silos of infrastructure to a new paradigm that aligns and integrates urban services at multiple scales both for new growth and existing development.

**Financial Sustainability.** Creating more value for each dollar spent compounds the benefit year after year. The agency or jurisdiction gets more robust investments that provide multiple services by creating a system that can better withstand economic downturn or a sudden shock due to natural or manmade disaster.

**Natural Resource Sustainability.** Sustainability also means investigating alternatives for capital spending that explicitly consider environmental and community impacts. This broadens traditional approaches to identify and select alternatives that achieve an equal level of service, and may also achieve better environmental and community outcomes. See Section 4 for a discussion of seeking broader alternatives.

The capital planning benefits from this more sustainable approach are significant and varied. When pursued effectively, the advantages of sustainable infrastructure planning include:

- It pays for itself over time (the aggregate value of services provided exceeds the cost);
- It will help to restore environmental functions through greater reliance on natural systems/ecologies;
- It directly benefits the community by providing services such as functional and aesthetically pleasing open space, and these goals can be incorporated into selection of appropriate projects or project alternatives; and
- It benefits the economy by creating jobs, which can be targeted for local residents, while new alternatives generated in this process may also help emerging, green, decentralized, and local businesses get established.

### How to Implement a Sustainable Infrastructure Decision Process

This section sets out practical steps to implement a Sustainable Infrastructure decision process, with Analytical Guidelines, Triple Bottom Line Evaluations, and Life Cycle Cost Analysis.

### Analytical Guidelines

To make a difference, the Sustainable Infrastructure design, review and analysis of capital projects must be sound and accessible, and its advances over previous practices must be clear. These general guidelines help define in brief terms how it will work.

1. **Support for Analysts.** Customize the process defined in this toolkit to the local situation, by providing both a written "guidebook" and staff expert support, to help local planners know how and when to use elements of this toolkit.
2. **Simple Checklists.** Establish a standard checklist of project impacts or design features most likely to offer synergistic opportunities. Examples include:
    - Projects that are near streams or wetlands;
    - Projects that use substantial amounts of water; and
    - Projects that are part of a transmission, collection or distribution system.
3. **Alternatives.** Broaden the range of project alternatives. This step is fully described in Section 4: Consider Broader Alternatives.

## *Build a Better Business Case*

4. **Pre-Plan.** Focus the City's GIS capabilities on identifying possible co-location of different capital needs. Establish a set of "early detection" capital planning procedures that consistently identify and produce sustainable solutions throughout the jurisdiction.

5. **Impacts.** Develop checklists of environmental and social impacts that are common to municipal capital projects in your jurisdiction, together with shared information on tools, multipliers, etc. for quantifying those impacts.

6. **Off-Ramps.** Design and use "off-ramps" that help staff identify unpromising alternatives and unnecessary analytical tools as early as possible, to avoid costly and wasteful work and time.

7. **Triple Bottom Line.** Universalize the consistent use of environmental and social considerations in evaluation of capital alternatives ("Triple Bottom Line," or TBL).

8. **Future Conditions.** Account for the impact of changing future conditions, such as those accompanying continued global warming (warmer temperatures, sea level rise, increased flooding, reduced water supplies in summer, etc.).

9. **Risk Evaluation.** Broaden risk evaluation to identify capital alternatives that are most suitable for a wide variety of potential futures, including major natural and financial disasters.

10. **Best Solutions.** Consistently apply Sustainable Infrastructure analysis tools to identify the best overall solution, independent of financial constraints.

To implement these strategies, it is important to ensure adequate in-house capacity and clear lines of accountability. Identify the lead and central "clearinghouse" for both record-keeping and methodological support for sustainable infrastructure approaches and make sure that each capital department has some level of dedicated staff assigned to this responsibility.

> "The triple bottom line analysis differs from the typical financial analysis. A triple bottom line analysis considers all the benefits and costs accruing to the community as a whole. This means that values are assigned to benefits and costs that arise from non-market-priced sources. The triple bottom line considers all benefits and costs to be relevant, no matter to whom, or how, they accrue."
>
> *John Gibson,*
> *Gibson Economics*

**Triple Bottom Line Evaluation**

The Sustainable Infrastructure capital planning approach expands on the "triple bottom line" approach, which folds environmental and social impacts into project review along with financial considerations.

The Sustainable Infrastructure approach recognizes that impacts remain important even when they cannot be converted to equivalent dollars. Environmental and social impacts are important to project evaluation, but frequently they are difficult to describe in terms of dollars, the natural units for assessing financial impacts. It is helpful to decision-makers to understand these non-economic impacts in qualitative terms if quantitative impacts are not readily available. For example, perhaps two alternatives have similar economic valuations but one promises to create more local jobs or provide better environmental performance. It need not be necessary to quantify the number of jobs or environmental performance—just that some will be created. Thus a policy-maker can make an informed choice realizing that while the economic performance between alternatives is similar, the social or environmental impacts differ. The recommended approach is to address these impacts in three steps:

1. **List and describe the impacts** across all three bottom lines. Include all benefits and costs to the project proponent, the local government, and the broader society.

2. **Quantify them,** when reasonable, in consistent units for each alternative so that "apples-to-apples" comparisons can be made between the alternatives. (For example, if both alternatives cause repair or replacement of sidewalks, then each alternative should use comparable sidewalk systems.)

3. **Monetize the impacts when appropriate,** preferably using standard valuation units that fairly represent the impact. (In the example above, the cost for similar sidewalks should use the same cost/square foot multipliers.

## *Build a Better Business Case*

For hard-to-quantify impacts, it may not be necessary to monetize, for example, the "existence value" of a duck if one alternative creates more habitat. Simply noting that a certain alternative 'creates more duck habitat' or 'creates less duck habitat' might be enough qualitative information to assist the policy-maker in understanding the tradeoffs.)

**Life Cycle Cost Analysis**

Sustainable Infrastructure planning also includes a life cycle cost analysis, to consider and anticipate impacts associated with project alternatives over their entire lifespan. This long-run approach also encourages considering the relative flexibility of various alternatives to adapt and perform their intended purpose in the changing environments that may emerge as a result of climate change, market transformation, and other unknown forces. Thus, a life cycle cost focus can improve both long-run economic efficiency and performance risk management.

A life cycle costs analysis is designed to encompass all associated costs, both direct and indirect, and all costs anticipated to be associated with a project alternative over its useful life. There are several major features of life cycle cost analysis that support an inclusive perspective.

1. **Inclusion of All Project Phases and Costs.** The broader range of alternatives that characterizes Sustainable Infrastructure planning heightens the importance of including the projected costs of all stages of a project's life. A fair and thorough comparison of alternatives requires full inclusion of all costs, including initial capital cost, operating cost, routine maintenance, major maintenance costs, and periodic replacement costs. Risk costs for uncertain future events such as performance failure or private abandonment should also be included.

2. **Use of "Full Cost Accounting.** "Another key feature of life cycle costs analysis is the use of "full-cost" accounting. This means inclusion of both direct and indirect project costs, and specifically the inclusion of initial-year overhead and administrative costs that are inevitably associated with project development. These include project planning, design, property acquisition, environmental review, permitting, contingency allowance, project management, and closeout activities.

3. **Coverage of End-of-Life Costs.** Many projects require specific handling at the end of their useful lives ranging from decommissioning to demolition to disposal to long-term monitoring and environmental protection measures. End-of-life adjustments may also include revenues from salvage value for project assets. All of these should be part of the comparative analysis among alternatives.

4. **Net Present Value, with Benefit/Cost or Comparative Cost Analysis.** Life cycle cost analyses include costs over a long planning period. It is important to combine these costs in the normal present value units already used by agency protocol. There are policy rationales for assuming a range of discount rates to make the present value calculations.

### Case Study

**City of Seattle's Sustainable Infrastructure Initiative:** In the City of Seattle, every major department involved in the City's capital budget had begun to address the need for long-term infrastructure planning by implementing asset management strategies. These approaches include 'full-cost accounting' as well as better identification of asset ownership and asset conditions. However, it soon became clear that, as departments implement asset management, the City was running the risk of precluding integrated solutions that cross lines of business. The Sustainable Infrastructure Initiative was inspired by the diversity of capital projects needed to deliver the City's various services, the presence of significant environmental and social impacts for many of them, and the opportunities to improve coordination among potentially complementary projects from multiple departments. **(http://www.seattle.gov/dpd/vault/cs/groups/pan/@pan/documents/web_informational/s048350.pdf)**

# Section 7: Educate, Engage, and Inspire Public Support

**By Lynn Schneider and Marty Curry, AICP**

*Infrastructure systems for the most part are already in place, so people tend to assume that they will continue to operate efficiently and reliably. However, due to a lack of ongoing investment, this is actually not the case. Costs of maintenance, reluctance to raise rates or taxes, uncertainties around performance due to climate change, and the disconnect between use-based fees and actual costs has resulted in delayed maintenance. In turn, increasing deterioration is common and failures in infrastructure systems happen regularly. The following discussion can help planners to generate public support for ongoing infrastructure investments.*

## Why are Education, Engagement, and Public Support Important?

Public support for infrastructure investment is critical to the ability to upgrade and adapt current infrastructure systems to current and future needs. While infrastructure needs can be quantified, investments in those systems compete with many other priorities that local, state, and national elected officials must address.

**Most projects will not happen without public support.** Many major infrastructure systems are publicly funded and operated; others rely on a mix of public and private funding. The public's understanding of and support for ongoing financial investments in infrastructure systems is critical. Broad public education and engagement, leading to public support, is essential to effective infrastructure planning and support for long-term sustainable funding to operate and maintain systems. It's important to remember that many projects cause temporary or permanent disruptions in people's lives. Construction of new roads, sewer mains, and public venues can create tremendous disruptions. Of course, these projects benefit communities as well. Engaging the public early in the planning process helps to mitigate issues and concerns, reducing the chance that a vocal minority may cause delays.

1. **The community engagement process is an opportunity to raise issues that may not have been considered by planners.** An inclusive, open community engagement process offers the ability for the pubic to raise issues that may have been overlooked by technical experts and planners. People know their communities best and this is where their insights can help identify and address a wide variety of infrastructure related issues.

2. **Community engagement can create opportunities for broadening alternatives and increasing community benefits.** In turn, having raised the full spectrum of issues early in the planning process, planners and technical experts are more likely to develop and consider a broader set of alternatives that benefit the community. In addition, community engagement can provide people in the community the opportunity to help choose the preferred option for infrastructure investments. However, this must be based on solid public education and understanding of what the options are and how they affect the performance of the infrastructure systems.

3. **Community engagement can be essential to realizing alternatives that reduce demand on infrastructure systems.** Infrastructure systems are used by people. Reducing the demand on an infrastructure system may be a better option than spending money to build a larger system. But whether the target is to reduce the number of drivers on the road or the amount of water used, people need to be involved in the planning process in order to determine whether these demand reduction alternatives are realistic and will be acceptable. Public engagement and education is also an essential component in changing people's behavior, for example in reducing water use, reducing single occupancy vehicle travel, and increasing recycling. Seattle provides an example of a city that has not increased its water use, even with significant population growth, through conservation. **(http://www.epa.gov/WaterSense/docs/utilityconservation_508.pdf)**

## What Basic Principles guide Education, Engagement, and Public Support?

1. **Collaborative Inclusive Planning** is increasingly seen as the most effective approach to gaining community engagement and support for major public investments such as infrastructure. Educating and engaging community members through the entire process is essential.

2. **Education and knowledge** is the key to a successful community engagement process. People need to understand for themselves how infrastructure systems work, why these systems are important to a resilient community, and how sustainable infrastructure enables the community to learn, adapt and maintain a strong community over time.

3. **Visioning** is an important early step in developing a holistic strategy for infrastructure investments. This is an opportunity to educate the community on how infrastructure systems work and how factors like changing technology, climate change, and resource management affect our ability to create and maintain reliable infrastructure systems. This results in a shared broad vision for the community that everyone has helped to shape.

## *Educate, Engage, and Inspire Public Support*

4. **Holistic planning approaches** are needed to evaluate the complexity and overlap among infrastructure systems, including how people interface with various infrastructure systems. This is particularly true because communities must address changing circumstances that require new ways of managing resources and infrastructure systems. For example, a city that is interested in reusing wastewater for irrigation and commercial purposes needs the support of its community members. Without support, negative feedback can sink a project. In San Diego, water systems leaders were planning on utilizing reclaimed water, but concern from citizens put the project on hold. An outreach strategy was put into place and the City is now working with the public to determine the feasibility of using reclaimed water. See the case study at the end of this chapter.

If a local government wants to reduce solid waste, citizens have a fundamental role to play in waste reduction, recycling and composting programs. Citizens involved in decision-making can help to design efficient and usable systems that make sense to the public. By engaging with the community during the planning phase, the public can be more supportive of proposals tailored to local needs and sensibilities.

Because infrastructure is expensive and is typically a permanent fixture in the community, it is critical to design the system right the first time. A knowledgeable and engaged community offers a more informed conversation about possibilities for solving seemingly impossible problems. Every infrastructure planning decision includes complicated trade-offs. Citizen engagement provides an excellent tool to prioritize those trade-offs. Several of the case studies below show how city planning is successfully using community engagement in infrastructure planning.

**How to design and implement education and engagement**

The process of community engagement is transitioning from the traditional public comment period at the end of the planning process to engagement beginning at the problem-solving, brainstorming stage and continuing through the decision-making, design, and implementation stages. Engagement frameworks and educational methods come in a variety of shapes and sizes, with four main components:

1. **Clear and comprehensive communications strategy.** Development of and commitment to a clear and open comprehensive communications strategy is critical to planning sustainable cities and will serve as the guide for an effective process for engaging the community in infrastructure planning. This should be based on a clear understanding of the different community stakeholders and their preferred method of communication. For example, via phones, emails, texting, tweeting, or other state of the art technologies—or going to community based institutions where people gather who are not as involved with technological innovation. Communication should be a continuous process, from information about the issues and needs, about the engagement process, and about implementation.

2. **Collaborative and inclusive multi-media public education and engagement process.** For stakeholders to have sufficient understanding of the project and its objectives, to provide constructive feedback, and buy in, they need to be involved in the process as early as possible and be treated as collaborators. Developing the public education and engagement process should be a basic part of all infrastructure planning to ensure it is fully integrated into the planning process. Shared values, information and choice are essential for stakeholders to have sufficient understanding and buy-in. Informed communities make better decisions and informed citizens can become advocates for solutions that require public approval or support. Traditional media, such as newspapers and television, along with social media and other forms of technology, can help to widely distribute information, encourage interaction, elicit feedback, and invite the public to participate directly in various steps of the planning process.

3. **The community's core values should be reflected in education and engagement.** In many communities, this involves understanding the different cultures in the community and "going to the people" through both outreach and engagement techniques. Guiding principles for community education and engagement, developed in partnership with community members, can also help to ensure that these core values are reflected in the process.

4. **Public engagement is fully integrated into the public planning process, with close coordination among partner agencies and organizations.** Link Public Engagement to key stages of the infrastructure planning process.

Public education and engagement is an ongoing process to ensure that the public keeps up with changing issues and circumstances related to infrastructure planning. At the very earliest planning stages, public education should be implemented to develop an informed community. Engagement strategies may vary during infrastructure planning and implementation and should be appropriate to the situation. Take care to ensure that engagement fits the roles of the public at each stage (informing, consulting, approval, etc.). In all of

## *Educate, Engage, and Inspire Public Support*

this a critical component is reporting back to the public and showing people how their input has been integrated into the analysis and development of solutions.

Develop a clear coordinated process within and across agencies to incorporate public education and engagement from the earliest stages in a policy or project planning process. Do not relegate public education and engagement to a public affairs liaison, but ensure that planners, technical experts, and policy staff are engaged and committed to listening and responding to the community.

Public education and engagement has been the subject of substantial research and practice over the past 30 years. New communications technologies and changing demographics are changing how information is received and processed. Younger people, for example, are more comfortable with social media, while older people may continue to prefer written information. For those who are comfortable online, interactive surveys, Facebook pages, Twitter feeds, Webinars, and blogs can all be helpful tools for engagement and education that go beyond one way communication and can offer substantive interaction.

There are several models for citizen/community engagement that have been used successfully by public agencies and non-profit organizations. Some provide very useful templates and checklists to guide development of public education and engagement efforts. Take advantage of these existing resources -- learn from others what works effectively. Some models to consider include:

**Collaborative planning.** This is an inclusive process that views community members as partners in setting priorities and designing infrastructure systems. This relies on a good education component so that community members are informed and able to hold their own.

**Asset Based Community Development (ABCD).** First developed by John McKnight, this has become an important approach to community problem solving and planning. It is based on identifying community and individual assets first, then describing problems or issues that need to be addressed. Planners and community members work together to find opportunities to use the community's assets to solve problems and plan for the future.

**Deliberative Democracy.** This approach uses a deliberative democracy model that focuses on listening and dialogue in addressing community issues.

**The Art of Hosting.** An emerging group of methodologies and tools for facilitating conversations in groups of all sizes, supported by principles that help maximize collective intelligence, welcome and listen to diverse viewpoints, maximizing participation and civility, and minimize/transform conflict into creative cooperation.

### Case Study

**San Diego:** A reclaimed water facility was proposed to provide a partial source of San Diego's drinking water. The proposal took place prior to a good public relations campaign. Opponents of the project used a campaign slogan, "Toilet to Tap," which led to a groundswell of opposition. San Diego public utilities were surprised, and the project was cancelled by the City Council. The utility learned a lot from the experience and decided to propose a demonstration project, which included a strategic public outreach strategy and a highly-qualified Independent Advisory Panel. Many years later, after a significant number of studies and a successful demonstration project, the City is spending $1 million on an education and outreach campaign using a Pure Water Program slogan. **(http://www.sdwatersupply.com/index.php/news-channel/77-city-of-san-diego-approves-outreach-contract-for-water-reuse)**

**Sonoma County:** The County launched a community engagement process for its public health infrastructure. It includes the following best practice strategies for reaching underrepresented populations, such as seniors, Latinos, and low income households:

- Go Where People Are
- Make the Process Accessible
- Customize to Culture and Circumstance
- Invest in Ongoing Relationships
- Foster Community Capacity
- Use Media and Marketing Strategically

**(http://www.sonoma-county.org/health/community/)**

# Section 8: Adapt Infrastructure to a Changing World

**By Karmen Martin and Nicholas Matz**

*Infrastructure decision-makers are increasingly future-casters. Capital projects are often paid for over many years and in operation even longer. To ensure that they remain relevant, infrastructure systems must be built to adapt to change, from technology revolutions to major environmental stresses, from shifting living patterns to changing lifestyles and demographics.*

### Why focus on a changing world?

Infrastructure systems are often the largest investments communities undertake. How these public investments are prioritized and focused can have a tremendous impact on community resilience. As communities confront an increasingly uncertain future, adaptability to changing conditions and future threats is key.

*A construction worker installs solar panels at the Marine Corps Air Ground Combat Center in Twentynine Palms, California.*

**Changing technology.** Technological advances are altering how infrastructure is planned and how it is provided. To take advantage of these advances, communities can embrace today's leading-edge technology, prepare for technological change, and be open, yet realistic, about the potential of technology to transform the way infrastructure systems work. The specific technological innovations that will shape the future cannot be known fully, but some of the general trends are clear. For example, changing technology will shift energy and water use from a pattern of continuous growth in consumption toward greater efficiency and conservation.

**Climate change.** This is one of the most important planning challenges of the 21st century. Planners are in a unique position to address climate change because the problem itself presents the full spectrum of the classical planning dilemma—it is long-range in nature, comprehensive in scope, and significant in impact. All infrastructure systems face potential new climate stresses and hazards. Coastal communities may need to relocate roads and pipelines from expanded flood and storm surge areas and in many communities water, wastewater, and stormwater infrastructure may need to respond to changes in precipitation patterns.

**Social and demographic drivers of change.** Shifting living patterns and changing lifestyles present similar planning dilemmas. For example, the shift to new vehicle technologies and vehicle ownership patterns will increase the need for greater accessibility and convenience of car-free transportation options. The shifting population and demographic trends, with additional changes due to climate change, will present other challenges. For example, areas to which populations migrate will see economic benefits but will also be forced to handle the impacts of growth. In other areas, a shrinking population—whether it be related to economic conditions or climate change impacts—will reduce the ability of the remaining population to maintain and pay for infrastructure that is already on the books.

### How to proactively adapt infrastructure to a changing world

Building flexibility into long-lived infrastructure is a principle that should be considered during every planning process or when existing plans are modified and updated. Practical steps for including this forward-thinking approach into local planning processes include:

### Long-range Plan Development

1. **Include the principle—Adapt Infrastructure to a Changing World—as policy.** Planners prepare plans that recommend actions to shape growth and direct

## *Adapt Infrastructure to a Changing World*

infrastructure investments. Consider including resilience as policy in all planning processes that affect regulatory and investment decisions, such as comprehensive plans and functional plans (e.g., transportation facility plans), hazard mitigation plans, and more. Just as climate change is beginning to be addressed and integrated into these plans, other trends and uncertainties facing the future should also be integrated. The 'infrastructure element' of a local comprehensive plan is an obvious place to start.

2. **Develop a long-range Sustainable Infrastructure Strategic Plan.** Creation of an integrated infrastructure strategic plan that encompasses the community's various infrastructure systems can provide a central focus, aligning both implementation efforts and the various other local plans. It can also provide a platform for agencies and utilities managing different infrastructure systems to harmonize their plans.

Capital Facilities Planning

1. **Link asset management to resilient infrastructure.** As part of an overall sustainable infrastructure capital planning approach, consider potential futures in a decision-making framework. This long-run focus encourages consideration of the relative flexibility of various alternatives to adapt and perform their intended purpose in the changing environments that may emerge as a result of technology adoption, climate change, demographic changes, market transformation and other forces. Further, it provides a decision-making framework for capital spending that maximizes local policy goals relative to life cycle-costs.

2. **Thoroughly analyze alternatives.** In addition to consideration of economic, environmental, and social concerns in assessments of project costs and benefits (the "Triple Bottom Line" approach) include a thorough analysis of alternatives. The intent is to test alternatives for their ability to allow for adaptation to new information and changes in conditions. Often, it's at this stage that a broader consideration of alternatives can occur, as opposed to an adopted project's 'pre-design' stage when alternatives evaluation is typically more narrowly focused on design issues. See Section 4 for a discussion of developing broad alternatives.

3. **Conduct life cycle analysis and cost-benefit evaluation for large investments.** These tools can help support the analysis of alternatives by considering and anticipating impacts associated with project alternatives over their entire lives. A life cycle costs analysis is designed to encompass all associated costs, both direct and indirect, and all costs anticipated to be associated with a project alternative over its useful life. A life cycle cost focus can improve both long-run economic efficiency and performance risk management. See Section 6 for a discussion of these analyses, under Build a Better Business Case.

Practical steps to integrating these general guidelines into capital facilities planning include:

- Align infrastructure modernization strategies with the community's strategic goals. A 10-year integrated infrastructure strategic plan should be integrated with agency capital facility planning.
- Analyze emerging trends and bring information to the table to assist all decision-makers involved with capital facilities planning. Account for the impact of changing future conditions, such as those potentially accompanying continued climate change and demographic trends.
- Screen the CIP to more efficiently identify the infrastructure planning candidates that could involve large infrastructure investments that would lock-in a certain path. Focus on those infrastructure projects with the greatest vulnerability in the face of an uncertain future.
- Avoid overly complicated tools—resist the tendency to over-analyze the situation. Scale-up or down the analysis framework depending on the need and the particulars of the planning problem.

### Case Study

**Inland Empire Utilities Agency** distributes water and recycled water wholesale, and also provides wastewater treatment services in San Bernadino County in California. It views its business as manufacturing three products: high-quality recycled water to help drought-proof our service area, converting high-quality compost to ensure healthy soils, and renewable energy through methane gas and solar power. Faced with exponential growth in demand but with a limited, regulated water supply, overlaid with uncertainties such as drought and climate change, the utility analyzed a range of approaches to find strategies that will position it best under a range of future scenarios.
**(http://www.watereuse.org/product/08-15-1)**

# Section 9: Integrate Smart Systems

**By Karmen Martin and Rhys Roth**

*People carry devices in their pockets packing information, communications, and monitoring capabilities unimaginable a generation ago. Advanced technologies are transforming many industries. Infrastructure managers can harness low-cost monitoring and real-time management technologies to improve service and achieve cost-saving efficiencies. Monitoring and real-time management technologies can be adapted to achieve service improvements and cost-saving efficiencies.*

**Why integrate smart systems?**

Urbanization, population growth, climate change and dwindling resources put increasing pressure on infrastructure systems worldwide. A smart city looks for ways to optimize its infrastructure, using information-communication technology (ICT) to inform decision-making and improve performance and efficiency. This is accomplished by the feedback loops of data captured from sensors deployed to monitor, measure, analyze, communicate, and act on this stream of information. By enabling better monitoring of infrastructure systems, cities can have faster, more efficient infrastructure management and timelier infrastructure repairs. The use of smart city technologies also results in more resilient infrastructure and an improved urban experience. Europe is leading the world in the race to develop the world's smartest cities. We all accept smart phones now, and increasingly smart cars. Why not smart cities?

> "We can't optimize with an abacus and a hand calculator."
>
> *Jesse Berst, Chairman of the Kirkland, WA-based Smart Cities Council*

"We can't optimize with an abacus and a hand calculator," points out Jesse Berst, Chairman of the Kirkland, Washington-based Smart Cities Council. Smart infrastructure "talks and it listens," he says. "It talks to tell you how it is– it tells you if the streets are congested. It tells you if the building on fire is occupied, how much water's being used. It listens, in that it accepts remote commands—you can save having to send crews out on multiple trips to deal with issues that can be handled remotely."

Today, smart systems in most cities tend to be limited, though many smart technologies are already feasible. Where smart systems are already sensing and analyzing information, many people might be unaware that these systems exist.

Smart system applications that have already been adopted in many areas include:

- Smart devices and sensors embedded in roadways, power grids, buildings and other assets to provide data that can be used to design more efficient and integrated urban systems
- Smart communications systems that use wired and wireless technologies for real-time monitoring of utilities, buildings and infrastructure systems and for remote operations that automatically adjust systems to environmental factors.

In Seattle, "Find It, Fix It" is a smartphone app offering mobile users one more way to report selected infrastructure and service issues to the City. In Boston, the Mayor's Office of New Urban Mechanics focuses on engaging citizens through means such as a scheme for turning people's cars into voluntary road monitors. A new app called Street Bump uses smartphone accelerometers to detect potholes in roads and send the information to the City, which could reduce the need for expensive road surveys. European cities are uncovering new ways to deploy low-cost digital capabilities to conserve resources and save money in delivering quality city services. For example, in Barcelona, sensors attached to trashcans now alert workers when they need to be emptied. Irrigation systems built into Barcelona's parks monitor soil moisture and turn on sprinklers only when water is needed—which the City expects will cut its water bill 25% and save $60 million a year.

Smart systems can also be used to optimize infrastructure operation, such as traffic flow. Cities can develop advanced traffic management systems, including traffic cameras, variable message signs, traffic detectors, traffic websites, and mobile apps. Using a cross-system intermodal traffic control system, integrating both private traffic and public transportation into one holistic traffic concept, urban traffic planners can intelligently network different streams of traffic in an effective and environmentally friendly manner. Intelligent traffic management systems, such as those developed by Siemens help keep traffic flowing around the world. In traffic control centers, all relevant traffic data is collected, and evaluated.

Other cities are testing more extensive projects. A control

## *Integrate Smart Systems*

room in Rio de Janeiro, created by IBM, allows city workers to monitor information from the sprawling metropolis to better manage public events and disasters. London's Greenwich peninsula is testing an "urban operating system" by a firm called Living PlanIT that offers a single platform for integrating services like water, traffic, energy, and street lighting across the city. Smart City Barcelona is a long-term plan involving government, residents, and the business community. As part of this plan, the City is seeking a developer for a unique solution called CityOS (operating system). This OS is envisioned as an open platform that unites the various smart technologies operating across the city.

**How to move towards integrating smart systems**

The local planner's main role is to understand the potential for smart systems to improve monitoring, efficient operations, infrastructure integration, and the significant social, environmental, and economic benefits that can result.

Smart systems also raise a unique set of issues which city planners, engineers, and public officials must address. For example, integrating smart systems into infrastructure brings up questions about how deeply cities rely on private companies to set up and maintain the systems they run on, and the potential privacy, cybersecurity, model reliability, and government accountability issues as new technologies are adopted. Partnerships with private companies are crucial, since government isn't in a position to build sensors and networking software.

Planners are uniquely qualified to provide leadership in defining, analyzing, and debating the issues in the broader discussion. For example, the American Planning Association (APA) created a Smart Cities and Sustainability Task Force whose mission is to "address advances in technology and innovation to cultivate cities which are smarter, more resilient, and sustainable."

Local planners' roles can be roughly summarized as follows:

- Vision
- Communication
- Advocacy
- Policies
- Partnerships and collaboration

**Vision.** Berst notes it is crucial to have a "vision for what the city or region wants to be when it grows up, and to put technology in service of those goals." Think, he says, in terms of integrated strategies, so the city's communications network can serve the power utilities, as well as the water, fire, police, and emergency services. Not only will shared, integrated communications networks save money, but they can get back online quicker in a crisis.

**Communication.** Communicate the role and importance of smart technologies. Engage operations staff in learning opportunities and in dialogue to explore the ways smart systems might benefit local infrastructure operations, repair, efficiency, and customer service.

**Advocacy.** Implementing smart systems requires a robust, reliable, affordable broadband network. Cities need to assess the capacity of their networks and work with private and public partners to ensure that their broadband infrastructures are adequate to meet current and future needs. Advocate for adequate broadband infrastructure to support smart technologies. The APA recommends "Planners will need to become aware of the importance of planning for broadband infrastructure. In order to incorporate broadband strategies into local plans, they need familiarity with how various technologies operate. Understanding broadband applications is essential to working with telecommunications experts that are designing wireless, fiber and cable networks."

**Policies.** Policies will need to be in place to help encourage investment in broadband infrastructure, the backbone of the smart city. Consider including these in Comprehensive Plans, TIF Districts, Downtown Revitalization Plans, Economic Development Districts and Capital Improvement Plans.

**Partnerships and collaboration.** Develop cooperative approaches to instituting smart system technologies. Partnerships and collaborations increase the ability to pool resources and avoid duplication of effort.

### Case Studies

**Seattle and Boston** may serve as important case studies for cities seeking to emulate focused monitoring and management strategies, while Rio de Janeiro, London, and Barcelona have implemented more comprehensive strategies. Recently established "smart cities" across the world include Dubai, Malta, Kochi (India), and Singapore.

The APA Smart Cities and Sustainability Task Force is seeking best practices, reports, websites, and affiliate organizations that represent innovative smart city practices. The task force has set up an interim website to begin compiling information. Contribute to, and track the progress here: **(https://www.planning.org/sustainingplaces/)smartcities/)**

# Section 10: Partner with Nature and Enhance the Community

**By Tye Ferrell and Steve Moddemeyer**

*The most cherished community places are often those where nature and beautiful, functional structures meet. Compared to conventional hard infrastructure, aka gray, approaches, green infrastructure can increase functionality and save money, as well as help to mitigate and adapt to the impacts of climate change. Where a conventional concrete and steel structure makes the most sense, a beautiful design may help to transform a perceived community eyesore into a community asset. Where it is feasible and desirable, partnering with nature and enhancing community can serve multiple community, ecology, and cost objectives.*

**What is Green Infrastructure?**

Green infrastructure uses vegetation, soils, and natural processes to manage water and create healthier urban environments. It encompasses a wide range of approaches primarily, but not exclusively, focused on water, wastewater, stormwater, solid waste, and transportation. Natural systems, processes, and limits on natural resources can serve as inspiration for rethinking traditional infrastructure approaches. A focus on enhancing community is valuable regardless of the infrastructure approach, particularly if the process for engaging the community in the planning process is done well, and will usually result in projects that protect and enhance the environment.

Infrastructure that partners with nature and enhances community should ideally:

- Focus on the desired outcomes versus the infrastructure itself;
- Be multipurpose, for example, combining a bridge and a pipeline to decrease cost, increase project support, and multiply potential funding sources;
- Create synergies, for example, using the heat from one infrastructure system to augment another system, to decrease energy inputs, reduce waste, and increase the overall efficiency of the system;
- Serve as a community asset; and
- Mimic nature's resilience.

**Why Partner with Nature?**

**Nobody does it better.** Nature supports life without charging for service or requiring maintenance. Cities and towns that have been fighting nature for centuries are now welcoming it back and working to preserve and restore natural environments. For example, after extensive flooding of the Rhine River in 1993 and 1995, the Netherlands government approved the "Room for the River" Plan to accommodate an increasing number of flooding events, a concession to the reality that holding the river at bay was no longer a successful long-term strategy. The wide-ranging plan calls for actions such as relocating vulnerable farms and residences; reclaiming wetlands, and refashioning basements and parking garages to double as catch basins for floodwater. Newly constructed dikes were targeted for well-planned urban developments. Copenhagen has a similar plan to address more frequent and intense rainstorms.

**Natural solutions can often save money and add attractiveness to urban spaces.** Thanks to evapotranspiration, trees are efficient coolers. Planting trees near the fresh air intake of a building pre-cools the air naturally and can lower the heating and cooling costs inside the building dramatically. In a test in the Physics building at Berlin Technical University, the use of evaporation from plants to cool incoming air reduced energy used to cool the building by 70 percent. Strategic tree planting can lower peak-day events, generating significant savings, while also adding great beauty, habitat for pollinators and birds, and even forts or spaceships for enterprising children.

**Climate change mitigation and adaptation.** Green infrastructure may increase the resilience of an overall infrastructure system to shocks and stresses, including those caused by climate change, particularly if designed with resilience principles in mind. Climate mitigation and/or adaptation services that can be provided by green infrastructure approaches include reducing urban heat islands, mitigating flooding, treating wastewater, replenishing groundwater, decreasing carbon output, increasing biodiversity, and carbon sequestration.

**Community amenity vs. community resistance.** A lush natural area surrounding beautifully designed and integrated infrastructure will almost always be seen as a community amenity. Conversely, gray infrastructure serving the same purpose is likely to be less welcome. Green infrastructure approaches are more likely to increase nearby property values, supporting the local economy. It may also be possible to minimize the community impact of gray infrastructure by making it less visible: integrating it into another development, burying it, and/or minimizing noises, odors, or other emissions.. All of these were done in the development of the Besos Wastewater Treatment Plant in Barcelona **(http://81.47.175.201/project-protocol/index.php/barcelona-make-yourself-beautiful-2)**. The project sited the wastewater treatment plant under a popular market and added a marina and new urban development. Green spaces and parks are an existing part of a city's green infrastructure and there may be opportunities for integrating them into infrastructure plans, while expanding or enhancing them.

## *Partner with Nature and Enhance the Community*

**Potential for savings.** In order to determine the true costs and benefits of different alternatives for any kind of infrastructure, the initial feasibility analysis is critical. In general, green infrastructure approaches are more likely to require integrating expertise from a range of fields into the planning and design team. They may also require a larger physical footprint and more time to become operational, because plants and trees take time to grow, after all. However, they are also likely to be cheaper, require less maintenance, generate fewer externalities, inspire less public resistance, and have lower or slower depreciation.

**Free energy from gravity.** When the City of Seattle built its first major water supply system, it set the pool elevation in the mountains at sufficient height that the water would flow without pumps into the highest reservoirs in the city. Those reservoirs, in turn, provide sufficient water pressure for virtually every home and business in the city.

**Free energy from soils.** Dig a few feet down and the temperature of the soil is a steady 55 degrees Fahrenheit. Running incoming air through an underground pipe can pre-condition fresh air and lower energy bills.

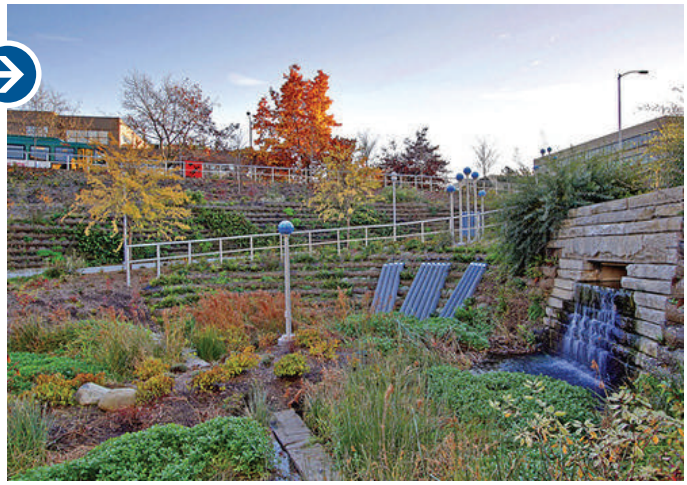
**Free energy from sunlight.** Solar hot water turns even cloudy day sunlight into thermal energy by heating fluids in insulated glass vacuum tubes. Daylight is another important source of free energy from the sun. We can design windows, room size and ceiling heights to flood indoor areas with natural light. Vegetables and fruits turn sunlight and soil into food that gives us energy. Growing food in back yards, parking strips, and urban infrastructure can add to the community's resilience. Sharing Backyards **(http://www.sharingbackyards.com)** is a program that connects people with back yards with people who want to grow food, creating community and reducing the community's food vulnerability.

### How to Partner with Nature and Enhance the Community

**Preserve and/or Restore Natural Functions.** Preserving natural infrastructure in watersheds, such as forests, can have multiple benefits, including cleaner drinking water, flood mitigation, and cooler water **(http://www.wri.org/sites/default/files/wri13_report_4c_naturalinfrastructure_v2.pdf)**. Creating or restoring natural functions can help to control stormwater, decrease flooding, treat wastewater, and provide a relaxing natural space in an urban area **(http://www.domusweb.it/en/architecture/2012/01/19/nature-as-infrastructure.html)**. The associated benefits include carbon sequestration, cleaner air, and potential recreation areas.

**Incorporate Natural Functions.** Infrastructure systems that incorporate natural functions are beginning to proliferate. Natural drainage strategies can be a part of an overall stormwater control approach. Likewise, infrastructure on residential or commercial sites can incorporate a range of technologies that can collectively reduce the demand on the system. For example, green roofs, rain barrels, permeable pavement, trees, and rain gardens on private property reduce overall system loads, mitigate flooding, protect property, and clean water. These technologies can also be a part of overall climate change mitigation and adaptation strategies.

**Minimize Ecological Damage and Maximize Beauty.** Consider if it possible to maintain ecosystem functions on or adjacent to a project site. If not, consider the construction process itself, how wastes can be minimized during construction, and reuse or integrate waste on site. Consider the energy or other flows from the infrastructure and how will they impact the surrounding ecology and community. Design to minimize or adapt these resources in ways that serve additional community purposes. Finally, consider the relative beauty or ugliness of the project, and its social impact on the surrounding community.



*Seattle's restoration of Thornton Creek emphasized natural stormwater solutions as well as beautification. Courtesy of Thornton Place.*

**Derive Inspiration from Nature.** Nature is multipurpose, synergistic, resilient, and every waste is repurposed. Many of the ideas and examples in this section derive inspiration from nature, including swales, green roofs, and permeable pavement, but there is still much to learn and apply.

With any of the above approaches, the following practical steps can help to guide the process.

1. **Place-based mapping.** The first step in partnering with nature and engaging with a community is to understand the place, including its history, demographic trends,

## *Partner with Nature and Enhance the Community*

development trajectory, and site ecology. A mapping of the place and its unique features, including how it fits within the broader ecological and built environment systems, is that first step. A green infrastructure project will require engagement with multiple stakeholders and a holistic understanding of potential sites and their contexts.

2. **Systems and life-cycle analysis of alternatives.** Because gray and green infrastructure options may involve different tradeoffs, it is critical to understand the full life-cycle costs, fairly quantify the risk, and grapple with how the projects may relate positively or negatively with their local built, social, or ecological systems. Some of the key areas where gray and green projects may differ in terms of trade-offs include financing, land area, community buy-in, operation costs, construction costs, and the time required for the project to become operational. See Section 4 on Consider Broader Alternatives.

3. **Meaningful, early, and ongoing engagement with the community.** Engaging with the community around an infrastructure project early and in a way that maximizes the value of the process for everyone is important. Meaningful citizen engagement requires sufficient time and multiple opportunities for input. It takes citizen input, concerns, and ideas into account in the planning process. Citizens need to understand what is being proposed, how they can influence the process, and when their input has been integrated. Citizens may also volunteer to provide green infrastructure services by implementing rain gardens or other such strategies on their own property and at their own cost. (See Educate, Engage, and Inspire Public Support, Section 7.)

4. **Bust the silos.** Bring in expertise from other disciplines. In addition to engineers, architects, and urban planners, consider including ecologists, landscape architects, artists, biologists, and community outreach specialists.

### Case Studies

**Room for the River Plan, Netherlands.** A partnership among the provinces, municipalities, water boards and Rijkswaterstaat (Ministry of Infrastructure and Environment) in the Rhine River Delta to accommodate increased river flows rather than continue to simply build taller and stronger dikes. **(http://www.ruimtevoorderivier.nl/english/room-for-the-river-programme/)**

**Copenhagen Climate Adaptation Plan, Denmark.** Addresses increased and anticipated flooding and seawater encroachment in the decades to come. Also addresses the urban heat island effect and increased average temperatures, all in a way that is designed to keep the city attractive and livable. **(http://en.klimatilpasning.dk/media/568851/copenhagen_adaption_plan.pdf)**

**Green Stormwater Infrastructure Program, Seattle, Washington.** An excellent example of green stormwater improvements at the street level that are designed to process water much like a forest meadow. The improvements decrease stormwater runoff, reduce flooding, naturally cleanse runoff, slow traffic, and provide a beautiful community amenity. **(http://www.seattle.gov/util/MyServices/DrainageSewer/Projects/GreenStormwaterInfrastructure/CompletedGSIProjects/index.htm)**

**Rainwise Program, Seattle, Washington.** An example of distributed, parcel-based infrastructure that, when implemented broadly through development incentives or requirements, can have a larger system impact on stormwater, flooding, and water quality. **(http://www.seattle.gov/util/MyServices/DrainageSewer/Projects/GreenStormwaterInfrastructure/RainWise/index.htm)**

# Section 11: Build Community Prosperity

**By Stacia Jenkins**

*Infrastructure spending is paid by and benefits the whole community. It is widely recognized as a job generator and is important to local business and economic vitality. Evaluating the community's strategies for infrastructure in light of its economic development goals can reveal opportunities and strategies to in-source infrastructure jobs and lift up segments of the community too often left out. Higher education can build the critical pipeline of local talent by designing technical training and advanced degrees important to sustainable infrastructure.*


*Workers ensuring frames for solar panels have a good foundation. (By Oregon Department of Transportation. "Footings" uploaded by Smallman12q. Licensed under creativecommons.org/licenses/by/2.0)*

**Why build community prosperity?**

Infrastructure systems are often huge investments of public funds. When capital investment program strategies are aligned with goals for economic development, they offer an opportunity to maximize returns to local governments with immediate and lasting impacts. The employment opportunities that infrastructure investments can provide for underserved segments of the population offer pathways out of poverty, and can be a powerful force in improving the lives of workers and families, and cities as a whole.

**Living wages, training, career path opportunities, and equitable access to jobs** are among the benefits local governments can provide through infrastructure decisions. Infrastructure jobs in construction and operations offer better wages than some other occupations and many do not require a bachelor's degree. Partnering with local vocational, apprenticeship and community college programs develops a pipeline for technical training and generates access to advanced degree programs. Today's workforce equity agreements and policies can strategically in-source jobs by targeting hiring of local and disadvantaged workers, including women, veterans, and people of color. Local communities benefit from a trained workforce to serve their infrastructure investments. These investments in turn help build a stronger middle class and long-term prosperity for all members of the community.

**Community workforce strategies also help generate public support for infrastructure projects** by ensuring public funds support the local workforce. While the current economic climate makes infrastructure investments challenging, it also highlights the opportunity and necessity to enhance project benefits by creating training and job opportunities that reduce poverty and economic inequality. Citizens expect that public investments will result in long-term and equitable community benefits.

**How to build community prosperity**

Workforce equity partnerships, agreements and policies have become more and more widely used in cities throughout the U.S. to ensure publicly subsidized development accrues benefits to local communities through access to job training, hiring provisions, and opportunities for disadvantaged businesses. Building workforce equity into local infrastructure projects should be considered early in the planning process, long before construction is underway.

**Long-range Plan Development**

1. **Utilize local workforce development resources for infrastructure jobs to develop a pipeline for technical**

## *Build Community Prosperity*

**training and advanced degree programs.** Vocational high school, community college, apprenticeship, and other local training and higher education programs invest considerable resources into workforce development, but frequently are not directly connected to local job opportunities and contractors for immediate job placement. Outreach, job fairs, internships, and direct entry agreements, can help program graduates understand employment requirements. This helps ensure that local students continue to live and work in their communities and that education resources accrue to local workforce needs. Large-scale infrastructure agencies, or smaller ones working together, can develop their own in-house training program with grants, partnerships, and other funding strategies for sustained operations.

2. **Project-specific Community Workforce Agreements.** Community Workforce Agreements (CWAs) have emerged across the country on public infrastructure projects to bring measurable and permanent improvements to the lives of local residents, particularly those in low-income neighborhoods and communities of color. Also known as Project Labor Agreements, CWAs ensure that infrastructure projects create opportunities for local and disadvantaged businesses and workers. Common agreement terms include targeted hiring, based on area of residency or disadvantaged status, such as veterans, women, and/or minorities. See a list of potential provisions below.

3. **Policy-based community workforce and equity programs.** A workforce equity policy adopted by a local government or other public jurisdiction that requires community hiring on all projects attaches standards to public works or projects on city-leased land. Such policies can also proactively apply labor equity principles to large parcels of land slated for private development. These policies make the development process more predictable and efficient by reducing the need to negotiate workforce agreements on each project. Rather than a project-by-project basis, local governments establish workforce policies governing all large infrastructure projects to make local hiring goals, job access requirements, and provisions for disadvantaged businesses the standard conditions of public and subsidized projects.

Provisions in community workforce agreements and policies on capital projects may include:

- Local hiring—a percentage of the workforce are required to be residents of the local jurisdiction;
- Targeted hiring—percentages of workers are required to be veterans, women, low-income, or minorities;
- Apprenticeship utilization requirements—percentage of workers that are employed through state-registered apprenticeship programs;
- Responsible contracting provisions—prohibit the city or other public agencies from hiring contractors that have violated labor or other occupational laws;
- Worker retention policies—guarantee a minimum number of hours a contractor will employ workers on the specified and/or other projects to establish careers, not just short-term jobs;
- Hiring from specific job training programs—to provide employment for locally-trained workers, or those that serve targeted workers from disadvantaged backgrounds; and
- Minority/women/local business contracting goals—to ensure subcontracting opportunities for disadvantaged business owners.

For examples of Community Workforce Agreements and Labor Equity policies, see Partnership for Working Families, Jobs for the Future, and the Community Hub for Opportunities in Construction Employment.

**Capital Facilities Planning**

1. **Involve community, labor, training, and employer partners early in the planning process to identify feasible local hiring targets and training resource needs.** Agreements and policies that set baseline hiring goals also provide flexibility for contractors and often include partnerships with local training programs. Agreements are negotiated with stakeholders from contractor associations, labor unions, and community-based training programs that provide the skilled workforce to develop appropriate hiring targets and build training capacity. While these agreements and policies do not require the use of union labor, labor union district councils are familiar with training and workforce needs of large projects and are generally involved.

2. **Incorporate CWA or other requirements into project bid documents and make introductions early.** To ensure seamless project construction and accurate bidding, contractors need to know hiring expectations and requirements before they bid on projects. Many contractors are now familiar with these types of provisions and have established relationships with training and labor partners, but others have not and will need opportunities to become familiar with local training programs and identify pathways to achieve

## *Build Community Prosperity*

the targeted hiring goals. Administration is necessary throughout the project to ensure contractors have access to the targeted workforce and hiring goals are achieved. Costs of tracking and managing these policies or agreements, either by agency staff or third party administrators, are built into the project budget. The costs of administering them are a tiny fraction of the overall project cost and benefits to the community are immediate and long-lasting.

3. **Establish oversight committee before construction begins.** Community workforce agreements and policies include periodic reporting, disclosure requirements, complaint investigation mechanisms, and provisions establishing oversight committees. Government agencies are best placed to monitor the workforce results, but community, labor, training, and contractor stakeholders also participate to troubleshoot problems and help ensure goals are achieved. Monthly or quarterly meetings are generally convened by the funding agency during the planning and construction phases.

**Development Review**

1. **To ensure infrastructure investments create meaningful, measurable community benefits, workforce statistics should be monitored, reported, and reviewed.** Community workforce programs can transform a local community through more equitable access to skilled, living wage jobs on infrastructure projects and lifelong career opportunities, but only if they are thoroughly implemented and monitored. Regular reports and reviews help identify whether goals are achieved, targets are appropriate to the local community, training resources are appropriate to the needs of the projects, and job access is equitable and fair.

2. **Community impact reports.** Community members and elected officials will want to know how well public investments served the local workforce and if program goals are achieved. Transparent communication with stakeholders helps build support and identify resource needs for future projects. Sharing community impacts through an ongoing communications strategy is also an important part of maintaining public awareness, engagement, and support for the projects.

3. **Continue to work with local education and workforce development agencies, to ensure a well-trained workforce for future projects and operations.** A large majority of infrastructure jobs focus on operations and maintenance, after construction is finished. Direct and regular communication and participation with vocational, trades, community college, and university programs will ensure that workers are trained to understand current technology and regulations, and will help attract workers into these jobs. If qualified, skilled workers are scarce, look into developing in-house training programs in partnerships with local education resources that can provide instruction, funding and facilities.

### Case Studies

**Labor Equity, From Planning to Project to Policy.** The Elliott Bay Seawall Replacement is the largest project in City of Seattle public works history. The community workforce agreement includes goals to include workers from zip codes identified as economically distressed areas, apprentices, women, and people of color. Disadvantaged women- and minority-owned (WMBE) contractors are also targeted for subcontracting opportunities. The City has staffed the project to ensure targets are met throughout the ten-year duration of the project, and as of early 2015, all targets were exceeded.

This project agreement led to a city-wide labor equity policy on all public works construction projects of $5,000,000 or more. The goal of the program is to both improve access to construction jobs and improve training programs for underrepresented workers in need of family-wage jobs. The priority hire program will prioritize the hiring of residents that live in economically distressed areas of Seattle and King County. These results are outcomes of a long-term planning process that included a Construction Careers Advisory Committee comprised of labor, community, and business stakeholders, convened to review the City's contracting diversity, study best practices from other jurisdictions, and make policy and program recommendations. **(http://www.seattle.gov/city-purchasing-and-contracting/social-equity/labor-equity)**

# Section 12: Value Capacity and Expertise

**By Rhys Roth**

*Successful infrastructure innovation that delivers long-term cost savings and a host of better outcomes requires sophistication and deep expertise. Centers of expertise can help ensure local agencies do not reinvent the wheel and that they do access the best data, tools, policies, and case studies from the broader marketplace. New procurement strategies may also be key: Rather than staging the typical 'low-bid war' to hire the cheapest contractor, new approaches can incentivize private sector innovation and sustainability, reduce risk of cost overruns borne by the public, and reward quality performance over time. Within organizations, translating a new vision into the day-to-day priorities of staff may require revamping job descriptions, performance metrics, and training.*

**Why value capacity and expertise?**

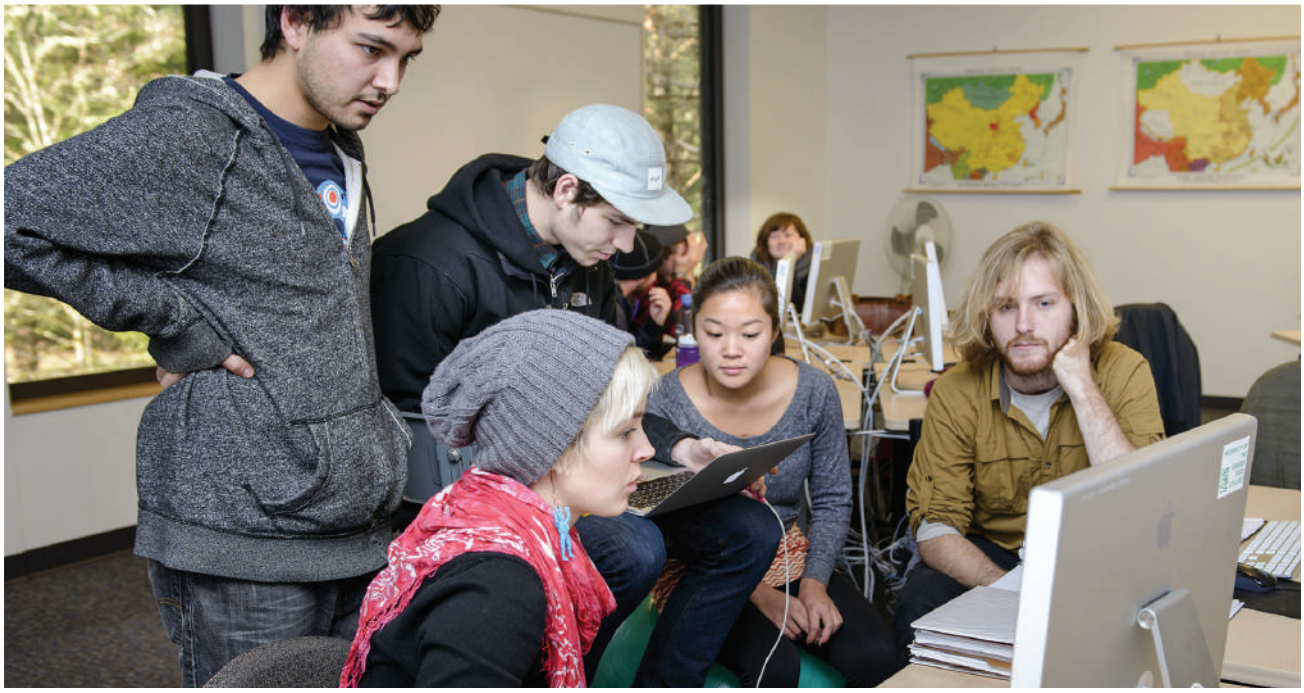
**In-House Expertise.** Local governments do not typically manage all the infrastructure systems operating in their community. But local governments can represent the interests of their citizens in aligning infrastructure investment decisions with the goals, aspirations, and policies of the community, even when those investments are made by external utilities and agencies. It is therefore important for local government to recognize the value of in-house institutional knowledge and to invest in attracting and retaining talented professionals who can represent the community's interests through the various infrastructure planning and investing processes. A looming wave of retirements, however, threatens to drain critical knowledge from infrastructure agencies across the country.

**Due Diligence.** Spending a little more upfront for due diligence can result in much better decisions that deliver continuous, long-term value. Before committing real money to standard approaches, smart infrastructure investors will invite innovative ideas. They will then rigorously compare the best options, on a lifecycle basis, to uncover the ones that benefit the community most. The full range of benefits, costs, and risks need to be carefully and transparently documented for decision-makers and the community.

**Innovative Procurement.** When putting an infrastructure construction project out to bid, the standard procedure is to choose the lowest bid. But contractors that win a low-bid war may not be incentivized to care about operating and maintenance costs over the life of the project. On larger, more complex projects the public agency can be saddled with cost overruns in the short-term and poor performance and higher operating costs in the long-term. Innovative procurement strategies may result in less risk, better performance, and lower costs for the public owner, but they require skill and sophistication to design and negotiate.

**How to value capacity and expertise**

**Develop a long-range Sustainable Infrastructure Strategic Plan that addresses the value and importance of capacity**



## *Value Capacity and Expertise*

**and expertise.** Creation of an infrastructure strategic plan that encompasses the community's various infrastructure systems can provide a central focus aligning implementation efforts and the various other local plans, as well as plans by external infrastructure utilities and agencies. The plan should recognize why successful infrastructure planning and investment requires sophistication and deep expertise, identify the expertise needed to meet the Plan's goals and requirements, and commit local government to recruiting and retaining the necessary talent.

**Develop in-house capacity and retain outside expertise (as needed)** to bring state-of-the-art management and analysis tools to infrastructure planning:

Communicating a new planning and management vision and strategy to staff may not be enough to transform long-standing approaches. Training staff in the use of advanced sustainable infrastructure planning and rating tools, such as EnvisionTM, can help get everyone on the same page and thinking in a fresh way. Reworking job descriptions, skill expectations, and performance metrics can be crucial to enable staff to reorient their day-to-day priorities to align with sustainable infrastructure best practices.

- Cultivating partnerships with the nearest university or community college can build a local talent pipeline by designing technical training and advanced degree programs that instill skills important to sustainable infrastructure.
- Actively participating in professional development and training programs can ensure staff and management are gaining state-of-the-art skills and tools. Joining innovation networks that connect planners and professionals from communities with common interest in infrastructure innovation can enables successful models to be widely shared.

### Case Studies

**City of Olympia Public Works.** The City's Public Works Department is institutionalizing the EnvisionTM sustainable infrastructure rating system and recently trained 60 staff members—engineers, operations supervisors, planners, and inspectors. Rich Hoey, Olympia's Director of Public Works, "likes the way Envision gets our staff and public to really think about upfront and long-term costs. It will be very valuable as we do our capital facilities planning 6 years, 20 years and even 50 years out." Staff meet at least twice a year in Performance Roundtables to explore opportunities to integrate across sector lines. See page 7 of the report titled *Infrastructure Crisis, Sustainable Solutions: Rethinking Our Infrastructure Investment Strategies* **(http://www.evergreen.edu/sustainableinfrastructure/docs/CSI-Infrastructure-Crisis-Report.pdf)**.

# Resources

***Infrastructure Crisis, Sustainable Solutions: Rethinking Our Infrastructure Investment Strategies.*** Distilling interviews with 70 thought leaders and innovators by The Center for Sustainable Infrastructure at The Evergreen State College, this report will help planners, industry leaders, academics, and the public rethink how communities are planned and the types of investment needed to manage, operate, and rehabilitate America's infrastructure systems. **(http://www.evergreen.edu/sustainableinfrastructure/docs/CSI-Infrastructure-Crisis-Report.pdf)**

***Integrated Community Sustainability Planning Tool.*** A short tool developed by Drs. Chris Lin, Ann Dale, and Kevin Hanna at Royal Roads University in 2007, Canada for Canadian communities, but applicable more broadly. **(http://crcresearch.org/sites/default/files/icsp-planning-tool.pdf)**

**Sustainable Infrastructure: Standards and Guidelines.** A compendium of sustainable infrastructure standards and guidelines from around the world, from the International Federation of Consulting Engineers **(http://fidic.org/node/5965)**. New York City's *High Performance Infrastructure Guidelines*, October 2005, and the Chicago Department of Transportation's *Sustainable Urban Infrastructure Policies and Guidelines* are particularly worth taking a look at.

***Next Generation Infrastructure: Principles for Post-Industrial Public Works***, by Hillary Brown, Island Press, Washington, DC, 2014.