

Urban Infrastructure.

A Holistic System of Smart, Green Facilities.

THE IDEA OF INFRASTRUCTURE.

Character towns have strong, well-funded infrastructure systems. Potable water supply, wastewater disposal, solid waste collection and disposal, electricity, natural gas, stormwater management, roads and bridges, transit, sidewalks, parks, schools, hospitals, and the myriad of other systems that support our well-being go mostly unnoticed, until they break.

Most of the systems we use and enjoy today were provided by previous generations who invested in the future by installing pipes and pavements and public systems of all sorts that make a city function. Today, infrastructure gets a lot of talk and press, but not so much money. The trends are:

- **Renewal & Replacement [R&R] Funds:** Our existing systems are showing the effects of neglected and raided renewal and replacement funds. Rather than paying smaller amounts on a more regular basis, we are now faced with a big bill for major upgrades and replacements.
- **Public-Private Partnerships [P3s]:** Public-private partnerships are popular and offer relief when used properly. Long-term, “sweet-heart” deals can leave cities without revenues for years, like the City of Chicago’s privatization of their parking system. It may be a good deal; but it has to be done carefully.
- **Smart and “green” infrastructure systems** are proliferating. The timing and extent of transitioning old infrastructure systems with new technology will be expensive, technically difficult and time consuming.

THE ASCE INFRASTRUCTURE REPORT CARD.

Every four years the American Society of Civil Engineers [ASCE] releases a report card of America’s Infrastructure that depicts the generally poor condition and performance of the nation’s infrastructure.

While many types of infrastructure are maintaining their grade, the grade is poor. The Bipartisan Infrastructure monies need to be spent effectively.

	2013	2017	2021
▪ Aviation	D	D	D+
▪ Bridges	C+	C+	C
▪ Dams	D	D	D
▪ Hazardous Waste	D	D+	D+
▪ Energy	D+	D+	C-
▪ Drinking Water	D	D	C-
▪ Inland Waterways	D-	D	D+
▪ Levees	D-	D	D
▪ Ports	C	C+	B-
▪ Public Parks and Rec.	C-	D+	D+
▪ Rail	C+	B	B
▪ Roads	D	D	D
▪ Schools	D	D+	D+
▪ Solid Waste	B-	C+	C+
▪ Stormwater	NR	NR	D
▪ Transit	D	D-	D-
▪ Wastewater	D	D+	D+

Improved or Declined from Previous Period.
NR – Not Reported

Source:
2017...<https://www.infrastructurereportcard.org/wp-content/uploads/2016/10/Grades-Chart.png>.
2021...<https://infrastructurereportcard.org/making-the-grade/>

THE 2021 INFRASTRUCTURE INVESTMENT AND JOBS ACT. This Bipartisan Infrastructure Deal will rebuild America’s roads, bridges and rails, expand access to clean drinking water, ensure every American has access to high-speed internet, tackle the climate crisis, advance environmental justice, and invest in communities that have too often been left behind.

The Infrastructure Bill will ease some of the supply chain challenges, especially with funding to repair and rethink the ports and waterways. It may also bring a resurgence to more reshoring to further shorten existing supply chains.

Programs in the Infrastructure Investment & Jobs Act (IIJA) ⁽¹⁾

- **Roads, Bridges & Major Projects – \$110 Billion**
- **Public Transportation – \$39 Billion**
- **Passenger & Freight Rail – \$66 Billion**
- **Airports – \$25 Billion**
- **Ports & Waterways – \$16 Billion**
- **Water, Drinking – \$62 Billion**
- **Clean Energy & Power – \$73 Billion**
- **Electric Vehicles, Buses & Ferries – \$15 Billion**
- **Broadband – \$65 Billion**
- **Resiliency – \$47 Billion**
- **Environmental Remediation – \$21 Billion**
- **Safety – \$11 Billion**

LINK: <https://www.cbh.com/guide/articles/infrastructure-bill-2021-breakdown-analysis/>

- **Industrial manufacturers** must continue to prioritize evolving health and safety measures required to protect employees and customers while balancing impacts to productivity, service levels, and operating costs.
- **The technology evolution** will impact all businesses. Every business will need to identify its role in the supply chain ecosystem, maintain a total focus on the customer experience, and partner intelligently across the value chain to access greater opportunities for growth. In addition, it will help push greater advancement of Industry 4.0 than ever before — bringing better connectivity and automation. Those manufacturers who embrace digital transformation will be farther ahead to take advantage of infrastructure dollars.
- **Utility companies** will need to determine how best to upgrade their systems to build miles of new resilient transmission lines.
- **Public transit** investment will improve the effectiveness of the U.S. supply chain and increase talent mobility, which is vital to the future success of the manufacturing sector.
- **Companies focusing on renewable energy** will see a significant increase in demand.

HOLISTIC INFRASTRUCTURE SYSTEMS.

The trick is to build one system that solves several problems and provide several services. Greenville South Carolina has derived multiple benefits from one significant project at the west end of Main Street in downtown. In addition to being a great amenity, park and commercial venue, Fall Park serves flood control and stormwater management purposes.

"Falls Park on the Reedy, located in downtown Greenville's Historic West End, is one of Greenville's greatest treasures. The park serves as an oasis within the city - a place where people gather to work, play and celebrate life. The multi-use facility lends itself to a wide variety of activities for people of all ages and interests."

<https://www.greenvillesc.gov/174/About>

Urban stormwater facilities can be visual amenities. Using stormwater funding sources to address flooding and water quality issues while providing beautiful public open spaces and trails is a great multiple benefit.



It starts right in town in Falls Park... inviting trails and gardens greet visitors, leading off to a revitalized Main Street, with local shops, craft-beer pubs, and a global array of restaurants.

- LonelyPlanet.com

THE FISCAL CHALLENGE.

A city's infrastructure, by definition, supports the city's physical, economic and social systems. It provides capital improvements and public services that move people and goods throughout the city.

Demands for new and improved infrastructure systems come from several primary sources:

- As cities grow, more facilities are required.
- As cities age, facilities need to be renewed or replaced.
- As technology evolves, obsolescence appears at an increasingly rapid rate.
- As the public demands new public goods and services such as computers in libraries, recycling, green civic buildings, high speed rail, and interactive televised council meetings.

As cities become bigger, older, technologically more sophisticated and more expansive in their service offering, the system's upgrading, renewal and replacement grows exponentially.

Adequate public facility ordinances using adopted levels of service ease the evaluation of development proposals by establishing private infrastructure commitments at the outset.

More thought, investment and energy are required just to maintain the current level of service to existing residents and businesses. The challenge of providing for new and expanded facilities and services for growth while back-filling and replenishing existing systems becomes a serious management challenge.

ICMA, ASCE and the NLCs are working the issue.

All levels of government are focusing on this issue. The 2009 New York Times article voiced possibilities that have been far surpassed fourteen years later by AI, etc.

The New York Times

By [STEVE LOHR](#), Published: April 29, 2009

"In the mid-1990s, the Internet took off because its technological time had come. Years of steady progress in developing more powerful and less expensive computers, Web software and faster communications links finally came together.

"A similar pattern is emerging today, experts say, for what is being called smart infrastructure — more efficient and environmentally friendlier systems for managing, among other things, commuter traffic, food distribution, electric grids and waterways. This time, the crucial technological ingredients include low-cost sensors and clever software for analytics and visualization, as well as computing firepower.

"Wireless sensors can now collect and transmit information from almost any object — for instance, roads, food crates, utility lines and water pipes. And the improved software helps interpret the huge flow of information, so raw data becomes useful knowledge to monitor and optimize transport and other complex systems. The efficiency payoff, experts say, should translate into big reductions in energy used, greenhouse gases emitted and natural resources consumed.

"Smart infrastructure is a new horizon for computer technology. Computers have proven themselves powerful tools for calculation and communication. The next step, experts say, is for computers to become intelligent instruments of control, linking them to data-generating sensors throughout the planet's infrastructure. "We are entering a new phase of computing, in which computers will be interacting with the physical world as never before," said [Edward Lazowska](#), a professor of computer science at the [University of Washington](#)."

Source: The New York Times

INVESTMENT OPPORTUNITIES.

The entrepreneurs in the crowd should be amply impressed by the demands being placed on our existing management and infrastructure systems. Most public services and facilities are not discretionary. Cities and NGOs will be spending vast sums of money over the next decades to replace or renew everything. The technology companies are already in the game. Public infrastructure investors need to join.

URBAN INFRASTRUCTURE ELEMENTS.

Municipal public infrastructure, by its nature, consists of ten essential systems:

- **Drainage:** The stormwater management system associated with streets and highways along with building, development and environmental protection.
- **Education:** The education system of public and private primary and secondary schools with colleges, universities and skill training centers, as well as, libraries and museums.
- **Garbage and HazMat:** Many solid and hazardous waste collection and disposal systems are enacting “green” approaches to reducing, reusing and recycling.
- **Health Care:** Hospitals, clinics, indigent care, wellness programs and disaster relief.
- **Urban Open Spaces:** The urban open space system with urban plazas, parks, wetlands, stormwater areas and trails.
- **Police/Fire/EMS:** The public safety system of fire, police and emergency management services. Many cities spend over half of their ad valorem taxes on these services.
- **Power:** The power grid system that generates and distributes electric, gas, and hydrogen, sets rates and spurs innovations.
- **Transportation Systems:** Urban mobility systems consist of the street and road network, the transit and rail systems, the bicycle and pedestrian systems along with water ports and airports.
- **Telcom:** The telecommunication system includes phone, cable and information system facilities, cell towers, wifi networks along with public television and radio.
- **Utilities:** The utility system includes potable water treatment and distribution, wastewater collection and disposal, and reclaimed water distribution.

INTERNET SERVICE MASTER PLANS.

High-speed broadband internet service is becoming “coin of the realm”. It is a must have for businesses engaged in the global economy, for academic institutions of all types and local governments interested in providing better and more efficient public goods and services. Internet Service Master Plans are providing cities with choices of providing internet service as a utility or as a commercial service.



NATIONAL ACADEMY OF ENGINEERING
OF THE NATIONAL ACADEMIES

What is infrastructure?

Infrastructure is the combination of fundamental systems that support a community, region, or country. It includes everything from water and sewer systems to road and rail networks to the national power and natural gas grids. Perhaps there will be a hydrogen grid in the future as well.

PUBLIC PRIVATE PARTNERSHIPS [P3s].

P3s are useful in financing public services and facilities that have revenue streams attractive to private investors. Capital intensive projects requiring long-term financing not suitable for municipal bond programs are exploring P3 deals. Some cities privatize essential public services – one manager recently saying,

“It is easier to manage contracts than people”. Whatever the delivery vehicle, essential services are essential! Criteria for level of service expectations, performance evaluation systems and public feedback loops make the systems work better.

In all cases, it’s about the money. Skills in public finance, private-public partnerships, grant writing and other innovations are critical.

INFRASTRUCTURE AS AN ECONOMIC DEVELOPMENT TOOL.

Businesses and institutions choose to remain in cities or move to new ones based on many factors. One of the fundamental business locational factors is the quality and cost of infrastructure.

Dependable power, waste disposal, fire protection, continuing education institutions and mobility systems ensure the continual and cost-effective operation of their business, the reasonableness that employees have a safe and timely trip to and from work, that training programs are available and that the costs of doing business are competitive.

Jobs, family income and municipal tax and fee receipts rise or fall based on efficient and effective public infrastructure systems.

Community prosperity depends on sound infrastructure.

URBAN INFRASTRUCTURE FOR THE SUSTAINABLE CITY.

The sustainable city is the amalgam of places and systems with two foundational systems, open space and infrastructure, holding everything together: literally, fiscally and emotionally. The open space and infrastructure systems, when done well, are:

- fully integrated, mutually supportive assets of the city – visually, financially and socially.
- foundational to neighborhoods, city centers and development corridors.
- testing grounds and subsequent sources for innovation in the City. They can be “green” all at once or through pilot programs. They can use grants to test new ideas and approaches. They can be the subject of professional articles exploring new ways of solving old problems.



Institute of Local Self-Reliance

Mission:

“The ILSR’s mission is to provide innovative strategies, working models and timely information to support environmentally sound and equitable community development. To this end, ILSR works with citizens, activists, policymakers and entrepreneurs to design systems, policies and enterprises that meet local or regional needs; to maximize human, material, natural and financial resources; and to ensure that the benefits of these systems and resources accrue to all local citizens.

LINK: <https://muninetworks.org/content/about-us>

URBAN INFRASTRUCTURE AS A KEY ELEMENT IN THE CITY'S FINANCIAL MODEL.

“An effective infrastructure contributes to economic prosperity and improving quality of life. Urban residents need clean air and potable water, as well as security. They need efficient buildings, a reliable power grid and capable mobility solutions. The complexity involved requires a holistic view and sustainable solutions for cities.”

The city's infrastructure system should generate enough revenue to support itself and the city's open space system. Whether the city uses an “enterprise fund” system or operates these activities through the General Fund, the objectives are the same.

- Operate the open space and infrastructure systems as efficiently and as effectively as possible given the level of service standards acceptable to the community.
- Enact a fee structure for the fee-generating services that generate revenues sufficient to cover costs and reserves for both systems.
- Identify and program all revenue sources even though most revenue comes from the utilities and waste disposal activities. For example, use revenues from stormwater fees, selected park user fees [pavilions, boat ramps, e.g.], impact and connection fees.

COMPREHENSIVE LONG-RANGE FINANCE PLANS.

A Comprehensive Long Range Finance Plan for the city provides the framework for identifying and analyzing traditional revenue sources and uses while exploring non-traditional and non-recurring sources.

A thirty to fifty year horizon is necessary to fully anticipate the financial future of the city.

THE CHALLENGE FOR CITY MANAGEMENT.

The cost of creating, maintaining and upgrading infrastructure is high and rising. Big business is at the public trough with ideas, information, challenges and a high-quality sales force. The challenge for city management is to match the vendors' expertise with in-house knowledge sufficient to discern the good aspects of technology from those aspects that are ineffective, inappropriate or unnecessary. The ICMA, the NLC and ASCE provide resources to help evaluate the pros and cons of this surging wave of technology.

SmartCitiesCouncil

LIVABILITY
WORKABILITY
SUSTAINABILITY

The Smart Cities Council works globally across sector divides to make the world safer, more activated, beautiful, sustainable, equitable and resilient for *everyone*.

An objective and neutral network for sharing knowledge and driving capability and capacity, the Smart Cities Council is the world's longest-running and most impactful global network that develops and applies science, data, technology and engineering to make the world a safer, more activated, beautiful, sustainable and resilient place, and to inspire and enable others to do the same.

LINK: <https://www.smartcitiescouncil.com/>

CONCLUSIONS.

1. The time has come for the **transition** of older infrastructure systems to “smart” “green” technologies with real time data reported on a unified Dashboard.
2. A city’s infrastructure is **sustainable**, by definition, supporting the city’s physical, economic and social systems.
3. ASCE’s report card evaluating America’s infrastructure indicates major deficiencies and **improvement needs**.
4. The Bipartisan Infrastructure Deal offers **opportunities** for small cities and towns to obtain funds for infrastructure plans and improvements. Figure out how to get the money.
5. Infrastructure is a **significant economic development tool** of every city.
6. With the ubiquity of **sensors**, useful results can be obtained through the collection, organization and analysis of “big data”.
7. A city utility system can generate revenue to support itself and other non-**revenue generating** activities, such as the city’s parks and open space system; parking can pay for transit.
8. **Data centers** are being developed to take a holistic, real-time view of operations such as water and wastewater across department lines eliminating the inefficiencies of silos by aggregating, integrating and visualizing key data such as consumption, quality, flow and pressure.
9. Advice and **experiences of other cities and professional organizations** are becoming plentiful. The ICMA, the NLC and ASCE provide resources to help evaluate the pros and cons of the surging technological wave.
10. **Private industry** is aggressively innovating city applications of technology; stay ahead of the private vendors; work with them, not for them.
11. **Dashboards** are being developed that enable city managers to have real-time access to data from many city systems. Sensors enable “big data” to be organized into integrated management systems.

The 2023-2024 **Kansas City** municipal budget focuses on sustainability, infrastructure and accessibility and public safety to the tune of \$2.06 Billion.

Link: [https://www.kcmo.gov/i-want-to-Want To...](https://www.kcmo.gov/i-want-to-Want-To...)

More than \$9 billion in infrastructure funds coming to Ohio.

In Ohio, there are 1,377 bridges and over 4,925 miles of highway that are in poor condition, according to White House figures.

Link: <https://www.10tv.com/article/news/politics/9-billion-in-infrastructure-funds-coming-to-state-of-ohio/530-9cbb8658-f0b7-48ed-84b5-82fae04a756c>