APPENDIX D.

Best Practices Research

Background

The 21st Century Infrastructure Commission was charged with developing a plan to incentivize and encourage coordinated, long-term asset planning and management across multiple infrastructure types and all levels of government. To help the Commission better understand how Michigan could meet this charge, Public Sector Consultants (PSC) evaluated best practice models for integrated infrastructure planning and investment strategies from around the world, including more than ten different countries and 20 states across the U.S. PSC and the Executive Office of the Governor also interviewed several experts to supplement these best practice models. Deloitte Consulting also assisted with providing some research findings on best practices. This document summarizes the research that was presented to the Commission in June and July 2016.

Elements of Success

In PSC's review of infrastructure planning efforts from around the world, we found several models that utilize forward-looking, comprehensive, and integrated approaches to infrastructure asset management that reap the rewards of greater efficiency, access to additional investment resources, and more long-term technical solutions. Although each model has some unique processes or areas of focus, we identified six common elements of their success, including:

- Articulated vision for the future of infrastructure
- Planning processes that include a long-term planning horizon and regular updates
- Establishment of a coordinating or decision-making body
- Detailed asset inventory and condition assessment
- Projections of need based on nontraditional data and uncertainties (e.g., climate impacts, disruptive industry changes, etc.)
- Diverse mix of funding and financing tools

Articulated Vision for the Future of Infrastructure

States and countries that have adopted comprehensive and coordinated infrastructure planning processes have articulated a clear vision that describes desired outcomes or a desired future for their system. In many cases, the vision is codified in law or a policy resolution and has guided initial infrastructure asset management plans and subsequent updates. The vision for a future state often reflects a driving need—such as a rapidly growing population, impending climate risks, or power

outages due to capacity constraints—and is typically accompanied by a set of guiding principles to define how these places judge their future success. In California, for example, the Infrastructure Planning Act requires that any infrastructure proposed for funding in the state's plan must be consistent with the following priorities:

- Promote infill development and equity by rehabilitating, maintaining, and improving existing infrastructure and reusing previously developed, underutilized land, particularly in underserved areas.
- Protect environmental and agricultural resources.
- Encourage efficient development patterns by locating new infrastructure in an area appropriately planned for growth and served by adequate transportation and services, as well as by minimizing ongoing costs to taxpayers (State of California 2015)

Cities, including Portland, Oregon and London, England; states, including Minnesota, Ohio, and New York; and countries, including Canada and New Zealand, have developed forward-looking visions for their infrastructure systems. They aim to modernize their systems, advance their economic position, and build and maintain infrastructure that will protect public health and improve quality of life.

Long-term Planning Horizon

While infrastructure planning time horizons vary across states and countries, many comprehensive plans cover at least ten years, with most planning for 20 years or more. Most states and countries with longer planning horizons also have accompanying short-term action or budget plans. London, for example, has a comprehensive infrastructure plan that goes to 2050, but requires five-year business plans to ensure that economic changes and cost-to-consumer forecasts are continually included in the planning process (Greater London Authority 2014).

By law, the Governor of California is required to develop and submit a five-year infrastructure plan to the legislature along with the annual budget bill. The plan details proposed infrastructure investments, and outlines how those investments relate to the five-year plan objectives, including maintenance, improvements, and new infrastructure (State of California 2015).

Several other places utilize planning horizons for integrated infrastructure spanning ten or more years, including Oregon, New York, Canada, the United Kingdom, New Zealand, and Australia.

Coordinating Body

Another defining characteristic of model infrastructure planning systems is the establishment of a coordinating body or agency that is designed to break down traditional silo-based approaches to capital investment and infrastructure management and take a comprehensive look at statewide infrastructure investment. Through strategic collaboration and information sharing, a coordinating body can better leverage existing investment dollars and tactically allocate capital investment funding to maintain infrastructure, grow the economy, and create jobs. States and countries with infrastructure coordination bodies or agencies also focus on integrating project-level planning and investment across related infrastructure types or geographies to improve efficiencies and reduce costs.

PSC identified leading infrastructure coordinating bodies, including:

- **London:** After the 2012 Olympic Games were held in London, city government identified the need for citywide integrated infrastructure planning. As a coordinating body, the London Infrastructure Commission was created to continue this work and to carry out the vision of the London Infrastructure Plan 2050. This body is made up of economists; heads of global design and construction firms; public consultants in energy, water, transport, and information technology; infrastructure finance experts; and members of London First, an organization dedicated to making London the world's best city in which to do business (Whitelaw 2014).
- **Canada:** Canada's coordinating body, Infrastructure Canada, leads the country's federal efforts to ensure that Canadians benefit from world-class modern public infrastructure. The department makes investments, builds partnerships, develops policies, delivers programs, and fosters knowledge across the country. It works with provinces, territories, municipalities, the private sector, nonprofit organizations, and other federal departments and agencies, to address local and regional needs and advance national priorities. Infrastructure Canada reports to Parliament through the Minister of Infrastructure and Communities (Infrastructure Canada 2011).
- **New York:** The New York Works Task Force was initially charged with developing a long-term plan to strategically allocate capital investment funding in order to grow the economy and create jobs. Since completing the ten-year plan, the task force has worked closely with Regional Economic Development Councils to identify and invest in regional projects that maximize long-term economic growth (New York Works Task Force 2013).

Asset Management

An asset management plan, which includes a detailed inventory and assessment of public (and in some cases, private) assets, is another common element of a modern infrastructure management approach. The practice of asset management is used to guide systematic investment at strategic points in an asset's typical life cycle—including design, construction, Commissioning, operating, maintaining, repairing, modifying, replacing, and decommissioning or disposing of an asset.

Models of strong asset management approaches from around the globe include a comprehensive, baseline inventory of infrastructure that:

- Characterizes infrastructure condition
- Provides information on ownership
- Identifies key issues and risks associated with that infrastructure
- Tracks projected investment needs
- Measures progress
- Helps identify areas of integration between related infrastructure projects

London, England's infrastructure plan, for example, is integrated across housing, commercial, civil and public, energy, water, transportation, education, and medical/health facilities. The London Infrastructure Commission has worked with public and private parties to extensively map existing infrastructure, including condition and capacity assessments, and has aggregated data on

projected needs and planned projects into a comprehensive plan and online mapping tool. This tool allows people to see patterns of infrastructure development and concentration, identify opportunities for coordinated infrastructure construction, and track progress.

Planning for Uncertainty

Another best practice of coordinated infrastructure planning is recognizing that there is a great deal of uncertainty inherent in projecting the future. Therefore, model infrastructure planning processes are moving away from conventional, deterministic approaches that rely on single-scenario forecasting methods that acknowledge and accommodate various uncertainties (Wong 2013). New York, California, Minnesota, London, New Zealand, and Australia proactively evaluate and incorporate uncertainties into demand projections, infrastructure types, costs, and siting decisions.

Three primary uncertainties necessary to guide infrastructure plans are:

- Population change and density
- Technology innovation
- Nontraditional planning factors

Population Change and Density

Planning for uncertainty means using dynamic forecasting methods, including scenario planning and flexible design strategies, to better ensure infrastructure systems efficiently deliver services over the long term. During the 2000s, many older industrial cities in Michigan, as well as other states in the Great Lakes region lost a substantial percentage of their population. Although this phenomenon has serious implications for infrastructure service and delivery, most traditional population projections were not built to assume population loss.

Based on this experience, many planners recognize the need to better anticipate future changes in population and demand. When population does decline, some services can be downsized, but infrastructure is often immobile and costs tend to be fixed, so at times, it is more expensive to operate a system when demand is reduced (Hoornbeek and Schwarz 2009). While communities need to provide good service to the residents who remain in depopulating communities, they also need to anticipate future changes in population and demand–including growth. Planners and policymakers are increasingly looking to more dynamic forecasting methods that embrace uncertainty.

Technology Innovation

From smart meters to 5G mobile communication, processes at the best practice level address the profound impacts of technological change on infrastructure planning. For example, the London Infrastructure Plan 2050 devotes an entire chapter (“Open to Radical Change”) to methods for tackling the uncertain impacts of new technology and innovation. Given the potential changes expected to be introduced as new technologies emerge, the Commission engaged the global technology research firm Forrester to help provide insights into this evolving world. Forrester provided members of the Commission with an in-depth overview of current and anticipated technology trends that will likely drive a more connected, efficient society. Forrester’s team of

experts provided information about a variety of topics, including the IoT and how technology is enabling smarter cities.

Nontraditional Planning Factors

Best practice planning processes address the uncertainties presented by changing weather and climate patterns, from shifting precipitation levels to changing freeze-thaw cycles. These processes recognize the need for new approaches to understand vulnerabilities—across infrastructure systems and specific assets—to take appropriate actions to minimize risk and increase resiliency. Two U.S. states have moved to address this kind of uncertainty. Access Ohio 2040 calls for a Statewide Climate Variability Study and the Minnesota GO 50-Year Vision for Transportation addresses the trunk highway system's vulnerability to increased flooding events (Minnesota Department of Transportation 2012).

Model infrastructure plans also account for nontraditional planning factors, such as:

- Economic changes, such as major industry shifts and new types of businesses that disrupt industries
- Changing user preferences, such as the sharing economy (e.g., Uber) or desire for clean energy sources
- Decentralization of infrastructure services, such as the utility of the future concept
- Political changes, including major regulatory or legal changes

Funding and Financing

In most U.S. states, including Michigan, major infrastructure such as transportation, water, and wastewater systems are funded largely through public dollars, including tax revenue, license fees, and general obligation bonds. The energy sector is the exception, as generation, production, and distribution systems for electricity and natural gas are typically developed and managed privately or through P3s.

Historically, public funding for infrastructure has occurred on a pay-as-you-go cycle in which annual operating and capital budgets allocate dollars to maintain or expand infrastructure. Increasingly, states and cities have relied on general obligation and other types of bonds to finance infrastructure projects. As states and countries diversify funding sources, some have set explicit limits or targets for levels of indebtedness. Oregon, for example, has capped the amount of debt it will issue for infrastructure projects and has focused on other sources of funding such as fees, special revenues (e.g., lottery), and private investments (State of Oregon Office of the Governor 2012; State of Oregon 2016).

Today, best practice-level infrastructure management systems utilize a diverse mix of funding, including public and private investments, to maintain, improve, and expand infrastructure. In addition to the traditional public funding mechanisms like General Funds and traditional bonds, some states and countries have utilized more innovative tools to ensure adequate capital to fund projects and to improve efficiencies. These tools include infrastructure banks and P3s.

Infrastructure banks are state-owned banks that can finance and coordinate high-value infrastructure investments. These banks allow for borrowing (or loan guarantees) from public and

private entities to fund public-serving infrastructure projects, and can be used for projects requiring large lines of credit, which in some cases, allows an entity to multiply its infrastructure investment capacity. Infrastructure bank loans also use delayed-repayment mechanisms, which allows key projects to move forward even if they will not generate user fees or yield savings for many years (Miller, Costa, and Cooper 2012).

California and Pennsylvania each have an infrastructure bank (Deloitte 2016). Created in 1994, the California Infrastructure and Economic Development Bank finances public infrastructure and private development to promote jobs, contribute to a strong economy, and improve quality of life (State of California 2015). The Pennsylvania Infrastructure Bank leverages state and federal funds to accelerate priority transportation projects by providing low-interest loans (Pennsylvania Department of Transportation 2016).

P3s are another innovative tool that offer opportunities for government, business, and private sector organizations to collaboratively invest in and own public infrastructure, resulting in greater efficiencies. A 2009 study of the United Kingdom's infrastructure projects found that 65 percent of P3-related construction was on-budget, while only 54 percent of public sector-led projects were delivered on-budget. Similarly, a study of Australian P3s determined that these projects had cost overruns of 1 percent, compared to an average cost overrun of 15 percent for public-led projects. Europe uses P3s extensively, accounting for nearly 45 percent of global P3 projects ($353 billion in infrastructure development) in 2011, compared to 9 percent in the U.S. (Istrate 2011).

Expert Interviews

To further inform the Commission, PSC and the Executive Office of the Governor conducted telephone interviews to gather information on how some communities are implementing infrastructure planning, including asset management and rate structure modifications. These interviews included the manager of the London Infrastructure Mapping Application (IMA) and a representative of the Washington, D.C. water and sewer authority.

City of London

In many states, including Michigan, data on the location and condition of infrastructure assets are managed and analyzed by separate entities, leading to planning and investment inefficiencies. The City of London has worked extensively on this issue, creating a coordinating body, the London Infrastructure Delivery Board, and a tool, the Infrastructure Management Application (IMA), to capture and assess data, prioritize projects, and fund infrastructure across the city.

In August 2016, PSC, the Executive Office of the Governor, and the infrastructure Commission met with Andrew McMunnigall via conference call to discuss how they implemented the London Infrastructure Delivery Board and the how they manage the £550,000[49] IMA asset management tool. These two innovations have been successful at providing the following:

- Insight for private and public stakeholders into London's future growth, development, and infrastructure project pipeline
- Opportunities for joint delivery of infrastructure projects, reducing construction costs and disruption (McMunnigall 2016)

District of Columbia Water and Sewer Authority

Washington, D.C. recently completed an 18-month process of restructuring their water and sewer rates. A solid revenue source is integral to sustaining water and sewer infrastructure over the long life of these assets, especially in times when water consumption is declining and maintenance is deferred. The District of Columbia Water and Sewer Authority restructured its rates to reflect the full cost of operating, maintaining, repairing, and replacing water and sewer infrastructure.

The new multiyear rate structure focuses on affordability—including providing qualifying households with discounts of up to 50 percent—while incorporating the full cost of service with fixed fees and charges instead of volumetric rates. These changes include instituting a water system replacement fee to fund one percent of water system replacement compared to the national average of one-third of one percent and instituting a system availability fee (a hook-up charge) for new developments.

The restructuring has required the District of Columbia Water and Sewer Authority to utilize innovative financing mechanisms for their water infrastructure assets. They have issued a $2.6 billion 100-year bond for the D.C. Clean Rivers Project, which will create a deep underground tunnel system to alleviate combined sewer overflows. With such a long bond life, the asset matches the liability and has intergenerational equity such that the cost of the asset is spread across generations benefiting from it. The District of Columbia Water and Sewer Authority has also issued green bonds and social impact bonds. These bonds finance programs with environmental benefits, helping to identify the public value for such financing, in addition to identifying where the rate of return depends on the performance of green infrastructure (Kim 2016).

Conclusion

The 21st Century Infrastructure Commission examined these best practice elements, examples, and expert interviews throughout the Commission recommendation development process. The recommendations presented in this report have incorporated many of these methods and approaches to integrated infrastructure planning and investment strategies from around the world.

[49] Equal to $721,985 using August 2016's exchange rate of 1.3127 USD:1 GBP.