The aim of ***High Performance Guidelines: Triangle Region Public Facilities*** is to provide a roadmap for the design and construction of efficient, cost-effective, durable, and environmentally sound buildings and landscapes. Its intended audience is local governments and schools in the region served by Triangle J Council of Governments. This region includes the 3,300 square miles in North Carolina that lie within the counties of Chatham, Durham, Johnston, Lee, Orange, and Wake, an area with a population of just over one million.

Public buildings are financial investments by taxpayers, and one purpose of these *Guidelines* is to ensure that the design, construction, and maintenance of the region's public buildings provide the best possible return on investment as measured by long-term economic, health, and environmental benefits.

Public buildings are also highly visible and symbolic in our communities, so their construction provides an excellent opportunity to model principles of high performance for the private sector. These *Guidelines* will help produce the types of buildings and landscapes that can be emulated by the private sector for their own benefit and for the benefit of entire communities.

What is High Performance?

High performance entails designing, constructing, and operating facilities with a strong focus on the following principles:

- ***sustainability***, which is a long-term view that balances economics, equity, and environmental impacts;
- ***an integrated approach***, which engages a multidisciplinary team at the outset of a project to work collaboratively throughout; and
- ***feedback and data collection***, which quantifies both the finished facility and the process that created it and serves to generate improvements in future projects.

Sustainability

The concept of sustainability has been developing and evolving since the 1980's as a strategy that seeks to reconcile the economic, environmental, and equity needs of society. The ultimate goal of sustainability is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." (*Our Common Future*, World Commission on Environment and Development (the Bruntland Commission), Oxford University Press (1987) p. 43.)

Three fundamental concepts of sustainability that relate to the design and construction of the built environment are incorporated into these *Guidelines*:

- Use ***renewable resources*** so that the design, construction, and operation of a facility do not

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deplete non-renewable resources. The best example of a renewable resource is solar power, which is inexhaustible. Another example is wood from a sustainably-managed forest.

• Create ***resource use cycles*** during the design and construction of a facility that mimic how resources are used in nature. This involves setting up and using systems that allow finite natural resources to be used repeatedly. An example is the use of bathroom partitions made of a plastic material that can be melted and reformed into new bathroom partitions.

• Approach the design and construction of a facility using ***systems thinking***. This means starting each design with the understanding that all systems and elements that make up a facility are interconnected and have impacts on the operation and behavior of all the others. Systems thinking has traditionally been a key component of both sustainability and integrated facility design and construction.

Integrated Facility Design and Construction

Integrated facility design and construction recognizes that building systems and components are mutually interdependent, and for a facility to achieve its maximum possible performance, the design of each building system and component must be considered with all other such systems and components in mind. Of all of the principles, means, and methods discussed in these *Guidelines*, the application of integrated facility design and construction will result in the most immediate and dramatic improvement of a new or renovated facility's performance.

One example of integrated design is the collaborative approach that can be brought to maximizing the energy performance of a building. An energy-conscious approach to such issues as building orientation, landscaping, lighting, and windows can reduce building heat load. This means that the size and cost of the mechanical HVAC system and ductwork can be reduced. This in turn means that the height of the ceilings can be lowered, which again may reduce the building heat load. The designers of each building system collaborate until all systems are optimized collectively rather than individually.

Feedback and Data Collection

Continued progress is not possible without quality feedback that can be used to optimize procedures, processes, and techniques. This essential feedback requires accurate data collection and dissemination. Data must be collected that quantifies the performance of systems, the efficiency of processes, and the costs of both. The feedback based on this data may be used to inspire future designers to do even better, convince skeptical decision-makers that high performance buildings are indeed cost effective, or warn practitioners away from processes and materials that do not live up to expectations.

Benefits of Applying High Performance Principles

Some of the features and benefits of applying high performance principles to building design, construction, and maintenance are described below.

(1) ***Reduced disruption of the facility site*** is achieved through careful site impact analysis. Natural watersheds, functional and stable ecosystems, and existing biodiversity are preserved and enhanced to protect the natural services that all life depends upon (such as water retention and filtration, air replenishment and filtration, soil generation, and micro- and macro-climate modulation).

(2) ***Reduced water use and wastewater generation*** can be realized by techniques such as the use of efficient low volume irrigation systems, greywater systems, drought tolerant native plants, careful design of extent and location of landscaped areas, and diverter valves to prevent the loss of water when the hot water faucet is initially turned on. Additional water-saving methods include the use of biological wastewater treatment systems and rainwater collection systems that work to recycle or collect water that previously had not been considered for use. Water conservation has direct cost benefits to the facility owner and indirect benefits to the community by reducing competition for scarce sources of clean water and by minimizing the impact of the facility on the watershed.

(3) ***Reduced energy requirements*** can be achieved through attention to a building's siting and landscaping, the thermal efficiency of the building envelope, and the interaction of the different building systems (e.g., building shell, HVAC, plumbing, lighting, power). Designs that support pedestrians, bicycles, mass transit, and other alternatives to fossil-fueled vehicles are other important energy-reducing measures. Renewable energy sources (e.g., photovoltaic, solar hot water, geothermal exchange) and low emission technologies (e.g., fuel cells) can be used where appropriate and economical. Lower energy use results in direct cost savings over the life of the building and will also result in indirect benefits to the community by reducing the need for additional power generation, reducing associated power plant emissions, and preserving non-renewable fossil fuels.

(4) ***Minimized impact of material use*** can be achieved when the resources that make up building materials and furnishings are harvested, transported, manufactured, installed, operated, and maintained in a manner that is least damaging to the environment. This entails choosing renewable and recycled materials when possible, developing a construction waste management plan, and designing spaces that are durable, flexible, and adaptable to changing technologies and needs. It also entails a design that allows a facility to be easily deconstructed during renovation or demolition so that reusable materials, fixtures, and systems can be reused in the current facility or in another construction project. The surest way to reduce the life-cycle cost of a building is to dramatically increase its lifespan. Waste prevention measures are obvious contributions to direct and indirect cost savings.

(5) ***Improved indoor environment*** can be realized by choosing non-toxic materials, providing

a mix of natural and artificial light, paying attention to appropriate acoustics and the quality of the indoor air, and implementing an environmentally sound operations and maintenance program. A healthy indoor environment yields an increase in occupant productivity and efficiency, a reduction in absenteeism, and a reduction in the risk of liability associated with "sick building syndrome" (building related illness). Given the high cost of salaries and benefits, occupant productivity gains often justify the cost of improvements in indoor environment. For example, a company in Pennsylvania discovered that absenteeism dropped 25% due merely to the installation of energy-efficient lighting. (This and other case studies of productivity increases are detailed in *Greening the Building and the Bottom Line: Increasing Productivity Through Energy-Efficient Design*, by Joseph J. Romm and William D. Browning, Rocky Mountain Institute (1994), downloadable from www.rmi.org.)

Additional Design Issues

In addition to the specific criteria listed in these *Guidelines*, there are a number of other topics that should be considered by the design professional in order to ensure a high performance facility. These topics are not addressed in these *Guidelines* because no objective criteria and scoring have yet been developed. They include universal design, facility flexibility, regenerative design, and crime prevention through environmental design.

- ***Universal design*** yields a built environment that accommodates the needs of people of all ages and abilities, to the greatest extent possible, without requiring specialized design features or facility modifications. Universal design allows more people to use a facility, and it also reduces a facility's resource use over time.

- ***Facility flexibility*** anticipates "uncommitted potential for change" (Gregory Bateson) in the facility's site, structure, or systems, and allows the facility to undergo these changes while using minimal resources.

- ***Regenerative design*** methods create a facility that is able to generate resources (energy, water, fiber, nutrients) to replace, whenever possible, those resources that are depleted by the facility's own operations. Regenerative design reflects an understanding that the built environment must eventually become a net producer of resources to supply resource needs that cannot be met by the limited and valuable untouched areas of our planet.

- ***Crime prevention through environmental design*** creates built environments that are safe to occupy by reducing potential opportunities for criminal mischief. This is accomplished by ensuring natural surveillance, natural access control, and natural territorial reinforcement. These features work together to create a facility that is more safe and consequently more accessible and usable by the community.

Financial Impact

The lesson of previous experience is that total project cost need not increase when high performance principles are applied to facility design and construction. Some projects may experience additional up-front design expenses associated with spending more time to collaborate on and integrate system elements. Any such cost could be recouped over the total project, and more than recouped over the life of the building, given reduced operating costs and increased occupant performance.