Whole Building Design Objectives

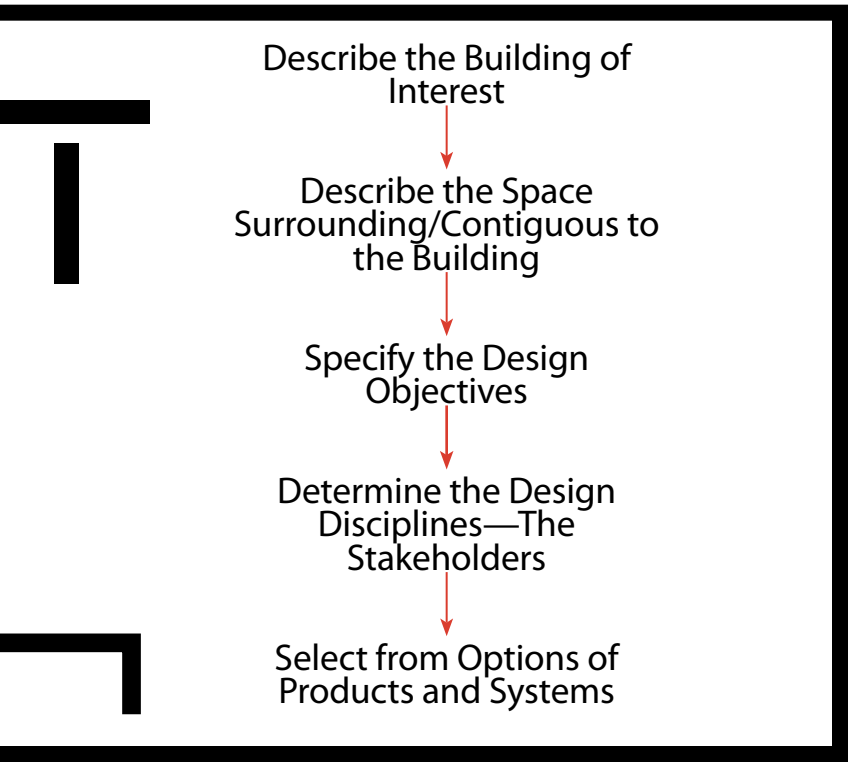
FOR CAMPUS SAFETY AND SECURITY: A SYSTEM DYNAMICS APPROACH

BY CHARLES G. OAKES, PH.D.

The May/June 2009 issue of *Facilities Manager* introduced APPA readers to the Whole Building Design Guide (WBDG)—today's most comprehensive Internet-based depository of resources contributing to a systems approach for everything of a building nature. The emphasis in that article was on Operations and Maintenance (O&M) issues and procedures.

The reader might rightfully ask, "Why is the WBDG approach so important?" The answer partly is explained in the 2009 article: 22.5 million PDF downloads in 2008, at an average of 250,000 visitors a month, with the educational community currently being the fastest growing user sector. Here, market demand for WBDG information is an indicator of emerging industry trends in design issues and particularly issues of a systems nature!

There is more, as explained to me by WBDG's director, Dominique Fernandez, who commented that WBDG's clients increasingly are "systems-conscious." They see each of the building trades impacting on and being impacted by the others; consequently, teaming committed to holistic solutions grows ever more diverse.



FOCUS OF THIS ARTICLE

This article applies WBDG's *Design Guidance Model* (a complement to O&M issues) to address safety and security design needs in the open spaces surrounding and contiguous to education, commercial, and industrial buildings, among others. There are four sections for our discussion:

- WBDG's Design Guidance
- WBDG's Design Objectives
- WBDG's Design Disciplines
- Safety, Security, and System Dynamics

DESIGN GUIDANCE

Architects, engineers, project and facilities managers and other stakeholders can improve the performance of buildings and their outlying campus areas by sequentially applying WBDG's five-step Design Guidance, which we have adapted for this article, as shown here:[1]

Our primary emphasis will be on the systemic relationships among the Design Objectives and, incidentally, how the other elements give perspective to the Design Objectives.

Building Types. Campus buildings, while not being the primary focus in this article, would normally include residence halls, lecture halls, maintenance and office buildings, infirmaries, research facilities, gymnasia, and libraries, to name a few.[2]

Buildings are reference points for the open spaces surrounding or contiguous to them. Building function influences building design and construction. We therefore expect to better understand how open campus areas complement the buildings they surround. A common example is the security-related design of restricted fire lanes contiguous to buildings.

These are required by the *2009 International Fire Code* (hereafter The Code), and every new building is required to have one. Here, the design features pertain to the fire lane and its protected entrance with a barrier but not to the building itself. The building nevertheless dictates the need for the fire lane.

Another common example involves the use of concentric circles of roadway protection to slow incoming traffic to the campus rather than having a straight-on roadway that could be traversed by a speeding explosive-laden vehicle to ram an occupant- and equipment-filled research laboratory.

Space Types. WBDG's Design Guidance cites firing ranges, surface parking and plazas as types of open space.[3] There

are numerous other open spaces for which security designs are frequently specified:

- Playgrounds
- Leisure Parks
- Sports Fields
- Landscapes
- Bus Em/Debarkation
- Traffic Medians
- Trails
- Fire Lanes
- Malls
- Pathways
- Toll Booths
- Site Perimeters
- Roadways
- Building Setbacks
- Traffic Gates
- Utilities Islands
- Bicycle Lanes
- Intersections

DESIGN OBJECTIVES

Unique to WBDG is the requirement that eight Design Objectives be given attention, wherever feasible, to the open spaces.[4] This is new in building science, in that it broadens the idea of what constitutes a "systems" approach to building and site design. (See final section on Systems Dynamics.) The systemic or integrated approach to building design is increasingly being adopted by building professionals and owners inasmuch it has proven to increase the building's sustainability.

Truly successful projects identify goals early on where all building systems are concurrently coordinated through the planning and programming phase. The eight Design Objectives and their interrelationships must be understood, evaluated, and appropriately applied to an open space even as they are to spaces within buildings.

The eight Design Objectives are summarized here:

- *Accessible*: addresses the needs of disabled/ease of movement in general
- *Aesthetics*: addresses appearance and image
- *Cost-Effective*: addresses life-cycle cost, estimating, and budget control
- *Functional/Operational*: addresses spatial needs, system-wide performance
- *Historic Preservation*: addresses needs of historic districts and buildings
- *Productive*: addresses occupants' overall well being and productivity
- *Secure/Safe*: addresses protection of occupants and space from hazards
- *Sustainable*: addresses environmental performance over time.

Because this article focuses on the issue of safe/secure in the context of the WBDG model, it is required to give attention to how safe/secure is integrated with the seven other Design Objectives, which we do in the last section.

DESIGN DISCIPLINES

A traditional approach to determining design team members tends to a more limited membership when compared to one reflective of WBDG's eight Design Disciplines.[5] Take the example of deciding who would be included in designating a protected fire access roadway as required by The Code.

A pre-WBDG-era team would include fire protection engineers, architects, fire marshals (the usual authority having jurisdiction), contractors, and clients. The Code requires some form of movable barrier to block the entrance to the fire lane and preserve its use solely for the fire apparatus and other first responders. Under a WBDG systems model keyed to all eight Design Objectives, there results a substantial increase in the number of stakeholders (indicated by italics below).

- Accessible: Building *safety* or *human resources officers* designate that the fire lane barriers will accommodate persons using wheelchairs
- Aesthetics: *Landscape architects* determine that the fire lane and its barrier style complements surrounding landscape design
- Cost-Effective: *Finance staff* has input into fire lane system life-cycle costing
- Functional/Operational: *Building architect* determines if entrances to building envelope can accommodate first responders or whether entrances require retrofitting, and *authority having jurisdiction* and *first responders* determine if the fire lane can readily be accessed through the barrier under emergency conditions
- Historic Preservation: *City planner* will address the special needs in historic districts and of historic buildings to accommodate fire lanes and barriers, and *city leaders* assure the public that historic qualities are retained
- Productive: The *HR officer* comments on felt security of those working in the protected building, and all *first responders* pass on their ability to perform under fire mitigation conditions
- Secure/Safe: Input by *building safety or security officer* and *representative first responders* to assure hallways and stairwells can accommodate first responders and that the fire lane is free of all obstructions 24/7
- Sustainable: *Landscape architect* and *surveyor* comment on long-term sustainability of area impacted by fire lane and use by first responders.

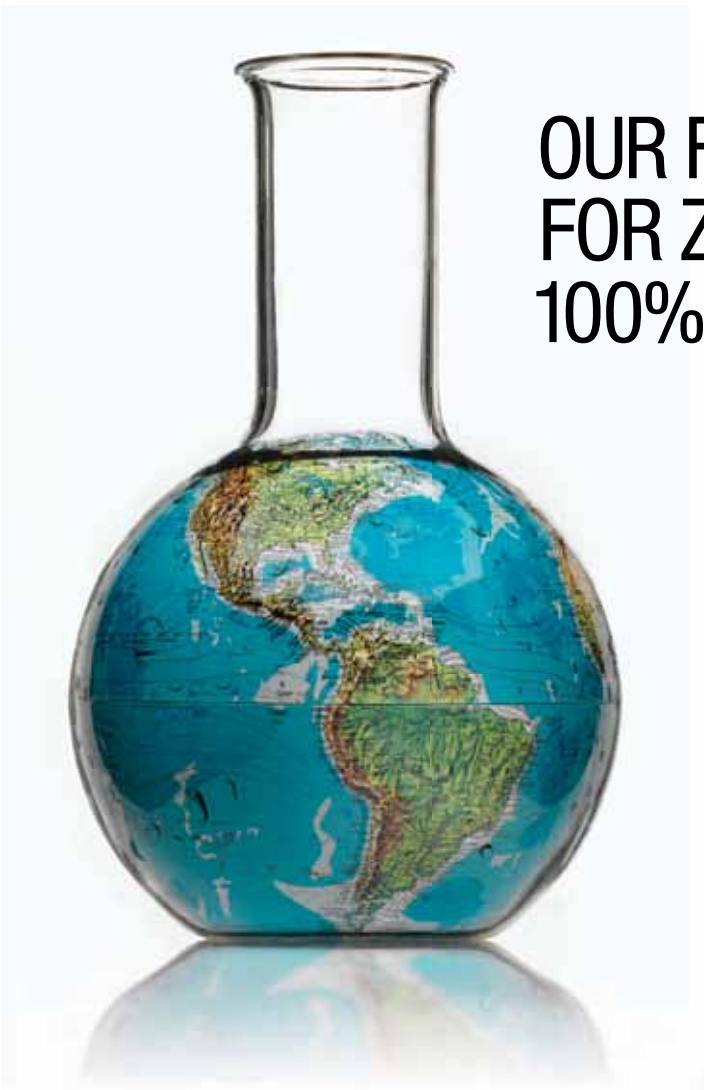
The stakeholders-in-session are the human side of what metrics are to system dynamics.

SAFETY, SECURITY, AND SYSTEM DYNAMICS

The definitions of safety and security are many and often interchanged—contributing to no little confusion for planners and design specifiers. We need a workable generic definition of *each* "safety" and "security" that can be applied across any of the open space environments we listed above. (Actually, we need conceptual clarity for the whole safe/secure industry, but that is for another time. See, e.g., articles from the American Institute of Architects and the Whole Building Design Guide.)[6, 7]

Before there was a "security industry" there was a "safety industry," the latter coming into its own early in the 20th century.

Safety involves whatever contributes to maintaining the "stead state" of a social and physical structure or place in terms of whaever it is intended to do. Safety connotes stability over time, continuity of function, and reliability of structure.



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The content of a steady state for any situation is operationally defined in terms of equipment users' manuals, regulatory codes and standards, an organization's vision and mission statements, structural schematics, personnel policies, or operations manuals.

Security derives from how we define safety or a situation's steady state, thus:

> *Security is the process or means of delaying, preventing, and otherwise protecting against external or internal dangers, loss, criminals, and individuals or actions that threaten to weaken, hinder, or des*troy an organization's steady state, and otherwise deprive it of its purpose for being.

Large campus or open area security programs have been described for university campuses and cityscapes.[8, 9] Our interest is in how they would look as dynamic multi-dimensional systems, encompassing the interactions of all eight Design Objectives.

The concept of System Dynamics had its origin with MIT's Professor Jay W. Forrester in the mid-1950s.[10] Growing out of his experiences as a manager and training as an engineer led Forrester to conclude that the biggest impediment to progress comes not from the engineering side of industrial problems, but from the management side.

Hardly a reader would disagree that his or her participation in a planning charrette did not fail to give evidence of disagreements regarding management styles and/or management content.[11] It was only when Forrester committed variables to impartial computer analysis that the implications of variable interactions came to light: enter the data; commit to statistical analysis; and, *voila*, the digital monster "spits" the findings out—including oft-times unintended consequences! How this resonates with our seasoned managers.

The value of Systems Dynamics and many of its close cousins (e.g., BIM or Building Information Modeling, which more recently is coming into its own) is that it is an analytical step beyond the deliberations of multi-disciplinary charrettes.[12] We would expect all participants of the charrette to include conceptual and arithmetic input to systems analysis.

To illustrate our thesis, we identified one nationwide security program that seeks to protect high value targeted buildings from terrorist attacks by designing a series of surrounding concentric protective circles, the outermost of which encompasses "civilian" residential, institutional, and commercial neighborhoods.[13] As a result of its own charrettes, this program identified about two dozen counterproductive unintended consequences that were feasible once security measures were instituted in the outer zone. We determined the unintended consequences could occur in numerous "campus-like" spaces. Our tasks here are to illustrate how one WBDG Design Objective—Safety/Security—impacts other aforementioned Design Objectives, and to show how these impacted WBDG Design Objectives impact still others in a systemic fashion.

Unintended consequence # 1: Street closures that challenge economic vitality and lessen parking meter and parking revenues:

- Security hardware negatively impacts vitality of downtown stores (*Cost-Effective*, *Functional/Operational*, *Productive*)

Unintended consequence # 2: Lower-quality temporary security solutions that undermine a neighborhood's sense of community, thus promoting fear—the fortress mentality—and impeding *Accessibility*:

- Security hardware negatively impacts neighborhood *Aesthetics*
- Impacted *Aesthetics* lowers property values (*Cost-Effective*)
- Lower property values (*Cost-Effective*) prompts neighborhood flight and store closures (*Functional/Operational*)
- Impeded *Accessibility* to retail outlets impacts shopper volume (*Functional/Operational*).

Unintended consequence # 3: Installing barriers and defensive elements placed in the public right-of-way and convey a feeling of fear and separation from the community:

- Security hardware incites fear in citizens (*Productive*)
- Fear (*Productive*) negatively impacts community interactions (*Functional/Operational*)

SUMMARY

The Whole Building Design Guide, published by the National Institute of Building Sciences, presents eight Design Objectives, which industry leaders recommend to provide a comprehensive set of parameters for building construction and retrofit. The Design Objectives accomplish two other significant tasks beyond their intrinsic value. They expand the usual limited number of stakeholders to a broader spectrum representing all Design Objectives. The interaction among this larger group during charrette deliberations sets the stage for the second task. This is to lay the foundation for formal modeling or Systems Dynamics.

In the informal charrette deliberations, the Design Objectives will be discussed largely in qualitative terms. When interactions among variables are operationally defined in quantitative terms the foundation has been laid for System Dynamics in its formal sense. This applies even to the revealing of unintended consequences.

NOTES

1. Design Guidance, *Whole Building Design Guide*, *http://www.wbdg.org/design/*
2. Building Types, *Whole Building Design Guide*, *http://www.wbdg.org/design/buildingtypes.php*
3. Space Types, *Whole Building Design Guide*, *http://www.wbdg.org/design/spacetypes.php*
4. Design Objectives, *Whole Building Design Guide*, *http://www.wbdg.org/design/designobjectives.php*
5. Design Disciplines, *Whole Building DesIgn Guide*, *http://www.wbdg.org/design/design_disciplines.php*
6. Oakes, Charles G., "Safety versus Security in Fire Protection Planning: The Case of Fire Access Roadways, AIA *Knowledge Net*, January 2009, *http://www.aia.org/practicing/groups/kc/AIAB079791*
7. Oakes, Charles G., "The Bollard," *Whole Building Design Guide*, *http://www.wbdg.org/resources/bollard.php*
8. The University of Texas at San Antonio: 2004 UTSA 1604 Campus Master Plan–Security. *http://www.utsa.edu/ofpd/1604%20master%20plan%20web%20site/i-security.html*
9. *Transportation Alternatives: Rethinking Bollards–How Bollards Can Save Lives, Prevent Injuries, and Relieve Traffic Congestion in New York City.* July 2007. (PDF), *http://www.transalt.org/files/newsroom/reports/rethinking_bollards.pdf*
10. *Origin of System Dynamics*, *http://www.systemdynamics.org/DL_IntroSysDyn/origin.htm*
11. Todd, Joel Ann and Gail Lindsey, "Planning and Conducting Integrated Design (ID) Charrettes," *http://www.wbdg.org/resources/charrettes.php?r=engage_process*
12. Smith, Dana K. and Alan Edgar, "Building Information Modeling (BIM)," *Whole Building Design Guide*, *http://www.wbdg.org/bim/bim.php*
13. U.S. General Services Administration, *Site Security Design Guide*, 2007, Chapter 2, *www.gsa.gov/ssdg*

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