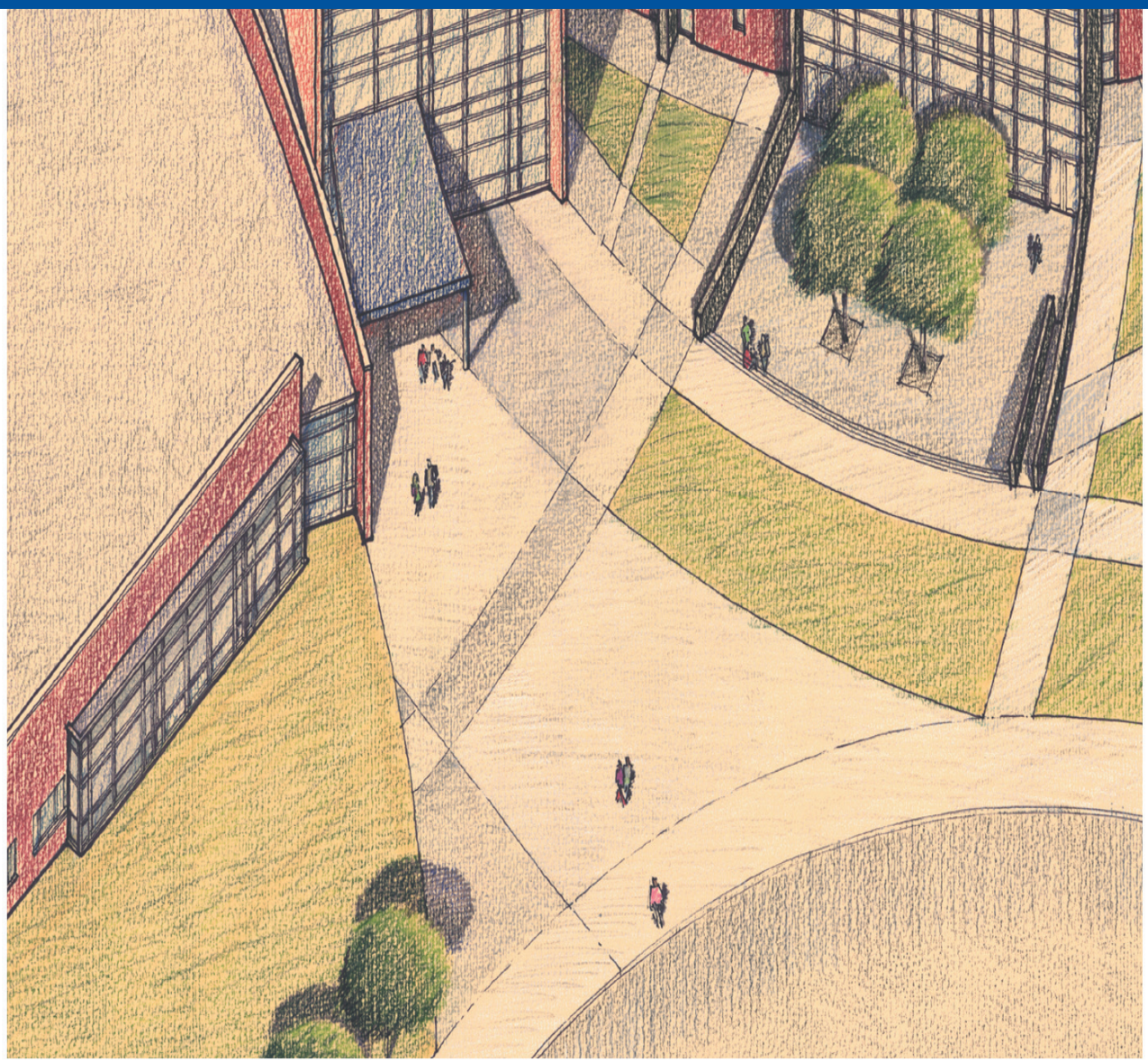
STATE OF NEW JERSEY
DEPARTMENT OF EDUCATION

FACILITIES GUIDE FOR TECHNOLOGY IN NEW JERSEY SCHOOLS



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Section 1. Introduction

The New Jersey Department of Education gratefully acknowledges all members of the advisory group listed in Appendix A. The group represents a cross-section of educators and educational technology professionals whose experience-based perspective, suggestions and comments have been incorporated into this document.

I. Preface

This section provides an overview of the new School Facilities Guide and events leading to its development. It also includes statements about the intent, purpose and goals of this guide.

A. Document Overview

Section 1: Introduction – includes document goals, intended audience and use and critical success factors.

Section 2: Vision and Design Elements – offers higher-level rationale and guidelines for design processes, configurations for learning environments, various guiding assumptions and highlights the new role of schools.

Section 3: School Construction Process – presents the typical design phases used on large-scale projects and provides guidelines for districts to follow regarding technology infrastructure planning.

Section 4: Administrative and Learning Environments – identifies technology resources recommended for use in the various school spaces and learning environments for all learning populations.

Section 5: Standards and Systems – lists applicable code and standards and describes communications services and systems.

Appendices: Acknowledgements, typical schematic drawings, security best practices and other resource material.

B. Department of Education (DOE) Facility Standards for Technology in New Jersey Schools - Background

The guidelines contained herein are intended to replace the information found in a prior document published in 1997.

In July 2007, the NJ Schools Development Authority (SDA) awarded a contract for the fourth and final phase of a multi-phased Information Technologies Infrastructure Consulting Services project. The first three phases of the project were completed in 2006 and involved:

Phase 1: A critical review of two documents: 1) the DOE's *Facilities Standards for Technology in New Jersey Schools* and 2) the "Information Technology" section (Division 17) of the SDA's 2004 Design and Construction Manual, issued as Bulletin 36.

Phase 2: Interviews with key DOE personnel, workshops with key stakeholders and site walkthroughs of representative schools.

Phase 3: A summary of recommended amendments to the DOE *Facilities Standards for Technology in New Jersey Schools* document and the SDA's Division 17 Guidelines.

For the final phase of the project, the recommendations made at the end of Phase 3, along with input from this project's advisory group, have been incorporated into a new document. Sections of this new document will also be referenced in future revisions of the SDA's Design Manual.[1] The online version of this document will have links to other resource documents and information.

C. New Document Goals

Goals for the new facilities guide document are:

- To serve as an up-to-date resource for schools involved in new construction projects or schools with technology upgrade initiatives, including additions and renovations.
- To help schools and districts plan for and make intelligent decisions regarding technology and technology infrastructure (Please note that this document is not prescriptive, but presents recommendations, except where construction code or statutory requirements are cited).
- To insure that key stakeholders are involved in all stages of the technology planning process.

II. Intended Audiences and Use

This document is intended for a broad audience including, but not limited to: school district administrators, school board members, information technology directors, teachers, students, support staff, parents, business representatives, design consultants (i.e. architects and technology consultants). It is to be used as an updatable resource for those involved in new construction, renovations, and technology upgrade initiatives.

A. School Design Team Participants

Individuals who ultimately use and support educational technology systems (i.e. teachers, curriculum supervisors, students, technology staff) should be involved throughout the design process. It is equally important that school administrators with fiscal and managerial responsibilities (i.e. superintendents, business administrators, and principals) participate in the design process in order to understand the project and to be able to support its implementation.

[1] http://www.njsda.gov/business/Doc_Form/PDFsForms/DM.pdf

Design Participant Groups Defined: For purposes of this document, in this, and subsequent sections, the following terms are used:

- Key Stakeholders – Key stakeholders refer to: school/district representatives including the superintendent, board of education/buildings & grounds committee, students, teachers, administrators, curriculum supervisors, support staff, IT staff/IT review committee, and community representatives.
- Design consultant – The architect and/or engineers or other professional services personnel of record providing design services on the project.
- Project team – Team comprises key stakeholders, design consultant, construction manager (if used), project management firm (if used), contractors, and SDA project manager (if a project is being directly overseen by the SDA).

Depending on the size and scope of the project, some or all of the following groups should participate in the technology design/planning process.

- Board of Education Facilities Committee/Superintendent:
  Suggested tasks include: reviewing design alternatives, approving Ed Specs, reviewing construction documents, receiving progress reports during construction. The district should also consult with their Executive County Superintendent (ECS) in order to determine the appropriate level of ECS oversight for construction projects.
- Project Committee of Teachers, Administrators, Curriculum Supervisors and Support Staff:
  Suggested tasks include: taking part in programming meetings with design consultant, reviewing construction documents, receiving progress reports.
- IT staff/IT Review Committee:
  Suggested tasks include: taking part in all technology design meetings with design consultant, reviewing and approving all iterations of technology-related design documents, receiving progress reports.
- Students, Community
  Suggested tasks include: taking part in programming meetings with design consultant. Students and community may be invited to join the review committee.

The concept of key stakeholder involvement is covered in depth in Section 3 of this document.

III. Critical Success Factors

For new technical guidelines to be most effective, they need to be accompanied by a commitment from the DOE, the SDA, and the districts to support and nurture additional areas that have been identified as critical success factors.

A. Leadership & Vision

Teachers and technology coordinators require a clear vision of 21st century teaching and learning environments and how the school and district leadership can meet this vision. Superintendents and principals need an equally clear vision as to the role of technology with respect to the improvement of teaching and learning, and how it supports the various noninstructional operations of the school. Without this vision and leadership, critical driving forces are missing. A quality technology plan that is understood and used by all levels of leadership and all stakeholders is the best tool for documenting the school's technology vision.

B. Professional Development

A 21st century teaching and learning community requires professional development in order to properly leverage the power of a 21st century educational facility. Merely adding wires, technologies, and software applications will not change the way teachers teach or students learn. School staff must be provided with ongoing and sustained professional development based on current research and best practices in order to enhance the integration of technology into the classroom. If professional development is made a part of the district vision and is supported with time, resources, and opportunity, then the efforts of the technology planning and design groups have a greater likelihood for success. To obtain maximum value from professional development efforts, there needs to be a follow-up process that links professional development activities to actual classroom practices. The use of teacher mentoring and master teachers to support teaching staff is recommended. It is also reasonable to expect that incoming teachers officially attain a certain level of educational technology skills, such as NETS for Teachers (NETS-T), through preservice preparation.

C. Technical Support and End- User Support

The impact of specific infrastructure design strategies should be linked to the technical support required to maintain systems over time. Districts with limited technical support budgets and staff need to clearly understand the implications that design decisions have on technical support needs. Districts should look to implement remote desktop management automation tools that can reduce travel time and allow the typical tech support employee in NJ Schools, who is responsible for multiple, geographically dispersed schools, to more effectively maintain sites.

D. Effective Turnover of Facility

At the end of a large-scale construction project, it is important that the principal, teachers, administrators, and school district support staff fully understand the characteristics of the new or renovated facility and how to use it effectively. Commissioning [2] of major building systems is part of most construction projects. However, commissioning of technology systems has not typically been part of the building commissioning scope of work.

To ensure that technology systems moneys are used effectively, regular audits and random site checks should be made. The subject of technology commissioning is addressed further in Section 5 of this document.

[2] Building commissioning is the systematic process of ensuring that a building's complex array of systems is designed, installed, and tested to perform according to the design intent and the building owner's operational needs.

Section 2. Vision and Design Elements

School facilities must be designed and built to help support the preparation of students to be productive citizens in the 21st century world we know today, yet have lasting capacity and flexibility to prepare students for a future we have just begun to envision.

This section of the facilities guide includes the following subsections:

- The Design Process
- Revitalizing Learning Environments with Educational Technology
- Guiding Truths and Assumptions
- New Role of Schools

I. The Design Process

The design of technology-rich classrooms and schools has to be a collaborative process and the voice of a broad spectrum of stakeholders must be heard in all of the planning and design stages. Teachers, students, technology staff, administrators, support personnel, board of education members and community members will provide valuable input when engaged properly. There should, however, be a process for developing an overarching philosophy regarding educational technology that all parties agree meets the vision of the district and the Department of Education. Key stakeholder involvement during the design process is further discussed in Section 3 of this document.

One of the several challenges faced by the design consultant is that of creatively balancing the need for flexibility and future proofing against the constraint of a project budget. There is no single classroom design that can offer the "right" solution for all circumstances. Nor is it possible to see into the future and discover what teaching methods and educational technology components will be used ten years from now. The design consultant must gather as much information as possible through research and outreach to the key stakeholders and use current best practices that reflect existing and emerging technology standards.

A. Design Process and Philosophy for Educational Spaces

One of the key objectives of this facilities guide is to provide information to help districts ensure that their technology infrastructure and systems are educationally adequate, include room for expansion, and are driven by the programmatic needs of the district, school, teachers, and students. The design process for a school building begins with the formulation of a building program based on information gathered from all key stakeholders. The information gathered is organized and presented within a document called the educational specification (Ed Spec).

During the formulation of the Ed Spec, the design consultant should engage all stakeholder groups and elicit from them information on a wide array of issues. Information gathering methods that have proven successful in the area of educational technology include the following:

- Forming a committee of teachers, administrators, support staff, students, board of education members and community members who represent all stakeholders involved with school use and function.
- Collecting input from the community at large via town hall discussion, survey, or other strategy that has proven effective in the past.
- Organizing onsite or virtual (if available) visits to newly built and retrofited schools or classrooms.
- Holding small-group work sessions where ed spec committee members collaborate on room layouts and device locations for a variety of room types.
- Reviewing previously developed planning documents, such as the current technology plan, long-range facilities plans, district strategic plan, New Jersey State Educational Technology Plan, and the National Technology Plan. Technology plan documents often contain language that can be adopted for the overarching educational technology philosophy statement referred to previously.
- Arranging for presentations (onsite and virtual) by experts who specialize in K-12 technology vision, products, and services.

Discussions must also take place regarding how the school/district's special education populations, at-risk populations, English Language Learners and students receiving remote services will be accommodated. Specialists in the area of assistive technologies and universal access/universal design techniques should also be included in discussions of spaces for special populations.

B. Total Cost of Ownership (TCO)

No school should be built without a plan for ongoing upgrades and maintenance of the resources installed. The focus should be on minimizing the total expenditures over the life of the system. This may mean that a more expensive, yet also more efficient, system should be initially acquired in order to take advantage of reduced operation and maintenance costs later on. Spending additional money up front to design flexibility and accessibility into building plans is money prudently invested when compared to the cost of retrofitting classrooms and labs after construction is complete.

Current strategies to address reducing long-term costs at the onset of planning include designing schools that take full advantage of natural resources, environmentally friendly solutions, and SMART design concepts. More information on these topics can be found at the following Web sites:

- Energy Star, Schools, An Overview of Energy Use and Energy Efficiency Opportunities, http://www.energystar.gov/ia/business/challenge/learn_more/Schools.pdf
- School Planning & Management, April 2008 Special Green Issue, Estimating the Cost of LEED in Schools and Green Schools from A-Z, http://www.peterli.com/spm/cover/tocspm.pdf
- US Green Building Council, LEED for Schools, http://www.usgbc.org/DisplayPage.aspx?CMSPageID=1586

- Build Green Schools, LEED for Schools – For New Construction and Major Renovations http://www.buildgreenschools.org/documents/leed-s_ratingsystem.pdf
- AIA – The American Institute of Architects, Sustainability, http://www.aia.org/susn_rc_default
- DSIRE – Database of State Initiatives for Renewable & Efficiency, Energy Efficiency in New School Construction, http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=NJ14R&state=NJ&CurrentPageID=1&RE=1&EE=0

As detailed in Section 3 (School Construction Process) of this document, the design consultant is responsible for providing cost estimates at various stages of the project. The IT staff/IT review committee should review equipment and installation estimates and also seek estimates on upgrade and replacement cycles and ongoing maintenance costs.

Technical support and end user support staff costs must also be considered when calculating TCO. Districts must understand the impact of various educational technology system choices on the IT staffing requirements. For example, a decision to give wireless laptops to a large group of students requires that additional support staff and/or computer maintenance costs be added to the TCO equation. Another example would be the extra dollars and time spent on supporting older equipment. A decision not to spend money on new computers is not necessarily a no-cost decision.

Although the primary intent of this document is to address infrastructure design and implementation which should serve the district for 10+ years, it is also the responsibility for each district to establish, implement, and fund a refresh cycle for computing resources. Even the most robust infrastructure will not be able to compensate for aging desktop and laptop devices over time.

Tools that will assist in the TCO process can be found at:

http://classroomtco.cosn.org/ and www.iaete.org/tco

II. Revitalizing Learning Environments with Educational Technology

The technology infrastructure of the 19th and 20th centuries is no longer keeping pace with the needs of the 21st century learner. New, flexible environments that encourage communication, collaboration, production, and innovation are required to support student learning of core content knowledge using 21st century tools, while also developing critical 21st century skills to meet the NJDOE vision of a 21st century education.

This section of the facilities guide focuses on how school designs must respond to:

- Educational Technology Advances
- The Need for High Speed Connectivity
- Ubiquitous Access to Computing Resources for Teaching and Learning

A. Educational Technology Advances

The Department of Education's ongoing vision for educational technology in New Jersey's Schools is documented in *Preparing Today for Tomorrow: The Educational Technology Plan for New Jersey* (http://www.state.nj.us/education/techno/state_plan.htm). This plan documents the role of educational technology in promoting students' academic achievement. (See Appendix C)

The educational technology information presented in this guide is intended to complement and align directly to the vision statement presented in the "New Jersey State Educational Technology Plan". This **vision statement** reads:

All students will be prepared to meet the challenge of a dynamic global society in which they participate, contribute, achieve, and flourish through universal access to people, information and ideas.

The following statements further articulate the benefits that educational technology will bring to the 21st century:

- Learners will experience quality time-on-task and access resources using one-to-one networked computing classrooms and learning environments. They will engage in self-learning through Web-based research, collaborative work, critical thinking, and problem-solving activities with real-world, culturally-relevant, and appropriate content in all subject areas.
- All learners will benefit from personalized and managed learning around their interests, developmental levels, and preferred learning styles and modalities.
- Diverse and technology-rich learning resources will enable students to coordinate where they prefer to learn to what they want to know; how they learn best; and when they need to learn. They will use a wide variety of learning technologies that include graphing calculators, portable computing devices, handheld computers, mini-laptops/ultra portables, interactive white boards, digital cameras, and a wealth of other content-specific digital resources.
- Students will benefit from learning opportunities that include technology-rich environments that mirror the way that technology is used within institutions of higher education, the workplace, and in the global community.
- Schools will be viewed as an integral part of their neighborhoods and communities, allowing the community into the school and the school into the community. School facilities will provide a meeting space for community activities and a learning space for people of all ages to grow together, while representing a shared community vision of contribution through collaboration.

B. High- Speed Connectivity

In 2008, SETDA (State Educational Technology Directors Association) issued a report entitled "High-Speed Broadband Access for All Kids: Breaking Through the Barriers". In that report, SETDA identified several issues facing the educational community related to high-speed connectivity. Some of the key issues follow:

- Teachers and students need high-speed broadband access in their schools to take advantage of a wide range of new and rich educational tools and resources available for learning anytime, anywhere.
- Teachers need high-speed broadband access for professional development, and engaging in professional learning communities, as well as accessing new educational resources, such as curriculum cadres and education portals.
- Administrators need high-speed broadband access to conduct online assessments and to access data for effective decision making.
- Students need high-speed broadband access to overcome the digital divide in rural and low socio-economic areas.

To address these issues, SETDA made the following key recommendations:

In a technology-rich learning environment for the next 2-3 years, SETDA recommends:

- An external Internet connection to the Internet Service Provider of 10 Mbps per 1,000 students/staff
- Internal wide area network connections from the district to each school and between schools of at least 100 Mbps per 1,000 students/staff

In a technology-rich learning environment for the next 5-7 years, SETDA recommends:

- An external Internet connection to the Internet service provider of 100 Mbps per 1,000 students/staff.
- Internal wide area network connections from the district to each school and between schools of at least 1 Gbps per 1,000 students/staff.

NOTE: It is recommended that districts consider taking the 5-7-year perspective for technology infrastructure project planning purposes.

The full broadband report can be found at:
http://www.setda.org/c/document_library/get_file?folderId=270&name=DLFE-211.pdf

Additional SETDA reports can also be found at:
http://www.setda.org/web/guest/2020

C. Ubiquitous Access to Computing Resources for Teaching and Learning

Districts across the nation are implementing and evaluating a variety of approaches that allow students ubiquitous access to computing resources for teaching and learning. These approaches have been referred to as anywhere, anytime learning, one-to-one computing, laptop learning, or 24/7 access. In as much as the names differ, so do the possible approaches to achieving ubiquitous computing for the range of pre-K through high school students. The purchasing, funding, and dissemination strategies differ as do the computing devices, software alternatives, and network access.

Before exploring specific technology devices available in the educational marketplace, it is important to define the differing one-to-one environments and access strategies that can be created. The device might be any one of those described in greater detail in the next section, including a graphing calculator, handheld computer (PDAs), mini laptop/ultra portable, or laptop/tablet computer. Flexible use of these options may meet the various needs for differing learning audiences and communities:

- **Classroom- on- demand access:** This approach describes an environment where the classroom teacher can create a one-to-one ratio of learning devices to students within their classroom (or a cluster of classrooms) with little difficulty. For example, devices are used from class to class, and although the same device might be consistently assigned to specific students for tracking purposes, the students do not generally keep the device with them.
- **One- to- one access within the school environment:** This approach describes a strategy where students are assigned a learning device that they keep with them throughout the school day. Students in middle and high school take the device with them from class to class, using it for projects, note taking, scheduling, research, and content-specific activities. At the end of the day, the devices are returned to a central, secured location for recharging overnight. In this model, the learning devices generally do not leave the school facilities or leave on a case-by-case basis only.
- **One- to- one access 24/7:** This approach describes a strategy where students are assigned a specific learning device that they keep with them throughout the school year. They are generally allowed to take the device home as needed to complete assignments and conduct research.

Different learning devices are available for different developmental age groups, distribution/access approaches, and networking strategies. Providing a device per child by purchasing classroom sets of these individual computing devices has proven effective and even affordable. This section presents an overview of three different one-to-one strategies available for in-depth investigation by New Jersey Schools

1. Less than fully functional computing devices selling for under $200 per device that serve a specific purpose or complement fully-

functioned computers, for example, Neo[3], Dana, the Leapfrog collection, graphing calculators.

2. Mini-laptop/ultra portable computers with networking capacity currently priced from $200 to $400 per device, but expected to drop as demand and production increases (for example the XO One Laptop Per Child device, Intel's Classmate PC, Asus Eee PC, HP's mini-laptop).
3. Fully featured portable laptop computers or tablets that are Internet-ready, using wireless technology to connect to networks and the Internet available for less than $1,000 per device in volume purchases.

In the near future, students and parents will expect school resources for all students to include wireless portable devices that provide high-speed access to a broad array of educational, informational, recreational, and social-networking tools.

An overview of these one-to-one computing resources is included in Section 4. Administrative and Learning Environments, Subsection II. Instructional Environments, B. Ubiquitous Computing Strategies.

Benefits and Challenges

The *benefits* of employing portable one-to-one computing solutions are numerous:

- Resources can be moved ondemand to minimize down-time of technology resources and maximize return on investment.
- Mobile devices can be used, put away and reused as class time and activities require, becoming more of a learning tool and less the focus of instruction.
- Wireless and infrared capacity supports the sharing and "beaming" of information from student to student.
- Resources can be taken from within the classroom into the world to collect data outside, on field trips, in the halls, and in other environments not equipped with computing resources.

Likewise, a number of *challenges* have also been identified, examples include:

- Smaller and more portable devices that are more vulnerable to theft, damage, and loss.
- Longevity of rechargeable and conventional batteries and the need to continuously recharge batteries in a logical fashion can cause usability issues with shared resources.
- One-to-one computing environments that increase demand on infrastructure and bandwidth.

[3] Please note: throughout this guide a number of commercially available educational computing devices are listed as examples. This is in no way intended as an endorsement for these specific products, but is necessary in order to properly describe the growing field of mobile computing devices and instructional technologies that currently populate schools across the nation. It is acknowledged that, given the pace of technology change, the devices mentioned may be replaced or obsolete in the near future. Such instances will be addressed in subsequent revisions to this facilities guide.

- Movement of carts or cabinets in multiple-level facilities can raise safety concerns, as well as access issues in modular and relocatable classrooms.
- Ongoing maintenance of portable devices can also become a challenge for school tech support staff, if not properly planned and managed.
- Staying current with appropriate devices can be a challenge for schools with limited flexibility in budgeting resources.

III. Guiding Trends and Assumptions

The following are some technology-related trends and assumptions upon which this document is based:

A. Moore's Law

The original extrapolation made by George Moore in 1965 stated, "Since the invention of the integrated circuit in 1958, the number of transistors that can be placed inexpensively on an integrated circuit has increased exponentially, doubling approximately every two years". For the purposes of this document, the ongoing rapid advance in computing power per unit cost is acknowledged. This continuing processing power increase impacts a school's local and wide area networks and needs to be considered by the design consultant.

B. IP Convergence

The term *convergence* is commonly used in reference to the synergistic combination of voice and telephony features, data and productivity applications, and video onto a single network. These previously separate technologies are now able to share resources and interact with each other creating new efficiencies.

As more devices, such as surveillance cameras and hallway speakers, are made to run via Internet protocol (IP), IP convergence will continue to grow along with the need for bandwidth, which will increase the importance of efficient/effective use of that bandwidth. Networks should ultimately be designed to deliver broadband high-speed access to the desktop, in addition to supplying enough bandwidth for convergence.

C. Power, Cooling and Space Planning

IP Convergence, wireless devices and applications and higher-speed network devices will continue to grow and evolve. The equipment racks and spaces that hold or support these devices will require more power, more cooling and strategic space allocation, though the use of virtual server technologies can help reduce costs. Early design-stage planning of architectural and engineering requirements will be critical.

D. Wireless Impact in Educational Facilities and the Community

Wireless devices will continue to proliferate. The growth will not be confined to computing and communication devices, such as laptops, handhelds, and cell phones. Wireless technology will continue to spread to other disciplines that include: wireless clocks, wireless security cameras, wireless audio visual systems, interactive response etc. The required wireless coverage area will expand

outside the walls of the school to encompass courtyards, play areas, athletic fields and parking lots and thereby impact the neighboring community.

E. Protecting What Matters Most – Data and Physical Security Planning

The importance of securing data for students, teachers and administrators will increase as more applications and content are created and stored on the network. The tolerance for network downtime will decrease.

The physical security of students, school personnel, and school property will continue to be of paramount importance and command greater design and budgetary attention during the planning stages.

F. Interactive Technologies

Web 2.0 type tools (i.e. wikis, blogs, podcasts) will continue to gain a larger foothold in the teaching and learning environment. Likewise, multi-user virtual environments (MUVEs), such as Second Life, will bring lifelike worlds into the classroom. Avenues for incorporating online, interactive gaming technologies, both the use of and creation of by students, need to expand. The design consultant must recognize that these technologies impact bandwidth use and school/district administrators must consider these interactive technologies when developing acceptable use and filtering policies.

G. One- to- one Computing

Equitable student access to laptops, tablets and other handheld devices will continue to increase both onsite and offsite. Planning committee discussions, design consultant programming efforts and supporting infrastructure design must all reflect this concept.

H. Home/Remote eLearning /Virtual Learning

Planning processes, infrastructure, communications systems, and AV systems must all anticipate an increase in alternative learning/teaching locations that may occur twenty-four hours a day, seven days a week. As stated in Section F above, this increase presents issues for both the technology system/network designers and the policy makers.

IV. New Role of Schools

Twenty-first century schools must prepare students to compete in an increasingly global marketplace where innovation, information, and services are as highly valued as manufacturing products were one hundred years ago. This changing role places new demands on facilities, staffing, and resources as needs and audiences grow and change. This section of the facilities guide focuses on how schools/districts must respond to the following:

- New School Spaces for Evolving Roles
- New School Spaces for New Literacies
- Identifying Traditional and Non-traditional Activity Areas for New Audiences

A. New School Spaces for Evolving Roles

Students of the 21st century are life-long learners and can no longer be successful as passive recipients of knowledge focused only on processing prescribed information. Rather, they must assume the role of seeker and processor of information and creator of knowledge. As stated by former President Bill Clinton, "…what you earn depends on what you can learn. Not only what you know today, but what you are capable of learning tomorrow."

The *National Educational Technology Standards for Students* (NETS·S), revised in 2007, states very clearly on page 6 of the second edition booklet, "The World Has Changed and So Must We". Included in the NETS·S booklet is the below updated version of "traditional" versus "emerging" environments required to support 21st century learning and learners.

From the NETS·S booklet, the following chart lists characteristics representing traditional approaches to learning and corresponding strategies often associated with new learning environments.

Traditional Environments		***Emerging Learning Landscape***
Teacher-directed, memory-focused instruction	→	Student-centered, performance focused learning
Lockstep, prescribed-path progression	→	Flexible progression with multipath options
Limited media, single-sense stimulation	→	Media-rich, multisensory stimulation
Knowledge from limited, authoritative sources	→	Learner constructed knowledge from multiple information sources and experiences
Isolated work on invented exercises	→	Collaborative work on authentic, real-world projects
Mastery of fixed content and specified processes	→	Student engagement in definition, design, and management of projects
Factual, literal thinking for competence	→	Creative thinking for innovative and original solutions
In-school expertise, content, and activities	→	Global expertise, information, and learning experiences
Stand-alone communication and information tools	→	Converging information and communication systems
Traditional literacy and communication skills	→	Digital literacies and communication skills
Primary focus on school and local community	→	Expanded focus including digital global citizenship
Isolated assessment of learning	→	Integrated assessment of learning

The traditional classroom with rows of desks, a schedule of 50-minute classes, and curriculum consisting of memorization of discrete facts no longer aligns well with this vision of the *emerging learning landscape*. Instead, public education needs to embrace spaces that are flexible and promote group and collaborative efforts; schedules that allow for engaged, project-based learning; and curriculum that encourages interdisciplinary and cross-curricular research and exploration.

B. New School Spaces for New Literacies

The requirements for enhanced learning environments are defined by our changing world and the literacies necessary to be successful and productive citizens and workers. Nationally recognized groups, such as the International Society for Technology in Education (ISTE), the Partnership for 21st Century Skills, and many other corporate/education partnerships have comprehensively articulated these literacies. An overview that outlines the current thinking with respect to "new literacies" by respected professional organizations is located in Appendix B. More detailed information may be found on each respective Web site.

21st Century Skills and ICT Literacy

The *Learning for the 21st Century* report published by the Partnership for 21st Century Skills (www.21stcenturyskills.org) presents six **Key Elements of a 21st Century Education** that help define the requirements for 21st century learning environments:

1. Emphasize core subjects.
2. Emphasize learning skills.
3. Use 21st century tools to develop learning skills.
4. Teach and learn in a 21st century context.
5. Teach and learn 21st century content.
6. Use 21st century assessments that measure 21st century skills.

See Appendix B for more information on this subject.

NETS•S ~ National Educational Technology Standards for Students (Second Edition 2007)

The second edition of the NETS•S standards (www.iste.org/nets) was released in the summer of 2007. The newly released standards place greater emphasis on skills and expertise and less focus on the technology tools themselves.

These standards address six foundation areas:

- Creativity and Innovation
- Communication and Collaboration
- Research and Information Fluency
- Critical Thinking, Problem-Solving, and Decision-Making
- Digital Citizenship
- Technology Operations and Concepts

NETS·S also identifies thirteen essential conditions necessary to effectively leverage technology for learning. These essential conditions validate the critical success factors listed in Section 1 - III of this document.

Links to the New Jersey State Technology Plan

The recommendations and standards outlined in this facilities guide are intended to support and align directly to the goals presented in the New Jersey state technology plan. (*Preparing Today for Tomorrow: The Educational Technology Plan for New Jersey*)

The four New Jersey state **goals** for the integration of technology are:

GOAL 1: All students will be prepared to excel in the community, work place and in our global society using 21st century skills.

GOAL 2: All educators, including administrators, will attain the 21st century skills and knowledge necessary to effectively integrate educational technology in order to enable students to achieve the goals of the Core Curriculum Content Standards and experience success in a global society.

GOAL 3: Educational technology will be accessible by students, teachers and administrators and utilized for instructional and administrative purposes in all learning environments, including classrooms, library media centers, and other educational settings such as community centers and libraries.

GOAL 4: New Jersey school districts will establish and maintain the technology infrastructure necessary for all students, administrators and staff to safely access digital information on demand and to communicate virtually.

This facilities guide is a resource developed by the state to support the many audiences involved in new school design, construction, and renovations/retrofits as noted in the examples of assistance that will be provided by the NJDOE.

C. Identifying Traditional and Non- traditional Activity Areas for New Audiences

This section of the Facilities Guide presents an overview of traditional and non-traditional activity areas for students, parents, and community members. The topics addressed include:

- "Anytime, Anywhere Learning"
- Serving Multiple Audiences, Each with Multiple Roles
- Students and Teachers as Producers of Content
- Community Learning and Gathering Spaces

The impact on facilities design of these traditional and nontraditional activity areas are presented in greater detail in Section 4 of this guide.

"Anytime, Anywhere Learning"

Definitive research supporting the integration of instructional technologies to improve student academic performance has been a challenge for school districts across the nation. Finally, a few large-scale projects that have been carefully and closely monitored and evaluated are offering definitive results. In fall 2007, the Maine one-to-one laptop program (launched in 2002) announced improved scores on writing skills assessment. "The first in a series of studies aimed at evaluating Maine's pioneering laptop program, *Maine's Middle School Laptop Program: Creating Better Writers* concludes that the use of laptops improves scores on writing skills assessments, that more frequent use is linked to higher scores, and that writing skills of laptop users transfer to writing without a laptop." The full text of this article titled, *A research study from the University of Southern Maine shows that the state's one-to-one laptop program improves scores on writing skills assessments*, by Mary Axelson can be found at: http://www.k12blueprint.com/k12/blueprint/story_good_news_from_maine_about_the_impact_of_laptops_on_writing_skills.php . The full research report by the Maine Education Policy Research Institute (MEPRI) at the University of Southern Maine is located at: http://www.usm.maine.edu/cepare.

Harvest Park Middle School, located in Pleasanton Unified School District in Pleasanton, California, established its Laptop Immersion Program in 2001. Results indicate that Harvest Park Middle School students in the Laptop Immersion Program attained higher GPAs and end-of-course grades than nonparticipating students in their respective grades. Also, a substantially higher percentage of laptop students met or exceeded grade-level expectations in writing compared to Harvest Park school-wide averages and district-wide averages. And lastly, the California State Tests results indicate that a notably higher percentage of students enrolled in the Laptop Immersion Program at Harvest Park Middle School, across all grade levels, met or exceeded state content standards in English-language arts and mathematics when compared to their non-laptop counterparts.[4]

To support "anytime, anywhere learning", wireless networks, remote access, and one-to-one initiatives are encouraged in all schools.

Serving Multiple Audiences, Each with Multiple Roles

From early learner to adult, the 21st century learner experiences multiple roles and a wide variety of opportunities for learning. Throughout the school day, the learner may assume the role of writer, mathematician, scientist, musician, artist, researcher, producer, publisher, entrepreneur, or inventor. It is the responsibility of school district leadership to provide developmentally appropriate and challenging learning environments to support the work of its learner population in the many roles it is likely to assume during the course of its learning experience. Learning environment configurations with the capacity to address such diversity must be flexible, adaptable, powerful, and sophisticated, yet intuitive enough for an intended audience to use with ease. The following provides examples of the ways in which technology resources support the multiple roles of the 21st century learner.

[4] James Cengiz Gulek & Hakan Demirtas, "Learning With Technology: The Impact of Laptop Use on Student Achievement", The Journal of Technology, Learning and Assessment, Volume 3, Number 2 · January 2005

Mathematician

The world of the mathematician includes mastery of basic computation skills, practice with gathering, manipulating, and interpreting numerical quantities, contexts to write and communicate mathematical ideas, and real-world opportunities to apply his or her skills.

Scientist

The scientist learns to ask questions, theorize, develop hypotheses, and conduct experiments in an attempt to support or refute ideas. The scientist's ability to access research data in his or her field of studies, consult and collaborate with local, national, and global experts, collect, store, and manipulate findings for analysis, and present findings in a logical and understandable format for global peer review are greatly enhanced by technology resources.

Explorer/Researcher

As Internet access spreads and bandwidth increases, international borders seemingly disappear and our world appears to grow ever smaller. Whether the topic of his investigations includes the study of history, geography, government, or economics, the student researcher of the 21st century must master navigation, selection, critical thinking and evaluation, information discrimination/validation, documentation skills, and publishing for global peer review.

Writer/Publisher/Presenter

From the creation and publication of a child's first story to the production of a high school yearbook, writing and publishing tools have infiltrated educational learning environments across the nation. Publishing houses in elementary schools are busy laminating stories written and illustrated with easy-to-use word processing programs. Middle-school students regularly produce and publish weekly or monthly school newsletters. At the high school level, students are engaged in professional quality desktop publishing and graphic design activities for community businesses and organizations.

Arts and Music

The study of fine arts, composition of musical arrangements, and creation of artistic works can be enhanced and supported with learning environments rich in arts and music digital devices and applications. The primary learner begins with easy-to-use, yet powerful point and click applications, while middle and high school students frequently have access to nearly commercial-quality graphic design, MIDI resources, live recordings and videos.

Global/Health Citizen

The concepts of personal wellness and individual participation in a global community begin in the earliest grades, and are reinforced throughout the school years. Beginning with a basic knowledge of food groups and nutrition and progressing to a complex understanding of body functions, chemistry, and systems, multiple technologies support health and physical education programs. The ability to communicate online with peers and experts globally and locally significantly enhances our understanding of other cultures and nations.

Entrepreneur/Inventor/Engineer

The popularity in 2008 - 2009 of national and global programs such as Olympics of the Mind (OM), Thinkquest, Destination Imagination (DI), FIRST Lego League (FLL), FIRST Vex Challenge, (FVC), and the FIRST Robotics (FRC) competitions coupled with school-based Invention Conventions highlight the power and potential of technology resources to create, test, and refine inventions, as well as design, develop, produce, and market products, or identify and solve problems.

Lifelong Learner

Gifted or challenged, young or old, novice or expert, each of us are travelers on a lifelong learning journey. The appropriate use of and access to technology resources gives individuals in all stages of life, all occupations, and interest levels vast information resources, powerful productivity tools, easy communication channels, easy-to-use organizers, and exciting methods of expression and global outreach.

Students & Teachers and Producers of Content

Students and teachers have become co-learners and partners in learning and knowledge creation. No longer just a consumer of content, the 21st century learner is also a producer and publisher of important content that should be shared with local, national and global audiences. Projects and research result in products that may be created in a variety of digital formats including text, audio, video, and Web site content. Just a few examples include:

- Think.com is now part of ThinkQuest -- A learning platform where teachers and students create learning projects, participate in a Web site competition, and browse a library of student projects http://www.thinkquest.org/en/
- Powerful and moving videos created for the Mabry Film Festival by students at the Mabry Middle School in Mabry, Georgia (http://mabryonline.org/archives/2007/04/2007_film_festi.html).
- The Flickschool program started by Marco Torres and Veronica Marek located in San Fernando, California, comprised of the San Fernando Education Technology Team (SFETT) that also engages students in exciting and compelling video production (www.sfett.com/)
- Exemplary Web sites and animations created annually by high school students as a component of the FIRST Robotics Competition (FRC) (www.usfirst.org)

Resulting songs, animations, videos, Web sites, and presentations all require digital tools and space, resources, supervision for development and server space for storage, management, and distribution of final products.

Community Learning and Gathering Spaces

As district leadership explores strategies to extend the use of school resources to members of their greater community, they need to consider the impact of these audiences on the resources to which they will desire/require access and facilities they will frequent. External access to and from frequented areas,

security for the remainder of the building, and technical support and staffing during nontraditional school hours all impact school design considerations.

Recommended configurations and technology components for these areas that the community will access are discussed in greater detail in Section 4:

- Instructional Environments – classrooms, computer labs and computer classrooms
- Shared Environments - library media center, distance and virtual learning environments, and video production and distribution environments
- Large Group Environments - auditorium/theater, cafetorium/multipurpose area, gymnasium/athletic field

Access by multiple audiences during nontraditional school hours will require facilities that present models of **flexible use of space** and include **strategic placement of technology resources.** New school facilities should be planned and designed with the anticipation that they will be open before and after the traditional school day. Access, egress, and security strategies need to be considered in the total design process.

Section 3. School Construction Process

This section defines, in generic terms, the typical design phases of a construction project and provides recommended guidelines for schools and districts to follow when doing technology cabling, hardware and software planning. It includes the main design and construction phases and as such, is applicable to those schools or districts involved in large-scale construction/renovation projects. However, the concepts and recommendations regarding proper planning and key stakeholder involvement are also adaptable and applicable to smaller-scale projects that involve technology upgrades.

The main goal of this section is to provide strategies for injecting the input of various school and district personnel into the design process. These guidelines are not intended to supersede the requirements of the New Jersey Schools Development Authority (SDA). Projects that fall under the full control of the SDA must comply with all requirements of the current SDA design manual. The project deliverables referenced in this section do not comprise an entire list of all SDA required project deliverables. References to sections of the current SDA design manual[5] are intended to assist those seeking more information. They are not intended to indicate that all school construction projects or technology initiatives must follow the SDA design manual.

I. Design Input Matrix

One of the most important recommendations made by the advisory group is that key stakeholders be involved in all phases of a project. All too often, key individuals, such as teachers or IT support personnel, are not consulted during the design phases. This can result in a technology solution that is inappropriate or underutilized. The matrix below provides a picture of recommended stakeholder participation for the main phases of a typical project. Phases and participation guidelines are further developed in subsections II through VI that follow.

A. Matrix Notes

- It is understood that, depending on the project and how it is organized, there are others (e.g. SDA, project management firm (PMF), if used, or construction manager (CM) if used) that will have review and approval roles.
- The bulleted items after each of the typical design phases are intended to provide the reader a basic idea of what is happening during that phase. They are not meant to reflect all the deliverables required on a large-scale project.

B. Stakeholder Groups Defined

- Superintendent = school district superintendent or designee
- School Board/Buildings & Grounds Committee = can be a previously established school board subcommittee or a committee

[5] At the time of this document's preparation, the current SDA manual is the 21st Century Schools Design Manual dated May 15, 2007

comprising school board members and district administration formed for a specific project.

- Teachers, Administrators and Support Staff = individuals to provide input from the instructional, operational and administrative perspectives.
- IT Staff or IT Review Committee = members of the IT staff or a committee comprised of IT staff and other teaching or administrative staff.
- Students and Community = representatives from grade levels mature enough to have worthwhile input and from community groups, as appropriate (i.e. parent groups, municipal government, police, local business leaders).

C. Educational Technology Design Process Input Matrix

Design Phase	Superintendent	School Board, Buildings & Grounds Committee	Teachers, Administrators & Support Staff	IT Staff/IT Review Committee	Students, Community
Program/Concept • Ed Specs • Concept Designs Review	**PI, RC, AP**	**PI, RC**	**PI, ID, DT**	**PI, DT, AP, ID**	**PI, ID, SA**
Schematic Design • Schematic Drawings • System Narrative • Ed Spec (for DOE)	**PI, RC**	**PI, RC**	**PI, ID**	**PI, DT, AP**	**SA**
Design Development • Drawings w/Details • Specifications • E-Rate Package • FEA Submit to DOE	**PI, RC, AP**	**PI, RC**	**PI, ID, DT, RC**	**RC, PI, AP, ID, DT**	**SA, RC, ID**
Construction Docs • Drawings for Bid • Specs for Bid • Set of E-Rate Docs	**PI, RC, AP**	**PI, RC**	**PI, ID, RC**	**RC, PI, AP**	**SA**
Construction Admin • Const Observation • Sub Completion • Post occupancy • IT Shop Dwgs • As-Built Drawings	**ID**	**ID**	**PI, ID, RC**	**RC, PI**	**SA**

- **AP** = Has **Ap**proval responsibility
- **DT** = Part of the **Design T**eam with the Design consultant
- **PI** = **P**rovides **I**nput during design meetings
- **RC** = **R**eviews & **C**omments on drawings and specifications
- **ID** = **I**nformation **D**issemination: is copied on all correspondence
- **SA** = **S**tudent **A**udit: Students observe all phases for coursework credit (Middle and High School)

II. Program/Concept Phase

In this phase, the design consultant meets with the representatives of all user groups to discuss their expectations, operational practices and other project requirements (i.e. LEED). It is from this series of meetings that the design consultant begins to develop the educational specifications.

The IT staff/IT review committee should be part of all the programming meetings regardless of whether those meetings specifically focus on technology. At these meetings, it is imperative that the educational philosophy of the school be discussed and that the teachers, administrators, support staff, students, community, and any other partners are all represented. It is also during this phase that the design consultant gathers other appropriate information from the district/school. This information may include:

- Three-Year Local School District Technology Plan
- *District-Wide Technology Plan* (Bulletin 21 – NJSDA)
- *The Educational Technology Plan for New Jersey*
- *National Education Technology Plan*
- Equipment Lists, cutsheets, specifications, drawings, written standards from recent projects
- Disaster Recovery/Business Continuity Plans
- NJ Department of Community Affairs (DCA) *Best Practices Standards: Schools Under Construction or Being Planned* (see also Section 5 of this document for more information) http://www.state.nj.us/dca/codes/misc/pdf/ed_bp_stndrs_11_10_2008.pdf
- Building Program based on DOE Room Lists

At the end of this phase, the design consultant will submit a final program report /educational specification to the Department of Education by way of the design team for approval.

A. Technology Related Deliverables

The design consultant should produce a project approach document that includes a high-level discussion of plans for technology systems and how they relate to the district's curriculum needs. The major concepts of classroom presentation styles, student to computer ratio, convergence, the planned use of wireless devices, ADA requirements, inclusionary education for students with disabilities, assistive technologies and school safety should be discussed in the programming meetings and reflected in the educational specifications. A first draft of the IT plan should be included here.

The programming documents must show compliance with the most current applicable version of the DCA's *Best Practices Standards for Schools Under Construction or Being Planned* addressing safety and security. Specifically, consideration must be given to locating primary and secondary emergency control centers and for video surveillance of all interior and exterior spaces.

B. Who Should Participate

As this is the main information gathering stage of the project, all key stakeholder groups should participate. Special populations should be represented at these initial meetings.

It is highly recommended that the school or district assign an individual to act as project manager. This person should be familiar with the educational and/or operational aspects of the school (e.g. principal, assistant principal, someone from buildings and grounds department, or from the business office). This person would be part of the project team and act as the main liaison between the design consultant and the school. It would be incumbent on the project manager to ensure that all key stakeholder groups are included in the programming meetings.

C. Who Should Review/Approve Deliverables

The technology-related deliverables should be reviewed by the following groups:

- Superintendent
- Board/Buildings & Grounds Committee
- IT Staff/IT Review Committee

The technology deliverables should be approved by the superintendent and the IT staff/IT review committee.

For this and all phases, it is assumed that the Superintendent's approval responsibility covers all aspects of the design and is not limited to the technology components.

III. Schematic Design Phase

Based on the approved program documents, the design consultant begins to lay out the major equipment locations and supporting raceways and conduits. It is imperative that the IT staff/IT review committee work closely with the design consultant during this phase.

Prior to the completion of this phase on SDA and other large-scale projects[6], the project team is required to submit schematic drawings, educational specifications, and DOE project application forms to the New Jersey Department of Education, Office of School Facilities. (DOE OSF). (a.k.a. - Schematic Educational Adequacy Review Submission)

DOE OSF reviews the project for educational adequacy and compliance with PL 2000, c. 72 and *N.J.A.C.* 6A:26. At this time, DOE OSF prepares a Preliminary Eligible Cost (PEC) determination. If the project is an authority project, DOE OSF also prepares a preliminary project report.

If the district or school has standardized on a certain technology system and if introducing an alternate manufacturer would compromise the operational effectiveness of that system, the district must submit a letter to the design consultant requesting a

[6] On small-scale projects these submission requirements may not apply.

waiver for the issuance of proprietary specifications at this time. Assume a district had an existing centralized phone and voice mail system. A waiver could be requested by the design consultant to allow for specifying the same centralized system. This would allow the new telephone system to be fully compatible with the existing system. The design consultant will then write an explanation and justification of the district's request and submit this to the SDA for approval.

A. Technology- Related Deliverables

- Outline specifications
- Construction cost estimate
- Proof of compliance with the current DCA best practices standards document.
- Floor plan drawings indicating major equipment room locations, and HVAC and electrical requirements
- Approved IT plan (see Item D below)

B. Who Should Participate?

At this stage, the design consultant is delivering the first iteration of the design documents. They are, by definition, schematic and, as such, would not be informative to inexperienced reviewers. Therefore, the matrix has no involvement assigned for the students and community group with the exception of those students auditing the process.

All other groups would have some level of involvement with the IT staff/IT review committee taking the lead.

C. Who Should Review/Approve Deliverables?

The deliverables should be reviewed by the following groups:

- Superintendent
- Board/Buildings & Grounds Committee
- IT Staff/IT Review Committee

The technology deliverables should be approved by the superintendent and the IT staff/IT review committee.

D. IT Plan Issues

The SDA, in conjunction with the DOE, has developed an IT plan that is used to plan for and procure technology items. (See Appendix D for sample). Based on the number of classrooms, students (with grade levels), specialized spaces (i.e. auditorium, music room, gym, etc.) and particularized needs, the IT plan calculates an efficient IT solution for that school. The equipment identified by the IT plan must be educationally adequate by DOE standards for that specific school. After review and approval by the superintendent and staff, the SDA's procurement office uses the IT plan as the basis for obtaining the equipment. SDA procurement coordinates the technology with school personnel and a technology systems integrator for installation and programming.

Currently, IT plans are not generated or required for non-SDA projects, but will be made available to any district that requests it for their own use.

To avoid coordination problems at the end of the project when the hardware is installed, discussions regarding the IT plan equipment must be initiated in an early design phase. All the information that is required by the design consultant in order to fill out the IT plan should be known at the schematic phase. At this point, the SDA will use this IT plan as a budgeting tool for the technology component of the project.

Currently[7], for facility projects under SDA control, they procure certain furniture, fixtures, and equipment (FF&E), such as computers, printers and other technology related hardware, outside the main general construction contract.

E. E- rate Program Considerations

Whenever possible, the SDA and/or school district should apply for discounts on the E-rate-eligible technology components being considered for the project. The Schools and Libraries Program of the Universal Service Fund (a.k.a. E-rate Program) makes discounts available to eligible schools for telecommunication services, Internet access, and internal connections. The program is intended to ensure that schools have access to affordable telecommunications and information services.

In a typical school construction project, current[8] E-rate-eligible components include:

- Voice/data cabling along with associated patch panels, racks, cabinets, faceplates and jacks
- Telephone system, VoIP system (telephone handsets are not eligible)
- Network gear including switches, routers, wireless access points
- Network and E-mail servers (not application or content servers)
- Data protection components (i.e. firewalls, proxy servers, tape backup)
- Power protection – uninterruptible power supply (UPS)/ battery back-up

Seeking E-rate discounts on eligible items introduces complexity to the preparation of construction documents, to the procurement process and to the construction process. E-rate must be a part of document preparation processes at this early phase. Issues include the following:

- The E-rate program requires that the service provider be contracted via a competitive bidding process. On SDA projects, the SDA's typical single prime contract contains too many ineligible E-rate items and cannot be used for E-rate purposes. Therefore, a separate contract must be awarded. This typically

[7] The method for procuring IT plan components may be different depending on the project. The Design consultant should confirm how technology components are to be purchased early in the design process.
[8] The E-rate eligible component list is updated annually. Go to http://www.universalservice.org/sl/ for the latest list.

requires the preparation of a separate set of drawings and specifications.

- On SDA projects, there are some E-rate-eligible items that would be part of the base bid contract (i.e. voice/data wiring and telephone system) and other items that are part of the typical IT plan procurement. (e.g. network switches, routers) Care must be taken to avoid duplicating items or omitting items. In addition, the drawings and specifications must clearly delineate what is in the base scope of work and what is to be done by the E-rate contractor.
- Engaging a separate contractor to do E-rate-eligible work requires close coordination with the project's general contractor. The E-rate contractor's scope of work and schedule must be inserted into the overall project timeline.
- Applying for E-rate discounts requires the completion of a series of forms which must be filed within a certain time period. It is also required that a service provider be under contract prior to filing the final funding request form (Form 471). It is quite possible that the design documents may not be fully developed at the time the filing window is open. As a result, it makes the ability to effectively bid out the E-rate work and complete a contract award during the filing period a challenge.
- On SDA projects, the E-rate contract must be coordinated with the SDA procurement office.

An overview of the E-rate program, a complete eligible services list and required forms and filing deadlines can all be found on the following Web site: http://www.universalservice.org/sl/.

IV. Design Development

Upon approval of the schematic design documents, the design consultant refines the project to a point where all the major building systems have been identified, defined and coordinated. Again, the IT staff/IT review committee should have an approval role in reviewing the design development drawings and specifications. After the Final Educational Adequacy drawings are prepared, the Design consultant transmits the appropriate Design Development drawings, the revised educational specifications with the IT plan, and all applicable DOE project application forms to DOE OSF who, in turn, reviews the submission and determines final educational adequacy (FEA).

On some large projects there may be multiple submission delivery milestones at this phase (e.g. 50% and 100%) before the submission to DOE. SDA projects must follow the requirements set forth in the design manual. For other projects, the project team should determine the need for review of intermediate submissions.

A. Technology Related Deliverables

- Specifications using latest version of CSI/MasterFormat (see Section 5)
- Construction cost estimate

- Proof of compliance with the current DCA best practices standards document.
- Floor plan drawings showing symbols for devices including PA/clock, audio visual, CATV, voice/data outlets and wireless access points
- Riser diagrams of security and voice/data systems
- List of equipment to be furnished by SDA, District or School
- Review of coordination efforts regarding Electric, HVAC, and Building Management Systems
- Review of coordination efforts regarding building entrance facilities and service provider demarcation points.

B. Who Should Participate?

The level of detail at this stage is more complete and understandable. Therefore, all stakeholder groups should participate in this design phase by attending meetings and reviewing documents. At this phase, the technology users (teachers, administrators, support staff and students) confirm that the design consultant has properly incorporated their input from the preceding phases.

C. Who Should Review/Approve Deliverables?

The deliverables should be reviewed by the following groups:

- Superintendent
- Board/buildings & grounds committee
- The IT staff/IT review committee
- Teachers, administrators and support staff
- Students and community partners

The technology deliverables should be approved by the Superintendent and the IT staff/IT review committee.

V. Construction Document Phase

Upon approval of the design development documents, the drawings and specifications are further developed to a level of detail where competitive bids can be obtained. The IT staff/IT review committee should have an approval role over the technology-related contract documents. It is during this phase on large-scale projects that documents are reviewed by professionals at the Department of Community Affairs (DCA) for adherence to applicable building codes.

On some large projects there may be multiple submission delivery milestones at this phase (e.g. 50%, 75% and 100%). SDA projects must follow the requirements set forth in the design manual. For other projects, the project team should determine the need for review of intermediate submissions.

A. Technology Related Deliverables

- Final Specifications for PA/clock system, voice/data cabling, CATV system, telephone system, audio visual systems, security systems.
- Proof of compliance with DCA/Homeland Security requirements.
- Complete floor plan drawings showing symbols for devices including PA/clock, audio visual, CATV, voice/data outlets, wireless access points, cable tray, security system.
- Complete riser diagrams of security and voice/data systems.
- Equipment room layouts.
- Installation detail drawings.
- Separate set of contract documents for E-rate-eligible components (if required).
- Review of coordination efforts regarding Electric, HVAC, and building management systems.
- Review of coordination efforts regarding building entrance facilities and service provider demarcation points.

B. Who Should Participate?

All key stakeholder groups except the student/community group should participate in this last design phase. The project manager and IT staff/IT review committee can represent the student/community group at this point.

C. Who Should Review/Approve Deliverables

The technology deliverables should be reviewed by the following groups:

- Superintendent
- Board/Buildings & Grounds Committee
- IT Staff/IT Review Committee
- Teachers, Administrators and Support Staff

The technology deliverables should be approved by the superintendent and the IT Staff/IT review Committee.

VI. Construction Administration

This phase includes awarding the contract, building the project, testing, training and final acceptance. The visions and expectations of the IT staff, administration and other key technology stakeholders should come to fruition if the prior phases were successfully completed.

On an SDA project, bidding and contract award tasks are managed by the SDA and the design consultant as a separate phase. After the construction phase, there are separate phases for project close-out and post occupancy review.

On a smaller regular operating district project, proper bidding and contract award procedures must be followed by the district.

After an award has been made, construction administration tasks such as evaluating mock-ups, attending demonstrations, reviewing equipment model updates, equipment testing and system training are dealt with.

A. Submittal Process

Once the project has started, the contractor begins submitting product data (cut sheets) and installation detail drawings (shop drawings) to the design consultant via the PMF/CM, as applicable, for review and approval. These **submittals** represent the exact make and model of equipment the contractor intends to provide and how the equipment is to be installed. Submittals may also include mock-ups or samples of certain groups of components (e.g. a wall plate for a teacher's station showing voice/data/AV connections).

On a large-scale project, technology-related submittals are typically issued after the building's foundation and steel framework have been completed. On smaller projects, where technology is the major component, submittals begin shortly after award.

The design consultant reviews the submittals to determine if they satisfy the requirements of the drawings and specifications. If the contractor submits an alternate product, the design consultant determines if the alternate is acceptable.

It is during the submittal process that substitutions are made for technology products that are no longer available or no longer supported by the manufacturer. It is also during the submittal process where final details regarding color and style are made. (e.g. voice/data cable jacket color)

The IT staff/IT review committee should participate in the submittal review process for technology components.

B. Requests for Information (RFI) Process

As the contractor reviews the drawings and specifications and begins planning the work, it is inevitable that questions will arise. When they do, the contractor sends an RFI to the design consultant via the PMF/CM, as applicable. RFIs tend to fall into one of the following categories:

- Alternate installation method or material approval request.
- Conflict between drawings or between the drawings and specifications.
- A field condition that was not anticipated or covered on the drawings.
- Uncertainty as to the meaning of a particular drawing note or symbol.
- Missing information or incomplete installation details.

The IT staff/IT review committee should be copied on all technology-related RFI responses.

The RFI process is also employed during the bidding phase when interested bidders have questions about any of the material in the bid package (i.e. general terms and conditions, scope of work, individual specification sections, drawings, etc.)

C. Coordination among Contractors, Integrators, and Service Providers

Whether the project is a single prime contract with multiple subcontractors (i.e. mechanical, electrical, and plumbing) or a multiple prime contract (not done with the SDA), coordination among contractors is important. Typically, the electrical contractor will provide back boxes, conduit and power for technology systems and may even install certain technology equipment but often hires subcontractors to perform programming or final implementation tasks, such as programming a security system or telephone system. As mentioned previously, there may also be an E-rate contractor (service provider) on the job along with an IT systems integrator who is installing computers and printers. The important task of coordinating all these contractors is the responsibility of the PMF, CM or clerk of the works depending on how the project is structured. The IT staff/IT review committee and the school or district's project manager should regularly review coordination efforts with the PMF or CM.

D. Project Meetings

Regular project meetings are held with the entire project team. At these meetings, coordination issues are raised, schedules determined, critical path issues identified etc. The school or district's project manager should attend these meetings at a point in time when the technology work is ongoing or when a technology question is on the agenda. The project manager would then disseminate information to the other key stakeholder groups as necessary.

E. Periodic Site Visits

At appropriate intervals during the construction of the project, the design consultant reviews the work to determine if it is being performed in a manner that indicates that, when fully completed, the work will be in accordance with the construction documents. At a minimum, the school or district's project manager and/or someone from the IT staff/IT review committee should accompany the design consultant on these periodic site visits. Problems that are identified should be documented and addressed at a project meeting.

F. Testing and Training

All technology systems require some form of testing and many require user or system administrator training. Requirements for testing and training are covered in the specification documents and are typically part of the submittal/project closeout requirements.

Results of tests on fiber and copper voice/data cabling must be provided to the IT staff/IT review committee. These test results provide important cable infrastructure documentation and should be archived for future reference. As-

built drawings - that reflect the final installation conditions - must also be provided.

User training and system administration training must be coordinated with the IT staff/IT review committee. System administration training should be provided to a primary and secondary level of personnel to ensure that operations can withstand both a typical absence and a more serious, unanticipated problem.

G. Punch lists

As the project nears completion, the design consultant surveys and inspects the building and develops a punch list of items that are incomplete or incorrectly installed. The project manager and/or IT staff/IT review committee should accompany the design consultant when doing the technology systems review and should receive copies of all technology-related punch lists.

VII. SDA Design Manual References

Additional information on phase requirements as required on SDA projects can be found in the SDA's latest design manual.

- Design Criteria: Safety and Security
- Design Criteria: Information Technology
- NJ Department of Community Affairs - Best Practices
- Program/Concept Phase
- Schematic Design Phase
- Design Development Phase
- Construction Document Phase
- Bidding and Contract Award Phase
- Construction Administration Phase
- Project Close -out Phase

Section 4. Administrative and Learning Environments

The technology resources recommended for teaching, learning, management, and administrative environments in order to support all school staff and students are outlined in this section of the facilities guide. The articulation of these recommended resources and the functions they will serve should drive the design of the infrastructure needed to support this wide range of diverse functions at both the district and school levels. Emphasis is placed on *connectivity* for both local and global communication and collaboration, along with *flexibility* for maximizing potential of existing resources, and open *design* that will support needs not yet envisioned.

The current NJ SDA design manual incorporates Leadership in Energy and Environmental Design (LEED) concepts, along with quality educational space, security, and durability to optimize school facilities. Additional information regarding national efforts in the area of energy conservation and effective design strategies can be found at the following Web sites:

- Energy Star, *Schools, An Overview of Energy Use and Energy Efficiency Opportunities*, http://www.energystar.gov/ia/business/challenge/learn_more/Schools.pdf
- School Planning & Management, April 2008 Special Green Issue, *Estimating the Cost of LEED in Schools and Green Schools from A-Z*, http://www.peterli.com/spm/cover/tocspm.pdf
- US Green Building Council, *LEED for Schools*, http://www.usgbc.org/DisplayPage.aspx?CMSPageID=1586
- Build Green Schools, *LEED for Schools – For New Construction and Major Renovations* http://www.buildgreenschools.org/documents/leed-s_ratingsystem.pdf
- AIA – The American Institute of Architects, *Sustainability*, http://www.aia.org/susn_rc_default
- DSIRE – Database of State Initiatives for Renewable & Efficiency, Energy Efficiency in New School Construction, http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=NJ14R&state=NJ&CurrentPageID=1&RE=1&EE=0

In addition to technology resources and functionality driving design elements, the NJSDA *21st Century Schools Design Manual* and *Best Practices Standards for Schools Under Construction or Being Planned for Instruction* issued by the NJ Department of Community Affairs also impacts the configuration of some environments for school and district leadership. These considerations will be noted as they apply to specific environments in this section. Please note that the NJSDA *21st Century Schools Design Manual* and accompanying appendices are not prescriptive or required for all school construction projects, but rather guidelines that should prove useful for all participants in this process.

It is recommended that schools define standard technology outlet configurations for different uses and users. Designations can be modified from school to school with the exact components of each outlet adapted to local conditions. A chart of typical outlet configurations is located in Appendix E. This chart depicts the typical types of outlets defined, where they are used, the types of jacks in the outlets, and a sample graphic of the outlet.

These outlet configurations become the basic building blocks for providing network services throughout the facility and enable voice, video, and data transfer from the desktop for students, teachers, school administrators, and staff, as required.

This section of the facilities guide includes the following subsections:

- Administrative Environments
- Instructional Environments
- Shared Environments
- Large-group Environments

I. Administrative Environments

School administrators and support staff require sufficient technology resources and systems to manage their work and serve as an efficient and effective organizational framework. To support school administrative and instructional technology services, several building-level systems must be in place. These systems include:

- Telephone system with voicemail.
- Network servers (web, fileserver).
- Ethernet switches (100/1000) to interconnect workstations and servers and accommodate existing 10/100) that maintain backward compatibility (NOTE: The State Educational Technology Directors Association (SETDA) recommends that schools provide an external Internet connection to the Internet Service Provider of at least 10 Mbps per 1,000 students/staff; and district WAN connections of at least 100 Mbps to each school per 1,000 students/staff; see http://www.setda.org/web/guest/2020/broadband).
- Router that connects the school to the district network, as well as the Internet and district applications at 1.5 Mbps or higher (wired and wireless).
- Uninterruptible power supply (UPS) with backup capacity.

These systems should be located in one secure area. The construction of a new school facility presents a prime opportunity to consolidate all of these mission critical systems in a central, secure, climate-controlled environment specifically designed to support and maintain this collection of converging systems.

Likewise, these resources in a similar configuration are required at the district level. The location of district administrators and district network services varies from district to district, as space constraints allow. Some district offices are standalone facilities, while others are located on school campus property, or are located within an existing school facility. Regardless of specific location, the resources needed by district-level administrators and their staff are similar to those outlined above for school-level personnel.

Specific requirements regarding communication/connectivity needs; data collection/distribution/storage/archiving requirements; and access to data for decision-making are outlined below for the following administrative areas:

A. District and School Leadership Office Suites

B. Building and Grounds

C. District-Level Support Services (Transportation, Food Services, Data Centers, Facilities Buildings)

D. School-based Student Support Services (Special Education/Services, Health, and Guidance)

A. District and School Leadership Office Suites

Administrative computing resources for district- and school-based leadership and their respective support staff within each facility should include modern computers, desktop and laptop options, with network and Internet access (wired and wireless) and telephone systems equipped with voicemail capacity. In addition, access to printer/scanner/fax capacity, digital cameras, video cameras, data projectors, and other peripheral devices may be required from time to time.

Both the district office and the school administrative suite require private offices for administrators, work areas for clerical and support staff, meeting space, storage areas, and open space for students and guests. Monitoring access to school entrances is generally controlled in the school office suite. A meeting space and/or conference room should include a wall-mounted screen and/or ceiling-mounted projector depending on the size of the area. Within the work area for clerical and support staff, networked computer/printer/scanner/ copier resources should be centrally located for all to share.

A large number of school- and district-level administrators prefer a laptop rather than a desktop computer because of the transportability and flexibility. Many administrators have docking stations at work and home for their laptops that provide both a full-sized monitor and keyboard for ease of use and greater productivity. Whether desktop or laptop, the administrator's system requires sufficient capacity and processing speed to view, manipulate, and analyze large databases of financial, assessment, and district data. In addition, the increased dependence on video conferencing for administrators in order to attend meetings that otherwise would require significant travel time, suggests that their computer be equipped with a built-in camera, speaker, and microphone. A headset for Web conferencing is also recommended, as external speakers and microphones tend to cause undesirable feedback in this setting.

Administrative office areas need to plan for integration onto one comprehensive technology network system. These administrative offices include the main office suite and offices for principals, department heads, guidance, food services, health services, student services, and athletic staff. The planned location of a desk or workstation table in each office is needed to locate the data network outlet effectively and thus define the number of voice/data cables required. It is recommended that at least two voice/data cables run to each administrative outlet location. These areas can also be outfitted for wireless, but stationary desktop systems are not likely to require wireless capacity on a regular basis.

Office areas have the following needs:

- One networked computer station in administrative/departmental offices per administrator and each support staff.
- Wireless access points as appropriate.
- Integrated printer/scanner/fax/copier per area.
- Telephone.
- High-quality, high-volume printer, depending on production needs.

Conference areas should include:

- Video, voice, and data drops.

- Electric power availability (quad per drop).
- Capability to support computer, printer, telephone operations, and video monitor.

Sample outlet recommendations for office spaces and a conference room are included in Appendix E.

The following recommendations from the New Jersey Department of Community Affairs' *Best Practices Standards for Schools Under Construction or Being Planned for Instruction* impact administrative environments for school leadership:

- The interior of offices of those necessary for enacting emergency procedures, such as principal and vice-principal, shall not be visible from street or public areas (non-school property areas).
- Doors and windows that can be accessed from grade shall have the capability of being locked and alarmed when the building is not in operation.

B. Building and Grounds (HVAC, Security, Maintenance Areas, Roof, Parking Lots/Garages, Play Areas)

New systems for monitoring, managing, and controlling the resources that now fall under the purview of buildings and grounds are increasingly sophisticated, digital, and connected. These systems include lighting, access security, HVAC, fire protection, and video surveillance. This convergence presents both challenges and potential benefits. The initial challenge in retrofit and renovation projects is presented when merging newer and older systems into a unified system. This is less of a challenge in new construction. The long-term potential is the ability to monitor, manage, control, update, and track these systems remotely from one central location. To allow for centralized management, all systems will need to operate using IP for data-sharing, which requires newer digital versus older analog systems.

Workstations for monitoring HVAC resources are required in each school facility, as well as a central district location. Server space allotted to HVAC data provides the district with the opportunity to archive longitudinal temperature control information for making annual budget projections regarding energy consumption.

Access security and video surveillance systems consume significant server space if video archives are to be retained for longer than a week or two. The value and benefit of long-term video archiving of security system data will need to be determined at each facility based upon past security breeches and anticipated future need/risk. The location, especially mounting height, and quality of camera resolution are additional aspects to consider with the potential to impact both cost and functionality.

School/district fire protection, security, and lighting systems linked to a centralized solution also enable the facility to be linked to municipal resources, such as fire, police, and first responders, identifying problems quickly and decreasing response times when issues arise. Response time is especially pertinent during after hours, vacations, and other non-school times.

Roofs, parking lots/garages, and play areas until recently were not likely to be addressed in technology planning for school facilities, but with the increased attention to security issues and student expectations for Internet connectivity, even these spaces should be considered in new school design. Security systems in parking lots/garages require the capacity to link to the district network and wireless access to the Internet from playground space may be expected by students.

The following recommendations from the New Jersey Department of Community Affairs *Best Practices Standards for Schools Under Construction or Being Planned for Instruction* impact buildings and grounds management environments:

HVAC

- Mechanical rooms that house HVAC equipment shall have the capability of being locked and alarmed; this requirement shall also apply to interior air return grills in rooms or spaces where people are not readily observable.
- If zoning options are installed, they shall be provided with controls having the capability to shut down individual zones and spaces. In addition, the system shall be controllable from the emergency control center and have a switch that operates all zones.
- Intake air dampers that are centrally operated, motorized, low-leakage, and fast acting (less than 30 seconds) shall be installed.

Security ~ Emergency Control Center and Communications

- There shall be not less than two points of access to the public address system.
- Circuits for telephone, public address and alarm systems shall be redundant.
- The control center will contain access to all critical systems (HVAC, fire alarm and sprinkler, public address, communications, security, and video equipment).
- Fire protection systems shall be connected to the emergency or standby power supply as applicable.
- Rooms/areas that contain equipment for the functioning of the fire protection systems have the capability of being locked or alarmed.
- Smoke control systems shall have an independent control switch in the emergency control center.
- There shall be a standby power supply for the building's critical functions. In addition to the emergency system, the supply shall have sufficient capacity to power all required emergency lighting, **and** emergency control systems.
- An onsite, remote back-up control center shall be installed that shall have the capacities in "a." above; the back-up control center shall be installed as far away as practical from the main control center.
- The emergency control center and the back up shall not be adjacent to or visible from public lobby areas or the street, and shall not be located near each other.

Maintenance Areas

- Machinery rooms shall have the capability of being locked or alarmed.

Roof

- Doors and hatches that can be accessed from the roof shall have the capability of being locked and alarmed at all times.

Parking Lots

- Lighting shall be installed in all parking areas.
- Where parking is provided beneath school buildings, then access to the parking shall be limited to staff and controllable both electronically and during periods of high alert (orange or red) by security personnel. Such areas shall also be controlled by crash barriers which will prevent unauthorized access. The primary structural elements shall be designed to resist progressive collapse.
- Video surveillance cameras shall be installed throughout the exterior of the building, including adjacent parking.

C. District- level Support Services (Transportation, Food Services, Data Centers)

The population of a school district, its geographical footprint, and the number of campuses/buildings impact the strategy selected by an individual school district to provide support services such as transportation, food services, and information data services. For the purposes of this facilities guide, the following assumptions are made regarding district-level support services:

- Transportation services, if provided, are administered centrally.
- Food services, if not outsourced, are administered centrally.
- Information technology services, if not outsourced, are administered centrally.

District-level support services are an integral component of the comprehensive technology network system. These include resources for staff monitoring transportation, food services, and district information technology (IT) services (data center). The planned location of a desk or workstation table in each office is needed to locate the data network outlet effectively and thus define the number of voice/data cables required. It is recommended that at least two voice/data cables run to each administrative outlet location.

Office areas for district-level support services have the following needs:

- One networked computer station in administrative/departmental offices per administrator and support staff.
- Wireless access points as appropriate.
- Integrated printer/scanner/fax.
- Telephone.
- High volume printer, as necessary.

D. School- based Student Support Services (Special Education/Student Services, Health, and Guidance)

School-based student support services need access to many components of the comprehensive technology network system. These resources include office space for the school nurse, guidance services, and student support services. The planned location of a desk or workstation table in each office is needed to locate the data network outlet effectively and thus define the number of voice/data cables required. It is recommended that at least two voice/data cables run to each administrative outlet location.

Individuals providing student support services are sometimes shared between facilities and require secure access to sensitive and private student information, regardless of their location. Office space is necessary for full-time and shared student services staff that allows for confidential conversations and appropriate access to student information, health records, assessment data, as well as available community services.

Office areas for support services have the following needs:

- One networked computer station in administrative/departmental offices per administrator and support staff.
- Wireless access points as appropriate.
- Integrated printer/fax/scanner.
- Telephone.
- High-quality, high volume printer, as required.

Access to an appropriately configured conference room is also necessary on a regular basis to provide these services.

II. Instructional Environments

New Jersey educators seek to develop prototypes for best practice based on scientifically researched learning environments. Such learning environments are designed to support a range of instructional and assessment activities appropriate to meet the varied needs of learners, staff professional learning and growth, school improvement initiatives, and specific technology applications. They may include:

- Teacher workstations with whole class display capacity (flat panel display or projection device) and control system.
- Individual networked classroom computing devices (desktop, laptop, and handheld – wired and wireless[9]) with task-specific peripherals.
- Individual, portable computing devices for every child, such as text processors, PDAs, graphing calculators, ultraportables, handheld and laptop computers for content-specific activities.
- Classroom computer collaborative learning centers.
- One-to-one computer initiatives.
- Mobile laptop computer labs on recharging carts with wireless network connectivity.
- Instructional technology and vocational laboratories of twelve-to-thirty computer workstations.
- Information and technology resource centers with print and digital content and access to online subscription services.
- Distance/virtual e-learning resources for access to global curriculum.

Teachers and students require sufficient technology resources and systems to engage in authentic learning experiences. To support high levels of learning and efficient instructional management, the following are recommended for consideration in all instructional areas:

- Telephone with access to voicemail for each teacher.
- On-demand access to computing devices (ideally 24/7).
- Robust, consistent, high-speed network access (wired and wireless) to the school, district, and global resources.
- Large flat panel display and/or projection capacity for large-group instruction, collaboration, global communication, and reflection.
- Interactive whiteboards.
- Access to generic (digital cameras) and discipline-specific (digital microscopes) peripheral devices.
- Networked black and white and color printer/scanner/fax capacity.

[9] Each platform – desktop, laptop, etc. - has unique benefits and challenges, which continue to evolve. It is the responsibility of the school technology team to determine the most appropriate selection given the target usage, and to plan for adequate support and maintenance resources.

All students acquire content area knowledge and skills in: (1) Visual and Performing Arts, (2) Comprehensive Health and Physical Education, (3) Language Arts Literacy, (4) Mathematics, (5) Science, (6) Social Studies, (7) World Languages, (8) Educational Technology, Technology Education, Engineering, and Design, and (9) 21st Century Life and Careers. As they do so, they are supported by the ongoing, transparent, and systematic integration of technology from preschool to grade 12 in preparation for postsecondary education and the workplace. [10]

In **Preschool**, technology offers versatile learning tools that can support children's development in all domains. For example, electronic storybooks can "read" stories to children in multiple languages; adventure games foster problem-solving skills; story-making programs encourage literacy and creativity; math-related games can help children count and classify; and science activities promote inquiry and an understanding of the world through the eyes of a child. When preschoolers are encouraged to work together with electronic devices and computers, social skills are tapped as children negotiate turn-taking. However, technology should not replace the concrete, real-life experiences that are critical to a young child's learning. It must always be used in balance with other meaningful activities and routines. Technology should be embedded into children's learning centers and should enhance their learning and development during choice time, as well as in small-group experiences.

In grades **K- 2,** students are formally introduced to the basic features and functions of computers and demonstrate understanding that technology enables them to communicate beyond the classroom on a variety of topics. K-2 students are also exposed to elements of the design process, design systems, and a variety of technology resources, and understand the importance of safety when using technological tools.

In grades **3- 4**, students understand the purpose of and are able to use various computer applications. They continue to develop information-literacy skills and increasingly use technology to communicate with others in support of learning, while also recognizing the need for cyber safety and acceptable use policies. Students in grades 3-4 also investigate the impact of technology systems, understand the design process, and use it for problem-solving.

In grades **5- 8**, students expand their capacity to use operations and applications, apply information-literacy skills, and select the appropriate tools and resources to accomplish a variety of tasks, as they develop digital citizenship. As students participate in online learning communities, collaborating in the design of products that address local and global issues across the curriculum, they build understanding of the perspectives of learners from other countries. Students at this level can apply the design process in the development of products; understand impact constraints, trade-offs, and resource selection; and solve a design challenge and/or build a prototype using the design process. Students can explain why human-designed systems, products, and environments need to be monitored, maintained, and improved, and they recognize the interdependence of subsystems as parts of a system.

In grades **9- 12,** students demonstrate advanced computer operation and application skills by publishing products related to real-world situations (e.g., digital portfolios, digital learning games and simulations), and they understand the impact of unethical use of digital tools. They collaborate adeptly in virtual environments and incorporate global perspectives into problem-solving at home, at school, and in structured learning

[10] 2009 New Jersey Core Curriculum Content Standards for Technology

experiences, with the growing realization that people in the 21st century are interconnected economically, socially, and environmentally and have a shared future.

High School Specialization in technology enables students to design, create, and reverse-engineer technology products or systems, document the application of the design process, and understand its impact—including ethical considerations, costs, trade-offs, risks, benefits, and choice of resources. Students develop products that address local and global issues and challenges, which are disseminated for peer review. [11]

All secondary learning environments must promote skills fostering high levels of learning; engaging higher-order thinking; and encouraging collaboration, teamwork, and a sense of citizenship. The infusion of a diverse array of technology resources throughout secondary school facilities provides the potential to meet the disparate needs of this audience.

In the following sections, space configuration models and the needs of the learners and staff define the technology infrastructure for the various types of spaces in each building. Each building does not always have each model, and some facilities may have multiple types of various space configuration models.

Additionally, the following design criteria are referenced in the New Jersey Schools Development Authority (SDA) *21st Century Schools Design Manual* and have an impact on teaching and learning environments:

- Design Criteria #3. Visual Comfort
- Design Criteria #10. Learning-centered Design
- Design Criteria #12. Accessibility
- Design Criteria #13. Flexibility and Adaptability
- Design Criteria #14. Information Technology
- Design Criteria #23. Community Use

Specific communication, connectivity, teaching and learning resources, and high-speed data access needs are outlined in detail in the following subsections:

A. General Classroom/Instructional Space Configurations
B. Wireless Networks in Support of Teaching and Learning
C. Ubiquitous Computing Strategies
D. Teacher Computing Resources
E. Specialist Areas
F. Special Education
G. School-to-Work and Adult Education
H. Peripheral Devices in Support of Teaching and Learning

[11] 2009 New Jersey Core Curriculum Content Standards for Technology

A. General Classroom/Instructional Space Configurations

Learning environment configurations must match the needs of educators and students and the types of learning or instructional activities that will take place in each setting. For example, schools that currently support a computer lab approach should reconsider the established configurations to determine if they provide effective cooperative learning environments. ***It is important that schools remain in control of local decision- making regarding technology options that reflect the unique needs and goals of the school community and the existing learning environments***. However, information resources or other support from district technical staff in making decisions regarding wiring, Internet drops, computer locations, furniture, or other environmental issues should be readily available. School personnel will need to consider how to deploy appropriate resources (e.g., hardware, software, technology, support services) effectively in order to maximize the benefits of the entire technology system. The equitable distribution of the technology resources throughout the schools will enable all students, teachers, and administrators to function more effectively.

Accessibility and mobility of resources is critical. When called for within the educational technology specifications, teachers should be able to provide on-demand one-to-one student-to-computing resources, as needed. These resources may include desktop and laptop computers, numeric and graphing calculators, handheld computing devices, portable word-processing devices, peripherals such as color printers, scanners, digital still and digital video cameras, and sufficient consumable resources to maximize the potential of these devices. Each classroom should have on-demand access to these resources with minimal difficulty. Additionally, access to the resources alone is not sufficient. High-speed network access to each device, as appropriate, is critical to achieving the maximum learning potential from these resources.

21st Century Classroom

The 21st century classroom incorporates technology-enhanced teaching tools that will dramatically appeal to students. These classrooms include:

- Teacher computers (laptops are generally preferred).
- Student computers.
- Projection/display capacity (projector, flat panel display, interactive digital whiteboard, and/or document camera).
- Speakers for teacher computer and classroom audio enhancement (sometimes supported with voice amplification systems).
- Age-appropriate software.
- On-demand access (24/7) to mobile computing resources and peripherals.
- A combination of movable tables and desks to support both independent and group learning activities.

Sample floorplan drawings for typical classroom spaces are included in Appendix E.

In addition to the standard classroom space, some content areas will require unique configurations, such as science labs and world languages classrooms.

Sample outlet recommendations for classroom spaces and a science laboratory are included in Appendix E.

Computer Lab or Computer Classroom

Computer labs can consist of stationary desktop systems or mobile units comprising laptops in a recharging mobile cart. The computer lab or computer classroom generally provides a one-to-one student-to-computer ratio by locating approximately 15 to 30 networked computers, desktop or laptop, in one instructional area. High-speed network connectivity provides access to printers, Internet and the World Wide Web (WWW), networked media/video resources, library media center resources, digital curriculum and resources, and subscription services, as appropriate.

The desktop computer lab environment is best deployed for the following types of activities:

- Pre-engineering courses that use CAD/CAM applications demanding fast and wide bandwidth, along with the fast processing of high-end workstations.
- Business education courses where the same applications (generally an office suite – word processing, database, spreadsheet, and financial program) are used daily by students in the course.
- Programming, Web design, graphic design, technology certification courses where advanced students may be manipulating operating system configurations and/or computer code.
- Use of Web 2.0 applications that require optimum computer processing speed and Internet bandwidth.
- Video production studio where students are working on individual video productions or animations.

These stationary desktop computer labs are generally hard-wired to the network and provide the computing power necessary for accessing and distributing video and supporting high-capacity computing, such as graphic design, sound recording, and CAD/CAM renderings. Mobile labs use wireless technology to connect to the network, and they can access the Web, share files, and connect to printers. Although wireless bandwidth continues to increase, mobile labs generally do not have the bandwidth to support high volumes of video media.

Mini-labs consisting of 12 to 15 units are generally deployed with laptops and may be both permanent and mobile. For example, many library media centers have a designated teaching area that can be immediately turned into a mini lab by distributing laptop computers and accessing the wireless network in that space. Other specialty areas, such science labs or world languages classrooms, may include full or mini computer labs with 15 to 30 computers, providing one-to-one or two-to-one student-to-computer ratios. Projects and activities focusing on collaboration and cooperation among teams are ideally suited to a two-to-one student-to-computer ratio.

The ability to display a computer screen image to a large group using a projection device is critical to support large-group instruction and collaboration. A ceiling-mounted projection device is generally the preferred projection solution in this environment. As very large flat-panel displays become more affordable, they will present another large-group display strategy. The inclusion of an electronic whiteboard for efficiently capturing and reproducing ideas, diagrams, charts, and other notes should be considered. Some projector/interactive whiteboard combination units may be cost-comparable to traditional ceiling-mounted projector systems once installation costs are included. Likewise, an audio enhancement system may be a feature of this environment.

Although the size and shape of specific instructional areas may dictate the layout of the instructional technology classroom, four of the most common layout options for stationary labs of 30 workstations are:

- Multiple corner clusters
- Multiple hexagon clusters
- Perimeter workstations (with work tables in center)
- Rectangular back-to-back stations

A sample outlet recommendation diagram for a typical computer lab is located in Appendix E.

B. Wireless Networks in Support of Teaching and Learning

School districts are exploring the potential of wireless networking for many reasons. Wireless technology may reduce cabling costs and provide a way for avoiding hazardous materials located in walls and ceilings, as can be found frequently in older facilities. It can be configured to provide service in non-traditional instructional areas such as auditoriums, gyms, cafeterias and exterior areas, provide flexibility in instruction, and bring previously unavailable resources to these various areas, as well as support one-to-one initiatives.

For itinerant teachers who move between buildings or classrooms, wireless networks offer a way to stay connected to the district network from many points on the campus. As computing devices become smaller and more powerful, the vision for effective use of technology in teaching depends on increased mobility and flexibility.

Wireless networks cannot always be considered as an alternative to the wired networks in buildings. Rather, within limitations, it extends the reach of the wired networks and may offer a degree of flexibility and mobility that cannot be otherwise achieved. Security and reliability issues are greater with wireless technologies. For schools considering one-to-one computer initiatives, a wireless network is a necessity.

C. Ubiquitous Computing Strategies

Advances in the portability of computing devices, as size keeps decreasing while performance keeps increasing, the improvement in battery capacity and increased capacity of wireless networking solutions has fueled the growth of mobile computing options and usage. *Please note: throughout the following section a number of commercially available educational computing devices are*

described. This is in no way intended as an endorsement for these specific products, but mentioning them is necessary in order to properly represent the growing field of mobile computing devices and instructional technologies that currently populate schools across the nation. In many cases, these are "one-of-a-kind" devices, although it is expected that it will not be long before similar competing products emerge.

Components

Described throughout this section, mobile computing options range from primary learning tools to fully functional laptop computers. Devices that are readily available on the educational market include:

- Primary learning tools
- Word processing and hybrid computing devices
- Handheld computing devices (handheld computers, graphing calculators)
- Mini-laptop/ultra portable computers
- Laptop and tablet computers
- Cell phones/smart phones

Handheld Learning Aids/Devices

Providing activities in early literacy concepts in reading, mathematics, and English, these engaging devices present information using a multi-sensory, interactive approach that combines seeing, touching, and hearing. These devices include the Leap Frog collection of learning aids: Leapster® Learning Systems, the iQuest® handheld and accompanying content specific cartridges, and the Fly Fusion™ Pentop computer Generally, classroom sets of these learning devices are available for creating on-demand, one-to-one learning in primary- through intermediate-level classrooms.

Handheld Computers

Originally called personal digital assistants (PDAs) and initially used as an electronic address book and calendar, these devices have now earned the label of handheld computers. Available in multiple operating systems, they are compatible with current productivity suites, can be used to send and receive e-mail, connect to full-size keyboards for data entry, and communicate with wireless networks to browse the web. A significant number of education-specific applications are available for these devices. Many school districts are exploring the use of handheld computers with portable keyboard configurations as a low-cost alternative to providing laptop computers to achieve ubiquitous computing.

Portable Writing Devices

Battery-operated, portable writing devices by AlphaSmart® were introduced over ten years ago to provide a low-cost alternative for creating classroom writing laboratories. These devices enable students to easily brainstorm, draft, review, edit, and revise using the writing process. Files can be transferred, via cable or infrared signal, to any application open on the workstation (e.g., word processor, presentation application, and spreadsheet) for manipulation, publication, or printing or posting. Many portable writing devices purchased in the 1990's are

still in use today, as there is no operating system to become obsolete. At most, districts needed to purchase new cables that connected via the universal serial bus (USB) port in place of the original serial port or Apple Desktop Bus (ADB) as classroom computers were refreshed.

Graphing Calculators

Software and peripherals available for graphing calculators and handheld computers are quickly blurring the line between these two learning devices. Mathematical graphing applications allow the handheld computer to graph complex mathematical equations that once could be only done on a graphing calculator. Portable keyboards and word processing software turn today's graphing calculator into a writing tool. Probes, sensors, and meters are available to capture real-time analog data and convert it into digital input for graphing and manipulating.

In the areas of mathematics and science, the use of numeric calculators, graphing calculators, and computer-based labs (CBLs) using different probes and meters for real-world data collection places the student firmly in the role of mathematician, scientist, and explorer of his or her world.

Graphing calculators support algebra, trigonometry, and calculus studies. They allow the student to manipulate and understand otherwise abstract and hard-to-grasp equations and relationships. CBL meters and probes, linked to either a graphing calculator or computer, transform the world of analog information into digital data that can be graphed, charted, manipulated, and studied.

Mini- laptop or Ultra Portable Computers

Mini-laptop, ultra portable or net computers have entered the mainstream marketplace in full force. Development of these small laptop computers with networking capacity was initiated by Nicholas Negroponte's One Laptop Per Child (OLPC) project in an effort to bring computing power and global collaboration to developing nations. The concept motivated major computer manufacturers to develop their own versions of small, light-weight networking devices.

The unifying characteristics of these mini-laptop computers are as follows: 1) small size and light weight, 2) smaller screen (7" to 12" diagonal), 3) robust design to withstand the rigors of student use and travel, 4) flash memory or traditional hard drive for storage, 5) built-in wireless network capacity, and 6) cost effectiveness. Likewise, each of these laptops has unique characteristics that should be matched to local needs. Some of these devices include:

- Acer Aspire® One - http://us.acer.com
- Asus Eee PC - http://eeepc.asus.com
- Dell INSPIRON Mini – www.dell.com
- HP Mini 1000 – http://www.hp.com
- Lenovo IdeaPad S Series – http://shop.lenovo.com

Up-to-date detailed specifications and features can be found on each manufacturer's respective Web site.

The impact of these devices on the educational landscape is significant when looking at computing power versus price. Handheld, portable, mobile computing devices are priced so that the feasibility of providing one-to-one computing resources for all students becomes a financial reality for many schools. When selecting computing devices, districts will need to match the purpose and intent of the device with the most appropriate resource as each will have capacity and production limitations.

Laptop Computers and Tablet Computers

Early studies of one-to-one laptop initiatives present compelling evidence of the benefits and potential made possible through the "computer-for-every-child" strategy. Some of the benefits include on-demand access to technology at school and home, increased motivation by students and parents, active parent participation, and enthusiastic teacher commitment to the laptop initiatives.[12]

More recently, data following year one implementation from the state of Maine middle school laptop initiative launched in 2000 showed a significant increase in student attendance and decrease in discipline problems in the grades where the laptops were deployed.

The newest assessment report of the Maine Learning Technology Initiative (MLTI), released in the fall of 2007 revealed:

- Improved scores on writing skills assessment.
- A link to more frequent use and higher scores.
- Writing skills of laptop users transfer to writing without a laptop.

Tablet computers are very similar to a standard laptop with an additional feature that brings significant functionality, a touch-sensitive screen. The screen can be pivoted in multiple directions so that it provides a notepad-like surface with the ability to “capture notes” using a stylus and saves the notes, diagrams and pictures digitally for future reference. A tablet computer connected to a projection device offers teachers and students an effective way to work collaboratively to create easily shareable diagrams, graphics, and other information. Tablet computers continue to be somewhat more costly than standard laptops.

As fully-featured and custom-configured laptop computers become smaller and less expensive to purchase, upgrade, secure, service, and maintain, they become a more realistic integration strategy for K-12 school environments.

D. Teacher Computing Resources

The one technology resource in school districts with the greatest potential for implementing change and helping to create change agents is the computer assigned to the teacher. This computer is assigned to an individual teacher to assist with teaching, learning, and management of daily classroom functions. Whether it is a full-size desktop system or laptop/tablet, the acknowledgment

[12] Rockman, et al. “Report of a Laptop Program Pilot: A Project for Anytime Anywhere Learning by Microsoft Corp. Notebooks for Schools by Toshiba America Information Systems.” Microsoft Corporation Education Download Archive (submitted to Microsoft June 1997): http://www.microsoft.com/education/download/aal/resrch_1.rtf (accessed April 2004).

that educators require tools that are at a minimum equivalent to those used by students is critical to the successful integration of all technology-enriched learning environments.

Teachers need to apply teaching, learning and management skills that make use of diverse strategies, resources, professional development, computers and other digital tools.

This section of the guide discusses the types of teacher resources that are critical to transforming our educators into 21st century teaching and learning leaders.

Instructional Computing Connectivity/Media Control

It is recommended that teachers have a high-speed network outlet near their desk for voice, data, and video. Although most facility designs include broadband video distribution, it is no longer recommended that schools incorporate the use of TV monitors in new construction for large-group viewing. Instead, districts should consider high-lumen ceiling-mounted video projectors, and/or interactive whiteboards, or very large flat-panel displays, as prices continue to drop, that are connected to the teacher computer - desktop or laptop.

An additional strategy found more frequently in new school construction and retrofits is the inclusion of a centralized media control panel that connects the teacher's laptop or desktop to a wide range of video and/or audio teaching resources. The media control panel has a built-in cable TV tuner connected to the school's network, allowing the teacher to view and display to the whole class via the ceiling-mounted or other projector. It also will display video from a VCR, camcorder, DVD player, etc. through the auxiliary audio/video input (S-Video or composite). If attached to a camcorder, the media control panel can enable video conferencing over the Internet. Likewise, an audio enhancement system may be a feature of the teacher environment. Districts are urged to consider designing infrastructure to support centralized media control strategies, even if not deployed initially. A goal of this guide is to help create environments that can respond to future growth and potential.

Teacher Computer

To manage the emerging diversity of today's classroom, the individual teacher configuration should provide video-out and large-group projection capabilities, and built-in high-speed network capacity. This system should be compact enough to travel with the teacher who provides instruction in a variety of classrooms and into the homes of all educators. Access to the school network and global resources allows for flexibility in lesson planning, preparation, resources selection, and reporting.

The teacher workstation area is normally located in proximity to the teacher's desk. The exact location needs to be determined on a room-by-room basis during the design process. Access to voice, video, and data communications should be available at this location, requiring voice, data, and video cable drops. This allows access to a telephone, the Internet, and any video programming distributed throughout the school. The specific quantity of voice/data/AV drops per room should also be determined as part of the design process.

Teacher Workrooms/Faculty Planning Areas

Faculty planning offices and workrooms are recommended within each learning area of the school. Teacher workrooms are areas where teachers can access network and Internet resources for class preparation while meeting with their colleagues or review administrative and/or assessment data. These areas should be planned to allow teachers ample private space, as well as a small-group meeting environment. Therefore, the identification of an area where the workstations can be located is important. The exact location and quantity of workstations will vary depending on the room configuration and local needs.

Some of the technology resources that would be housed in the teacher workrooms or faculty planning offices include:

- Integrated printer/scanner/fax
- Digital still and video cameras
- Wireless and wired network access
- Telephone and facsimile
- Projection capacity
- Laptops, desktops, tablet

The teacher workroom should be sound attenuated to ensure quiet conditions for lesson preparation, personal telephone conferences, etc. The area would be wired for voice and data retrieval and transmittal, and should have enough outlets to provide for the staffs' portable electronic equipment.

Sample outlet configurations for a teacher workroom are included in Appendix E.

E. Specialist Areas: Music, Art, Video Production, Physical Education, Business Education, Technology Education

As implied by their title, "specialist" areas have special and unique needs with respect to both space and technology configurations. The requirements of the music department differ from that of the art department, with both being very different from the realm of physical education, yet, exciting and engaging technology resources are available for each.

This section outlines some of the many resources available to specialist educators that enable them to offer realistic, authentic, creative, and stimulating learning environments in their respective disciplines.

Music

With the incorporation of technology into the music curriculum, students can create new works and study existing pieces. In combination with special composition software, a MIDI keyboard connected to the computer allows students to create spontaneously while the computer records and remembers the details while printers directed by appropriate software can print out the music

annotations. Students may then review their musical composition, revise, and edit as desired with their work being saved to a flash drive, hard drive, or network storage device. Music CD-ROM and DVDs that combine music and graphics allow students to study the music of diverse cultures from all over the world. Applications such as iMovie, iDVD, GarageBand, Photo Story, or MovieMaker matched to distribution channels such as YouTube and iTunes allow budding musicians to record and distribute their musical creations. Storage and bandwidth needs to properly operate these applications must be planned for and met.

Likewise, there are currently a significant number of blogs and Web sites debating the merits and impact of simulations such as Guitar Hero and Rock Band on students learning to play a guitar or create music. Educators should be on the front lines of these dialogs and explorations.

Arts

For the student who never felt like an artist, the use of digital tools in the arts provides a pathway toward creativity through graphic programs that encourage exploration of shapes, colors, patterning, repetition, and recursion. The low cost of color printers adds another dimension to this level of exploration. Specialty software programs allow for cartooning, technical drawing, and combining colors and sounds. DVD resources provide the teacher of fine arts with a venue allowing students to explore the characteristics and trends of individual artists or time periods.

Virtual tours of art museums around the world, the National Gallery of Art in Washington, DC and the Louvre in Paris, being two of the most notable, allow art students to take virtual fieldtrips to study the works of the masters without leaving the classroom. High-speed bandwidth, high resolution projection devices and appropriately powerful computers are necessary to maximize the value of these visual resources

Video Production

The video production configuration enables students to record, edit, and digitally create near commercial-quality video segments. Students can generate commercials, MTV-like music videos, documentaries, and/or short movies. With the addition of video production software to a high-end workstation, students are able to input digital video from camcorders, VCRs, DVD, and other resources, and then output edited and compiled video onto an external monitor/TV for review, critique, and revision. Students electronically publish their work on the Internet and solicit global review and comments.

As in the area of music, common applications such as iMovie, iDVD, Photo Story, Premiere, and MovieMaker matched to distribution channels such as YouTube and iTunes allow students to record and distribute their video productions. Storage and bandwidth requirements to properly operate these applications also must be planned for and met.

Physical Education

Bio-feedback probes and devices connected to a computer allow educators to demonstrate reduced/increased heart rates and stress control, and record subtle

changes over time. Real-time data gathered during these activities in the physical education environment can be evaluated in science and math classes as an interdisciplinary link. Digitized videos of gymnastic moves, football throws, and golf and tennis swings allow students to compare, contrast, and critique their form with that of their peers.

With the rise of childhood and adolescence obesity and diabetes, there is an increased focus at school on health and fitness. Web sites are available to assist students with analyzing their diet and the nutritional quality of the food they eat, then prescribing fitness targets and exercise strategies to reach their goals.

Gaming devices such as the Wii present the opportunity for all schools, even those in urban settings, to offer "virtual sports" environments when campus facilities are not available to support all of these activities. Virtual golf, tennis, bowling, and boxing on the Wii present a similar physical workout as compared to engaging in the "real" sport. Other gaming systems offer activities, such as Dance Dance Revolution, that provide high levels of engaging aerobic exercise.

Business Education

As the typical business workplace has evolved to a technology dependent environment, so has the business education curriculum in secondary schools. The business education curriculum that has been recently revised at the state and district levels includes many of the following tracks (those listed below reflect the NJ draft standard 9.4 D – Business, Management & Administration (http://www.nj.gov/education/cccs/2009/final.htm):

- Administrative Services
- Business Information Technology
- General Management
- Human Resources Management
- Operations Management

Within the vast majority of these programs, students have access to degree and certificate programs and/or courses. Many of these programs are being offered through dual enrollment course partnerships with local community colleges. In an effort to replicate the technologies found in today's business community, many secondary schools incorporate sophisticated office automation and business systems into the curriculum, frequently providing a host of services to community organizations, such as developing business plans or marketing campaigns for small businesses. Secondary schools expecting to graduate students who will become productive citizens of the 21st century need to consider the technology resources and teaching expertise required to simulate a wide variety of real workplace environments, problems, solutions, and collaborations.

Technology Education

Likewise, in an effort to keep abreast of changes dictated by the demands of the 21st century, NJDOE's 2009 content standards in technology education, engineering and design and 21st Century life and careers have also continued to change to address emerging needs within the world of work in order to graduate

students with highly marketable skills. Courses of study can range from specializations in information technology to engineering to energy management to automotive maintenance and repair. An information technology track generally includes the following:

- Network Systems
- Information Support and Services
- Interactive Media
- Programming and Software Development

Today's cars and trucks require 21st century "auto shops" that incorporate specialized programs and computer systems for diagnosing and repairing vehicles.

Drafting and engineering programs have embraced many facets of computer-aided design (CAD), followed by computer-aided manufacturing (CAM) in woodworking and metals.

In the technology-enhanced "machine shop," students use sophisticated computer equipment to design, program, test, evaluate, and collaborate. It is not uncommon to see a room of HVAC equipment within the secondary school environment that is not only managing the climate within the facility, but also serving as a training ground for students interested in pursuing careers in the emerging market of climate control and energy management. Much of the information that these high-tech areas receive from the manufacturers comes to the facility via satellite, regular online updates, or CDs/DVDs.

F. Special Education

The target of special education programming is to provide a diverse array of services to achieve the goals articulated in Individual Education Plans (IEPs) for all students with special needs. Adaptive and assistive technology resources continue to play a significant role in helping to equalize learning environments for students with special needs. Some of the technologies used to assist students in the classroom include, but are not limited to:

- Text-to-speech programs that use a digital voice and read text aloud from software applications, ebooks, or Web-delivered content.
- Word prediction applications that present up to nine different possibilities once the writer begins to type.
- Portable keyboards, alternative keyboards, and switches to simplify the mechanics of the writing process.
- Concept-mapping software that presents information in graphic and outline formats.
- Electronic manipulatives that are digital versions of objects used to demonstrate math concepts (e.g., tangram blocks to create a design or dice to solve a probability problem).

New Jersey and many school districts across the nation are embracing the universal access or universal design model that employs a proactive strategy to embed in the curriculum multiple means to access content, demonstrate

knowledge, and be engaged so that the individual learning needs of all students are addressed. The universal access or universal design model employs the following strategies:

- Proactively installing/activating text-to-speech programs, auditory/visual enhancement, and other assistant applications on instructional computers in each school.
- Securing or scanning all school texts into digital format (national instructional media accessibility standards (nimas) requirements) so that all students can read with text-to-speech assistance, if needed, grade-appropriate textbooks in all disciplines.
- Ensuring that district Web pages adhere to federal accessibility guidelines.
- Providing high-quality, sustained professional development for teachers to help them incorporate universal design for learning principles into their instructional practices.

This overview of the technology-supported learning opportunities and resources available to all students including those in specialized programs, highlights the need for connectivity and technology resources where they might not have been considered before.

G. School- to- Work and Adult Education

New Jersey schools seek to provide superior educational experiences for students who desire to enter the world of work immediately after completing their K-12 education. More and more schools are offering access to training for work-related content for adults in need of retraining in this increasingly digital workplace. The resources planned for students in school-to-work programs can easily be repurposed for adult education courses beyond the hours of the typical school day.

Students of school-to-work and adult education programs are likely to experience the following technology-based environments:

- CAD/CAM design and manufacturing devices.
- Computer-aided automotive diagnosis and repair systems.
- Crisis management and medical emergency simulations for childcare providers and emergency-care first responders.
- Business planning and project management applications.
- Meteorological, atmospheric, environmental and climactic data on the web for agricultural and aquacultural planning.
- Commercial quality print, graphics, photography, and video production resources.
- Business applications associated with the standard office suite of word processing, database, spreadsheet, finance, and accounting.

Career and Technical Education

Career and technical education (CTE) programs have experienced an enormous transformation over the past twenty years from a hands-on curriculum that focused primarily on mechanical, manufacturing, carpentry, housekeeping, childcare and healthcare to a high-technology curriculum that employs technology tools and resources found in real-world business and industry. Career and technical programs offer certification programs in automotive repair, cosmetology, childcare, allied health services, networking, computer repair, technology training, bio-technology, and computer programming. Many of these programs require state-of-the-art facilities outfitted with 21st century tools.

Pre-engineering programs provide courses in the following areas:

- Middle school engineering
- High school engineering
- High school biomedical sciences program

Each of these courses requires specific hardware, software, and facility requirements that should be investigated if considering offering programs such as these.

Adult Education

The 21st century job market, including educational institutions, requires that all adult learners become lifelong learners, able to adapt and change in a global marketplace. No longer is one skill set likely to last an employable lifetime. Public school facilities have an opportunity to garner ongoing support from the greater school community while meeting an important retraining need for adult citizens. Providing access to technology learning environments and course work during primarily non-school hours holds huge potential as a "win-win" situation for preK-12 students and the community alike.

H. Peripheral Devices in Support of Teaching and Learning

Peripheral devices available to students and teachers significantly enhance classroom learning environments. It is expected that most teachers and students will have access to a wide variety of peripheral devices including projection devices, printers, scanners, cameras, CD-ROM and DVD burners, and other devices such as probes, meters, and storage devices. The long-term costs of consumables related to the use of peripherals (e.g., ink cartridges, paper, toner, blank CD/DVDs, USB storage devices, bulbs) are a major factor in selecting and setting standards for peripheral devices. This guide does not set standards for peripheral devices, but rather presents some of the growing collection of peripheral devices available to students and teachers that impact infrastructure planning.

Projection/Display Devices

With respect to projection capacity, many districts are budgeting for permanent large-group display capacity in each instructional area. Sometimes the size of a large television or monitor has not proven sufficient to display complex data or Web-based information. Adequate display capacity may be achieved in the form of a ceiling-mounted projection device, a large flat-panel display in smaller

spaces, or an interactive whiteboard. Over the past five years, projection device prices have dropped significantly, have increased in their brightness and clarity, and are less affected by ambient light conditions. The costs of large flat-panel displays and interactive whiteboards are also decreasing and should be examined regularly. Combination projector/interactive whiteboard units are now available that can significantly cut the overall unit cost due to less supporting infrastructure installation requirements.

Many districts already own portable projection devices and liquid crystal display (LCD) panels. These devices should be deployed regularly to emphasize their potential and to engage teachers in new teaching and learning strategies. If necessary, either of these units can be deployed on a mobile cart.

Document cameras or projectors allow individuals to project three-dimensional items, original print resources, dissection specimens, the screen of a hand-held computer or graphing calculator and any item that can be captured by a camera.

Printers

Schools should look closely at networked printing solutions (e.g., color, black and white, and photo quality) that provide the best return on investment. These solutions include printers capable of accepting an infrared (IR) signal from digital devices, as well as other handheld devices.

Personal Response Systems (PRS)

Personal response systems (PRS) developed for instructional use generally include software and handheld responders used by students to enter responses to teacher-generated questions. These responders transmit individual responses wirelessly back to a computer that instantly tabulates the data and then typically displays a summary of the results for the audience to review.

PRSs can be used for presentation support (general question and answer), surveys, opinion polls, voting, elections, quizzes and tests, group decision-making, and review games. Several different PRS systems are currently on the market for school environments.

Audio Enhancement Systems (AES)

Audio enhancement systems are showing positive results in elementary classrooms for all learners, not just special needs students with auditory deficiencies. The teacher wears an "audio enhancement necklace" which wirelessly relays his/her speech to speakers positioned throughout the classroom. The enhanced audio may help all students focus their attention more closely on the teacher and less on distractions within the everyday classroom environment. Proper acoustical planning in new construction may reduce and/or eliminate the need for audio enhancement systems in many classrooms by increasing the quality of acoustics and lowering peripheral noise levels.

III. Shared Environments

Each school facility has areas that are used and shared by multiple audiences for a wide variety of purposes. These areas may include the library media center, distance learning and video-conferencing facilities, along with video production and distribution studios. The audiences who share these resources consist of students, teachers, administrators, parents, and community businesses/organizations.

The purposes for which these areas are used are expanding each year as the need to research information, learn independently, and reach out creatively increases. Schools seeking to offer an expanded collection of Advanced Placement (AP) courses are using online courses to fill gaps in onsite offerings and meet student demand in a cost efficient manner. Library media centers are expanding their hours beyond the traditional school day and welcoming community members to use research materials, access the Internet, and tap expanded learning opportunities. Local business and community organizations are taking advantage of student expertise and school video distribution resources to reach out to wider audiences.

The following design criteria are referenced in the New Jersey Schools Development Authority's (SDA) *21st Century Schools Design Manual* and have an impact on shared learning environments:

- Design Criteria #3. Visual Comfort
- Design Criteria #12. Accessibility
- Design Criteria #13. Flexibility and Adaptability
- Design Criteria #14. Information Technology
- Design Criteria #23. Community Use

Specific communication, connectivity, projection, production, and acoustical needs for the following shared learning environments are outlined in this section:

A. Information Resource/Library Media Center

B. Distance Learning & Video Conferencing Environments

C. Video Production & Distribution Environments

A. Information Resource/Library Media Center

Located centrally within the school, yet preferably with secure access for community use, the information resource/library media center (IR/LMC) combines the roles of today's library services, audio visual/media departments, and technology centers into one information and technology resource center for teachers and students.

The IR/LMC is defined by its multiple purposes. Given the combined functions of providing access to information, as well as a place to process the information, the IR/LMC offers students and teachers an arena for extensive research and production opportunities. While this configuration is usually not well suited for formal large-group presentations, it serves as a resource-rich facility where independent and small-group learning are encouraged.

Information Resource/Library Media Center Configuration

IR/LMCs need to transform as access to information continues to move toward the digital environment. To support this, the IR/LMC must recognize and provide an environment for high-speed access to the expanding collection of online digital information (print, audio, and visual). In addition to traditional resources provided by the IR/LMC, students and faculty need technology-rich physical environments to collaborate and explore the virtual world. The IR/LMC should create a physical environment for this new world to evolve.

The modern information resource/media centers should be expanded to include the addition of the following areas:

- Virtual Learning Classroom
- Mobile Equipment/Laptop Repair and Information Center
- Teacher, Student Work Rooms and/or Conference Area
- Computer Training Area

In addition, schools should consider the following IR/LMC accommodations:

- Comfortable reading/lounge areas
- Open seating/tables
- Community access via exterior entrance/exit

All computers in this area are connected to the school's network and the Internet.

A sample library media center floor plan drawing is included in Appendix E.

B. Distance Learning/Video Conferencing Environments

The distance-learning classroom is designed to extend learning beyond the perimeters of the school site. This includes both formal and informal learning events. Because it features two-way communication, the range of possible opportunities in which to expand curriculum offerings is virtually limitless. Both staff and students can take advantage of off-site offerings that would otherwise be unavailable to them. With the inclusion of cable TV access, another dimension of learning sources is opened for the educational community. By using video networking capabilities, long-distance conferences can be arranged, participation in national and international forums is possible, and direct access to experts in the field becomes a reality. This form of learning is firmly grounded in communication and mutual networking with others who would otherwise be unavailable as resources.

The growing expectation by students and parents is that schools should provide access to a wide variety of e-Learning options and opportunities, especially free Internet resources. The growing collection of free resources available with high-speed Internet access presents itself as a huge untapped e-Learning resource for students, teachers, parents, and community members.

Distance Learning/Video- Conferencing Configurations

The traditional distance-learning classroom typically consists of a collection of large-screen monitors, video cameras, microphones, speakers, and a telephone/fax that allows "students"- teachers or school-age children - to actively participate, asking and responding to questions, in a class consisting of participants from potentially across the nation or the world.

The multiple monitors and video cameras capture and display participants and activity at the different remote sites. One video camera is generally dedicated to projecting instructor support materials in the form of either computer-generated images, maps, wall charts, close-up hands-on demonstration, such as dissection or hand-written notes. Likewise, microphones and speakers capture and transmit "classroom" oral presentations and discussion. The console to control the flow of voice, video, and data signals within this environment generally requires a custom design specific to each individual location.

Desktop video-conferencing solutions do not require this level of investment, but rather an investment in appropriate computers with cameras, headsets with microphones, and high-speed bandwidth to the desktop.

The distance between remote sites may be within buildings in a single township or among schools across the nation and the world. In the past, the electronic signals sent and received were carried via some combination of satellite, ITFS, fiber optic and coaxial cable requiring a separate network and support structure to support the transmission. Currently, video-conferencing is most typically conducted over the Internet via IP protocols.

Additional information regarding distance-learning and video-conferencing environments is included in Appendix E.

C. Video Production and Distribution Environments

Video production and distribution is evolving as a mainstream activity in education and the environments and systems to support this function continue to expand and become more affordable. Dedicated studio and control room space and equipment are one option, but the proliferation of more powerful computers and video-editing software provide additional options to be considered. Today, every computer on a high-speed network is a potential source of video production, as well as distribution, not only locally but also globally. The challenge is how to manage and control the storage and distribution of this content.

It is not unusual to find live building-level local video broadcasts being produced by students on a regular basis throughout all grade levels. Many schools produce a live morning announcements broadcast distributed to every classroom.

General Guidelines

The space should fit the purpose. If regular video production and distribution is performed, a permanent location should be considered.

1. Production

A. Storage and Network Bandwidth

- Large amounts of digital storage and network bandwidth are required to transfer raw and final production materials for manipulation, editing and ultimately distribution. Anyone engaged in this activity will require multiple gigabytes of file storage. If students are provided network storage, consider options to support this activity and the impact this may have on network storage and bandwidth, particularly if the files will be transferred over the school's wide area network or the Internet.

- Adopt and standardize on one video-editing software package, and install this software on all appropriate computers.

- Set clear guidelines and policy for the storage, backup and retention of raw and final versions of video material. One second of standard uncompressed raw video can consume as much as 25Mb of storage. Final production material should be in a compressed format and align with the standard video distribution methods used by the school.

B. Content Management

- For permanent and more formal video production facilities, the organization and storage of master tapes will require a management and documentation system.

- Consider a publication process that includes cataloging the video media produced with the installed library/media management system.

2. Distribution

Distribution can be performed live and in recorded format:

A. Recorded: Recorded Personal Media, such as tape, DVD, flash drive

- Standardize on one format.

- For tape, assure all digital camcorders use the same tape format.

- For each generation of DVD recording media, set a standard such as DVD+R, Dual Layer DVD+R or Blu-ray.

- Flash drives are generally compatible with most computers with USB interfaces.

3. Network Server

With the proliferation and ease of video production and distribution, where and how video is distributed must be clearly defined from a policy perspective. Network-based video should have clear policy and guidelines about how it will be published and who can view this content. Video content published and made available through a public Web site should be carefully monitored and managed in light of privacy and other important considerations.

Video distribution solutions should be carefully selected and measured against network and other technology infrastructure capacity. Video-streaming solutions exist that can provide the desired result more efficiently with less impact on the infrastructure. Careful selection can result in significant management and maintenance savings.

4. Distribution Network Infrastructure (CCTV)

Installing complete analog Coax-based video distribution networks in new school facilities has been declining as schools select to distribute video over the Category 5e/6a switched Ethernet local area data networks. There are cost savings in eliminating the complexities of installing, balancing and maintaining a separate network for the purpose of video distribution. A digital video distribution system can offer lower cost, as well as increased flexibility, quality and ease of program distribution. The selection of a digital video distribution system must be made early in the planning process and appropriate network outlets will need to be installed where broadcast video is to be displayed or content is to be uploaded to the network.

- Live video production and broadcast versus the distribution of recorded material may require different infrastructure considerations. The program requirements of the facility will drive the infrastructure need. Consider a professional studio if live video production and broadcast is necessary. This type of facility may also consider broadcast capabilities for analog distribution.
- Digital versus analog video production and distribution are vastly different. New schools should implement digital video production and distribution environments taking advantage of the data network. Digital distribution over a converged network that includes voice, video and data offers significant advantages and cost savings.
- The locations where regular live video is to be produced and become a source for rebroadcast over the video distribution network should be identified in the planning stages. These areas should be selected with consideration for lighting, sources of noise (motors, A/C equipment, bells, etc), and access control.

Sample Design Types

Three design prototypes for video production environments are presented for consideration:

- ***Type 1:*** Individual/small-group mobile production. This type of system requires no facility support other than access to facility resources such as electrical power and the network, as needed. Schools should consider creating areas that are better suited for this type of video production, such as small conference rooms where access and noise levels can be better managed. However, these spaces do not need to be designed specifically for this purpose.

- ***Type 2:*** Elementary and middle school studio. These studios are less complex than the professional studio but can still produce high-quality video productions. Depending on the focus of the video production, the size of the room will vary from a single subject to a group production, such as a sports or news anchor type desk. These rooms may function as dual purpose rooms and could potentially be integrated with a distance learning classroom.

- ***Type 3:*** High School/Vocational School Professional Studio. This permanent installation will require significant design planning to accomplish. These spaces are intended primarily for intensive and professional video production. Significant planning and support is necessary to sustain a professional studio that is used regularly. Careful attention to how video is managed and transmitted to the school, district and other networks will be necessary to assure smooth operations. Equipment and interface specifications in this design will dictate facilities design.

Additional information regarding video production and distribution environments is included in Appendix E.

IV. Large Group Environments

With the ever-rising cost of energy and the limited availability of space, districts are seeking ways to maximize the use of space for large-group environments. The auditorium that sits unused for much of the week is a luxury that few can afford in times when classroom space is at a premium. Additionally, areas that can accommodate large groups enhance opportunities for schools to extend learning and community access and participation beyond the school day. By designing large-group environments that meet the diverse needs of the school and community, schools can become the focal point of the community, thus increasing parents' and community members' participation in their students' education and their overall support of the school.

To ensure the security of the less public areas of the building, large-group environments should have exterior entrances and be partitioned off from classrooms and offices.

The following design criteria are referenced in the New Jersey Schools Development Authority's (SDA) *21st Century Schools Design Manual* and have an impact on large-group environments within school facilities:

- Design Criteria #3. Visual Comfort
- Design Criteria #12. Accessibility
- Design Criteria #13. Flexibility and Adaptability
- Design Criteria #14. Information Technology
- Design Criteria #23. Community Use

The following recommendations from the *Best Practices Standards for Schools Under Construction or Being Planned for Instruction* impact large-group environments:

- Video surveillance cameras shall be installed throughout the exterior and interior of the building, covering areas shall include, but not limited to, infrequently occupied areas that are not locked or alarmed such as, but not limited to, auditoriums.

Specific communication, connectivity, projection, production, and acoustical needs for the following large-group school facilities are outlined in this section:

A. Auditorium/Theater

B. Cafetorium/Multipurpose Area

C. Gymnasium/Athletic Fields

A. Auditorium/Theater

The auditorium/theater area can be used for a number of events that involve a large audience: dramatic and musical performances, speakers, film presentations, assemblies, dance recitals, and town meetings, to name a few. These events require a setting that is handicapped-accessible (including ADA listening device capability), well-ventilated, and acoustically sound.

Ideally, the auditorium has a separate exterior entrance near the stage to facilitate the loading of props and other equipment, as well as an exterior entrance for the audience. These will also serve as egresses in case of an

emergency. If this area is to be used by the community, there should be a means of partitioning it off from classroom and office areas.

The auditorium/stage area represents a presentation area for the entire school. The ability to present information to a large group is particularly important and, therefore, requires technology tools, such as video projection systems and large-screen displays. The fixed mounting of these devices normally is recommended because of the set-up time required. If these devices are planned and the locations are identified, both data and video cabling can be arranged. Usually it is recommended that multiple video cable drops be located throughout the auditorium to provide for videotaping or live broadcast of events. Likewise, a Codec video-conferencing system in this area may be considered.

It is recommended that the main room of the auditorium/theater area include the following equipment:

- Telephone
- Cable port for viewing and broadcast
- Data ports throughout areas
- Wireless access points
- Video projector on mobile stand/fixed position (mounted in rear projection booth)
- Large, electric front screen
- Modulated lighting
- Stage lighting
- Acoustical design
- Control panel for lighting, sound, and screen

Recommendations for the projection, sound, and video-recording areas include the following equipment:

- Stage lighting control panel
- Stage sound control panel
- Large area projector
- Video recording studio and equipment
- Data ports
- Cable broadcast hookup
- Security cameras (if needed)

Recommendations for the back stage area include the following equipment:

- Stage lighting
- Control panel for curtains
- Telephone and phone line
- Data ports

Sample floorplan drawings for typical auditorium/theater, sound/projection/video production area, and backstage area are included in Appendix E.

B. Cafetorium/Multipurpose Area

To maximize the use of space in newly constructed and renovated school buildings, many schools have one or more rooms that serve multiple purposes. The cafetorium is popular because it combines the features of an auditorium with the traditional food service requirements, enabling the space to be used for performances, large-group presentations, and meetings and eliminates the need for a less frequently used auditorium. The space should be adaptable and configurable for other school needs such as standardized testing.

These various uses require a setting that is handicapped-accessible, well-ventilated, and acoustically sound. The cafetorium should have a separate exterior entrance near the kitchen to facilitate the loading of supplies. An exterior entrance for the students and community members will also serve as an egress in the event of an emergency. Since the community also uses this area, there should be a means of partitioning it off from classroom and office areas.

The cafetorium should have video projection systems, large-screen displays, and a local sound system. Fixed mounting of these devices is normally recommended because of the set-up time required. Usually it is recommended that video cable drops be located in the cafetorium to provide videotaping or live broadcast of events and to enable the room to accommodate overflow for broadcast of events such as graduations. The cafetorium may also require data drops for point-of-sale terminals, card readers, and reverse-ATM machines through which students can deposit funds in lunch accounts. Wireless access should be considered throughout in order to give the space the flexibility for activities, such as online testing.

The following equipment should be considered for food service, preparation and serving areas:

- Networked point-of-sale (POS) terminal per food service line
- Telephone
- High-quality printer

The following equipment should be considered for food service offices:

- Networked computer for director and clerical support staff
- Integrated fax
- Telephone
- High-quality printer

The following equipment should be considered for student dining/common areas:

- Flat panel displays that can be used for electronic bulletin boards, CATV broadcast and in room presentations
- Cable TV drop

- Data ports throughout
- Wireless access points
- Video projector on mobile stand/fixed position
- Projection screen
- Telephone cable drop
- Acoustic treatment
- Light track
- Audio system
- Security cameras (if needed)

Sample floorplan drawings for typical cafetorium are included in Appendix E.

C. Gymnasium/Athletic Fields

Athletic events continue to provide communities with opportunities to engage in healthy competition in a manner that supports school districts and promotes community spirit. For this reason, a state-of-the-art gymnasium and athletic facility is desirable. A school athletic facility can also provide an arena for students, teachers, administrators, and community members to adopt/enjoy healthy lifestyles.

An arrangement for data and video drop cabling in the gymnasium, on the athletic fields, track facilities, stadiums, and other sports-related areas is recommended to support the ability to videotape or provide live broadcasting of events held in these areas. Planning for multiple video drops provides greater options for camera angle coverage.

The following equipment should be considered for gymnasiums:

- Data/video ports and monitors that can be used for video displays of electronic bulletin boards
- Video projector on mobile stand, video monitor on mobile stand, large electric front screen
- Video camera origination points
- Electronic scoreboard
- Telephone
- Wireless access points
- Security cameras (if needed)

The following equipment should be considered for athletic offices:

- Networked computer per teacher per office site
- Integrated fax/printer/scanner
- Telephone

- Data drops

The following equipment should be considered for weight rooms:

- Telephone
- Wireless access points
- Data drops
- Audiovisual/display capability

The following equipment should be considered for athletic fields:

- Large electronic scoreboard
- High-quality sound system
- Exterior lighting system
- Control panel for sound and lighting control
- Broadcast booth for announcer
- Video broadcast capability
- Connection for projector, when needed
- Electric panel for projection
- Data/video drop
- Electronic timing equipment
- Security cameras (if needed)

Sample floor plan drawings of typical physical education areas are included in Appendix E.

Section 5. Standards and Systems

The trends in facilities design have resulted in a greater emphasis on the need for standards. Through standards, design consultants and school planners can be sure the infrastructure and systems will successfully support the anticipated increased reliance on technology. By adopting standards in the foundation of the facility design, the fast-paced and constantly changing nature of the new technology systems built on this foundation can be more efficiently planned, constructed and managed.

Learning environments are becoming more modular, transformable and mobile as the boundaries between teachers and learners become more permeable. It is important to adopt industry standards and guidelines in order to best serve these environments and emerging technology systems. It is the purpose of this section to address these standards and to address the physical aspects of the design and planning for technology infrastructure.

I. Standards

Integration of technology is a key element of school building design. Administrators and design professionals need to make a concerted effort to intelligently plan and locate building systems as they become increasingly critical to the operation and day-to-day functioning of the facilities. This becomes evident as components such as voice systems (e.g. VoIP systems), Audio-Visual and security systems converge on to the network infrastructure.

A. Code vs. Standard - Definition

A code is a set of minimum regulations and requirements that an architect is legally bound to follow. A standard is an agreed set of principles and protocols that groups voluntarily follow.

B. Compliance Codes Examples

ICC/BOCA - The International Code Council (ICC) is a compilation of several code authorities including the Building Officials and Code Administrators who published the BOCA National Building Code series. New Jersey was under BOCA but now has adopted the International Code Council's NJ International Building Code along with associated codes.

N.J.A.C. – The New Jersey Administrative Code is relevant as it relates to technology proposes and adequately implementing the Core Curriculum Content Standards in Technological Literacy. Technological literacy includes both computer and information literacy and technology education. Integration of technological literacy should occur at all grade levels.

NEC (National Electrical Code) – Article 645. The most widely adopted element of a building code in the United States and the world, the National Electrical Code is the benchmark for safe and efficient cabling installations.

C. Additional Standards and References

The standards that are used for technology infrastructure design and construction have arisen out of necessity and demand from the design, installation and construction community.

ANSI - The American National Standards Institute (ANSI)

The American National Standards Institute (ANSI) has served in its capacity as administrator and coordinator of the United States private sector voluntary standardization system for more than 90 years. Founded in 1918 by five engineering societies and three government agencies, the Institute remains a private, nonprofit membership organization supported by a diverse constituency of private and public sector organizations. ANSI's common principles of understanding and guidelines include development of industry standards, as well as the standards and needs of network applications, users, content and information providers. They also include international standards matters, cross-industry cooperation and the role of government and architectural process and analysis.

ANSI standards are referenced in almost all product and project specifications with items, including, but not limited, to fiber optic connectivity, copper cabling standards and storage area networks.

EIA/TIA – Electronics Industry Assoc./Telecommunications Industry Assoc.

Published in July of 1991, the EIA/TIA 568, 569, 606 and 607 standards serve the following purposes:

- Specifies generic telecommunication cabling system which supports multi-product, multi-vendor environments.
- Provides direction for commercial telecommunication product design.
- Enables planning and installation of cabling with minimum knowledge of the telecommunication products to be installed.
- Establishes performance/technical criteria for various cabling system configurations.

The EIA/TIA Standard specifies:

- Minimum requirements for telecommunications cabling within an office environment.
- Recommended topology and distances.
- Media parameters which determine performance.
- Connectors and pin assignments to ensure interconnection ability.
- The useful life of telecommunications cabling systems as being in excess of ten years.

BICSI – Building Industry Consulting Service International

BICSI is a widely recognized leading professional association supporting the information infrastructure industry with information, education and certifications for individuals and companies.

NJ Department of Community Affairs (DCA) – Best Practices Standards for Schools Under Construction or Being Planned for Construction.

DCA has established security-related requirements that the design consultant **must follow** on new facility projects. The requirements encompass the following areas:

- Site Layout
- Building Layout
- Specific Standards regarding:
  - Exterior Lighting
  - Entrance access
  - HVAC
  - Fire Protection
  - Elevators
  - Emergency Control Center and Communications
  - Video Surveillance

The most current version of the best practice guidelines is available at http://www.state.nj.us/dca/codes/misc/pdf/ed_bp_stndrs_11_10_2008.pdf

Design consultants and IT planners shall verify with the DCA that they are using the most current applicable version of the best practice requirements. The technology disciplines most directly affected by the DCA requirements are Security and Telecommunications. Refer to Section 3 of this document for more detail on how these requirements are to be incorporated into the facility design and project deliverables.

ADA Compliance, Design for Inclusion and Technology (American with Disabilities Act)

In 1998, Congress amended the *Rehabilitation Act* to require agencies to make their electronic and information technology accessible to people with disabilities. "Inaccessible" technology interferes with an individual's ability to obtain and use information quickly and easily. This was enacted to eliminate barriers in information technology, to make available new opportunities for people with disabilities and to encourage development of technologies that should help achieve these goals.

D. Applying Standards

1. **Adherence to Standards**
   When there are industry or district standards addressing an item, such standards, wherever feasible, should be included in the requirements of the standard item.

2. **Flexibility**
   End users of technology usually have varying needs for digital tools and would like as much flexibility as possible in selecting the optimum product for each need. Whenever possible, the criteria for selecting standards should provide as much flexibility to the user as possible. When such flexibility is insufficient to meet the user's need, the technology standards procedures allow a waiver process for proprietary items allowing purchase of a non-standard item.

3. **Expandability**
   Standards should allow for the capability of expansion in order to meet growth. If the expansion requires the purchase of additional items, these items should fall under standards process control.

4. **Support for Existing Resources**
   Standards must require interoperability and compatibility with the existing infrastructure and any existing items that might interact with the standard item. Where possible, qualification testing should be required to assure interoperability.

5. **Reliability/Availability**
   For hardware items, the standard should include minimum acceptable reliability and availability requirements.

6. **Data Security**
   Standards should include specifications for ensuring network security, whenever applicable. For example, the proliferation of wireless telephones and wireless computers poses security risks that requires their inclusion under standards process control.

7. **Cost of Ownership**
   The standard should include any requirements that can lower the total cost of ownership while meeting the minimum requirements of the users.

8. **Performance**
   Standards should specify parameters for minimum acceptable performance in order to ensure the user requirements.

E. District Educational Technology Plan (Three Year Plan)

The New Jersey Department of Education recommends that each district have an approved educational technology plan. Also, the Federal Communications Commission requires district technology plans for certain funding programs such as E-Rate. To ensure that schools are prepared to effectively use the technology services, districts must certify that their requests are based on approved technology plans and include provisions for integrating telecommunication

services and Internet access into their educational programs. Most schools have already developed such plans and may only need to modify these existing plans to conform to program criteria for technology plans. The plan must establish clear goals and a realistic strategy for using telecommunications, information technology and digital tools to improve educational services. Districts who seek E-Rate funding for telecommunication services should review the following information about technology plan requirements and approval:

- The plan must have a professional development strategy to ensure that staff is trained to use these new technologies to improve education services;
- The plan must include an assessment of the telecommunication services, hardware, software, and other services that will be needed to improve education or library services;
- The plan must provide a sufficient approved budget to acquire and support the non-discounted elements of the plan - the hardware, software, professional development and other services that will be needed to implement the strategy; and
- The plan must include an evaluation process that enables the school to monitor progress toward the specified goals and make mid-course corrections in response to new developments and opportunities as they arise.

F. Specification Format – CSI Division 27 and 28

As the complexity and details for technology systems have grown, so has the importance of adhering to the CSI MasterFormat, the U.S.-Canadian standard for organizing specifications and other data for commercial and institutional buildings. MasterFormat 2004 Edition, released in November 2004 by the Construction Specifications Institute (CSI) and Construction Specifications Canada, has been greatly expanded beyond the previous edition to include significant changes in design, construction and management of facilities.

As a matter of practice, districts and design consultants may adopt and utilize this revised CSI MasterFormat 2004. The revision includes a new series called "Facility Services" that is numbered in the 20's. For example, mechanical and electrical, formerly Divisions 15 and 16, now are in this section, along with an area referred to as "CLA" (**c**ommunications, **l**ife safety, integrated **a**utomation systems).

Below is an outline of Division 27 (Communications) and Division 28 (Electronic Safety and Security) that may be considered and used for project specifications.

DIVISION 27 – COMMUNICATIONS

270500 - COMMON WORK RESULTS FOR COMMUNICATIONS
Materials and methods common to multiple communication systems.

271100 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS
Telecommunications mounting equipment, service pathways, and grounding.

271300 - COMMUNICATIONS BACKBONE CABLING
Pathways, cables, connecting hardware, and cable identification systems.

271500 - COMMUNICATIONS HORIZONTAL CABLING
Pathways, cables, connecting hardware, and identification and administration systems.

272000 – DATA COMMUNICATIONS
Network equipment, hardware, peripheral data equipment, software and programming and integration services

273000 – VOICE COMMUNICATIONS
Switching and routing equipment, telephone sets, facsimiles, modems, messaging, call accounting and call management

274100 – AUDIO-VIDEO SYSTEMS
Integrated audio-video systems for classrooms, theaters, auditoriums, conference rooms, stadiums and arenas

274133 - MASTER ANTENNA TELEVISION SYSTEM MATV
Options for off-air antennas, CATV, or broadcast satellite service.

275113 – PAGING SYSTEMS
Overhead paging, public address and mass notification systems

275313 - CLOCK SYSTEMS
Master and secondary clocks and signal devices; interface with intercom and public address systems

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

280500 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY
Materials and methods common to multiple electronic safety and security systems.

280513 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY
UTP, fiber-optic, coaxial, RS-232, and RS-485 cables, connecting hardware, and identification systems.

281300 - ACCESS CONTROL
Computer controlled, with interface to other facility management systems.

281600 - INTRUSION DETECTION
Detection devices, controls, and alarms.

281643 - PERIMETER SECURITY SYSTEMS
Detection devices, controls, and alarms on the site perimeter.

282300 - VIDEO SURVEILLANCE
Cameras, data transmission wiring, monitors, and control equipment.

283111 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM
Systems with addressable initiating devices and conventional or addressable notification appliances.

283112 - ZONED (DC LOOP) FIRE-ALARM SYSTEM
Small systems for buildings relying on zoned fire alarm concept.

283500 - REFRIGERANT DETECTION AND ALARM
Monitors, alarms, breathing apparatus, and ventilation equipment interlocks.

284619 - PLC ELECTRONIC DETENTION MONITORING AND CONTROL SYSTEMS
Monitoring and control of doors, gates, and related items for detention facilities.

II. Communications Services and Systems

This section examines specific technology services, systems, areas or concepts. Each item will be defined and an example or current industry standard will be included. These design concepts and standards are applicable to new construction and sizable additions and renovations. Smaller-scale projects and retrofits can also use these standards as a guideline to be incorporated accordingly by the district and their design team.

Definitions for certain IT spaces are changing and are used interchangeably. The space where communications cables enter the building and terminate is called the "MDF" (main distribution frame) and the space on each of the floors where the voice and data cables terminate is called the "IDF" (intermediate distribution frame). Small telecom spaces have historically been called "closets". These terms were originated by AT&T in the 1960s. While these terms hardly describe what actually goes on in these spaces, the nomenclature remains resilient. Even the most recent RFPs and specifications use these terms. But times are changing as new generations of designers enter the workforce and design process. For years, the Building Industry Consulting Service International (BICSI) has been defining the MDF as the "Main Cross-Connect" (MCC) and the IDF as the "Telecommunications Room" (TR). For the purposes of this document, the legacy nomenclature will be used in order to avoid confusion.

Every school should have some combination of the following types of facilities dedicated to telecommunications systems:

- Entrance Facilities (Demarc or Cable Vault) – Secured area where incoming service providers terminate their incoming cables for interconnecting with the building infrastructure.
- Main Distribution Facility (MDF) – Large, dedicated room containing head-end and control equipment for all communications systems.
- Intermediate Data Facility (IDF) – Medium sized “closets” or rooms dedicated to communications distribution equipment for distinct sections of the building to satisfy engineering length requirements.

Each school should have a single entrance facility and a primary MDF. Depending upon school size, a facility could have multiple IDFs

- Technology space requirements should be designed and located beginning with the MDF. The MDF should serve as the nerve center of the data, voice and

security systems. The video head-end equipment should be located within or adjacent to the television studio, in schools that have been provided with one. Otherwise, the video head-end should be in or adjacent to the media center.

- For multi-story buildings, an IDF should be present on every floor. Where possible, IDFs should stack on top of one another. IDF location should consider that no individual cable can exceed 300 feet in actual length, including vertical transitions and cable slack.

A. Entrance Facilities

The entrance facility is optimally a dedicated room in which all the outside technology services originate or enter the facility (data, voice, security, CATV or other audio visual).

Entrance facilities should comply with the requirements of TIA/EIA-569A and local utility requirements. These rooms should be designed with all four walls of floor-to-ceiling code compliant plywood and should be provided with base lightning protection. In instances where base building surge suppression and generator power is in the design, it should also be made available for this space.

The entrance facility may be a room separate and apart from the MDF. However, it is preferable to coordinate with the service providers and have service brought directly to the MDF. The design consultant should provide a closed conduit system from the cable entry point directly to the MDF or from the separate entrance facility room. All service providers should clearly identify and label all termination fields per TIA/EIA- 606A.

B. Primary and Secondary Technology Spaces and Equipment Rooms

The following are guidelines for placement, size, environmental requirements, grounding and bonding, cable routing, wall and rack space for the various technology systems.

MAIN DISTRIBUTION FRAME (MDF)

The MDF is a multi-function, secure, climate-controlled space dedicated to the exclusive use of building telecommunications systems. Every school should have a single MDF with the following characteristics or elements:

- Wherever possible it should house entrance facilities and demarcation points for the various telecommunications systems serving the building and the central grounding equipment for the telecommunications equipment.
- Access to this room should be tightly controlled via a non-master key or access control card reader.
- The data, voice, security and intercom/master clock systems should locate their head-end equipment within this facility.
- Consideration should be given to the room's layout to allow for expansion of the data network, location of additional systems as they come online, and possible location of technician work space to repair

equipment, troubleshoot network problems, or assemble new equipment.

- Floor-mounted standard open data equipment racks may be used in spaces where student/staff access is limited, otherwise data equipment cabinets should be used.
- The MDF should be interconnected with all other telecommunications rooms with minimum of two (2) 3-inch conduit assemblies. Guidelines for these conduit systems can be referenced from TIA/EIA-569-A.
- The MDF should be located to minimize the number of IDFs, but not violate the "300-foot rule" (restriction of horizontal cable links to less than 90 meters or approximately 300 feet).

INTERMEDIATE DISTRIBUTION FRAMES (IDF)

IDF design guidelines are as follows:

- Ideally, horizontal Unshielded Twisted Pair (UTP) cables should be designed to run no more than 220 feet horizontally measured from the IDF patch panel to the end-point/termination/jack.
- Consideration should be given for future expansion of telecommunication spaces and other systems without the need to assign new rooms for equipment. Adhering to industry standards for sizing IDFs based upon square footage of service area is recommended.

EQUIPMENT PLACEMENT GUIDELINES

- Allow three (3) feet of clear working space around cross-connect areas and equipment for ease of maintenance.
- Allow at least four (4) feet of clearance from the centerline of equipment racks and cabinets to the walls in front and to the rear of the rack/cabinet.
- Distribution racks and cabinets should be placed with proper consideration to clearances around the equipment, taking into account sources of EMI (electro magnetic interference), technician workspace, and sufficient walkways to avoid accidental disruption of service.
- When IDFs cannot be dedicated to technology equipment, the data equipment should be partitioned away from other material or equipment by use of a lockable separation. If the space cannot be divided, then equipment cabinets for data equipment should be used instead of equipment racks. Equipment that should be located within each IDF/MDF should include:
    - Distribution racks or cabinets for mounting hardware.
    - Termination fields for fiber optic, UTP, and coaxial cables.
    - Switches for the Local Area Network.
    - Amplifiers and other equipment for the CATV Distribution.
    - Rack-mounted Uninterruptible Power Sources (UPS).

OTHER CONSIDERATIONS

The routing of cabling for the telecommunications and security infrastructure requires consideration of shared space with electrical, mechanical and plumbing pathways. Proper environment for active electronics should be maintained and power be available as outlined below.

Pathways:

The pathways for low voltage cable may consist of cable trays, "J-hooks", conduits and chases to provide access to the various classrooms, administrative offices and other areas from the telecommunications equipment rooms. Low voltage cabling requires consideration in the early stages of the project design to ensure proper coordination with other trades.

HVAC:

- MDFs and IDFs should be maintained between 64 °F and 75 °F at all times. The humidity range should be kept between 30% to 55% relative humidity.
- MDFs and IDFs should have an independent air conditioning system separate from the rest of the building HVAC system, especially if the building's system is centralized, and be able to run 24 hours a day, 7 days a week.
- If the rooms are considered unoccupied, outside air (OSA) can be at the minimum, depending on local codes.
- Generally, no heating is required.
- Maintain positive air pressure to avoid ingress of dust and debris.
- The HVAC system should have an emergency power system backup.

Electrical:

- The electrical requirements for equipment such as computers, printers and scanners should be coordinated with the electrical engineer. Voice/data/AV jacks are typically co-located with electrical outlets.
- 30-Amp, twist-lock receptacles are often needed for rack-mounted, UPS equipment. Receptacles should be located within 12" of the rack or cabinet where the UPS should reside.
- When generators are to be installed, load requirements of the voice, data, and security system should be considered. Some schools may wish to have the public address system on emergency power circuits as well.
- The MDF and each IDF should have a minimum of two non-switched, three-wire 120 V AC duplex outlets, each on separate branch circuits (wired for 20 Amp capacity).
- Additional convenience outlets should be located a minimum of 10 inches AFF (above finished floor) at 6-foot intervals around the perimeter of each room.

- For wall-mounted video equipment, provide a duplex receptacle on a dedicated circuit mounted just above the top of the rack, and a duplex receptacle on a dedicated circuit at least 18" AFF in the center of the plywood sheet.
- Emergency lighting and power to MDF/IDF is recommended.
- Telecom power should be on different circuits than lighting fixtures.
- Lighting in MDF/IDF should provide a minimum of 500 lux (50 foot-candles) measured 3 feet AFF. Fixtures should be a minimum of 8.5 feet AFF.
- The school should be provided with a telecommunications grounding and bonding infrastructure designed and installed in accordance with the applicable codes and the latest version of ANSI/TIA/EIA-607, Commercial Building Grounding and Bonding Requirements for Telecommunications. A telecommunications bonding backbone (TBB) should interconnect the telecommunications bonding and grounding infrastructure, through the grounding busbar to the building service ground.

Plumbing/Fire Protection:

- Do not route wet pipes or steam through telecom rooms.
- Dry pipe sprinkler systems are preferred to wet.
- If wet overhead pipes such as drain lines, fire sprinkler lines, and domestic water lines are unavoidable, provide secondary drains below.
- Provide smoke detectors and connect them to the fire alarm system.
- As a first preference, possibly use a chemical fire suppression system such as Ansul 2000 system over a dry pipe sprinkler system.

C. Horizontal Cable

All horizontal cabling must conform to all physical and performance requirements of the current ANSI/TIA/EIA cabling specifications. Category 6 UTP cabling is recommended. Category 5e should be the minimum performance cable installed.

It is beneficial for cable identification and maintenance to use different color cable jackets and jack inserts for different applications. Standards should be established at a district level for uniformity and ease of support. The following color code provides an example for identifying cable and outlet usage:

Gray ……. Voice/Telephone
Blue…….. Data - Computer/Printer/VOIP
Green…… Wireless Access Point (WAP)
Black……..Video (over UTP)
Red ……Security
White ……. Building Control/Management Systems

D. Backbone Cable

All backbone cables should run from the MDF to individual IDFs and terminate in the appropriate cross-connect field. Telephone backbone cabling (for non VoIP phone systems) should terminate in a 110-block mounted on a patch panel within a rack or on fire resistant plywood sheet securely mounted to the wall, both in the MDF and at the destination IDF. Data and voice over IP backbone cabling (typically 6 to 12 strand multimode fiber optic cable) should be terminated in rack-mounted fiber optic patch panels. Single mode fiber may also be used depending on needs and configuration.

While there is no clear standard in copper connectivity, there are industry (TIA) standards for fiber cabling;

Multimode	Orange
Multimode (laser optimized)	Aqua
Single Mode	Yellow
Single Mode (polarized)	Blue

E. Cable Testing, Certification and Warranty

Included within the specifications for cabling systems should be language covering the following:

- Cable length, performance testing, continuity, and standards-based installation.
- Proper pathways installation, with proper support of cables to minimize damage and allow for quick access to the cable pathway.
- Proper labeling at all cross-connects telecom rooms, and service entries.
- Proper environmental conditioning for all telecom rooms: temperature, positive air pressure, humidity levels, lighting, and room layout.
- Proper equipment grounding.
- Equipment to be neatly and properly installed to allow servicing, minimize damage, and maintain clearances as required by code.
- Provision of adequate power has been provided at the proper locations for telecom equipment.
- The entire cable plant from equipment cable at the workstation to the patch cord at the horizontal cross-connect should come with a channel warranty of a minimum 15 years.
- Design consultant should follow the requirements of TIA/EIA-606A to fully provide “as-built” documentation clearly identifying completed IT construction.
- Telecommunications spaces, hardware, and equipment should be permanently labeled. Cables and outlets should also be labeled with a unique identification scheme for each individual cable link. Patch

cords, patch panels and equipment racks should also be uniquely identified.

- Access panels for accessing telecommunications equipment in the ceiling should be uniquely identified on record drawings and labeled accordingly.
- All labeling information should be maintained to reflect as-built and changes documentation. All test documents should reflect the district's standard labeling scheme.

F. Public Address and Clock Systems

The Public Address (PA) clock systems should have the following characteristics and usage.

- The PA system is typically a low voltage system that utilizes a copper cable infrastructure to distribute a user-defined input in a single or bi-directional manner.
- The system should be capable of multiple, simultaneous conversations on separate channels throughout the facility through call-in switches and loudspeaker assemblies.
- A programmable master clock with correction of secondary clocks is typically integrated with the PA system. The master clock system controls tone generation in order to signal class changes.
- The systems are typically microprocessor-based and should be integrated with the telephone system installed within the facility so that with the proper access code, any telephone can access the PA system and make an announcement.
- The system should be expandable to meet the user's future expansion needs and be programmable from a master phone or computer terminal located at the facility.
- The system's main controls should be located in the MDF with only music source and master phones located in the main office location.
- Clock/speaker assemblies are normally located above classroom doorways or at another approved location within the room. Call switches are typically wall-mounted near speaker locations to allow for two-way communications to the main office.
- Ceiling-mounted corridor speakers and wall-mounted clocks should be spaced appropriately to allow easy viewing of clocks and full audio coverage of pages throughout the facility.
- Amplifiers associated with local sound systems in gyms or cafeterias should be equipped and wired so as to mute local speakers when a PA announcement is being made.

G. Physical Security Systems

Security systems can be separated into two major components; access control and surveillance.

Access Control

The following are recommended components and features for access control systems:

- Components should be IP addressable allowing for the use of data cable plant for transport and network accessibility eliminating the need for static "head-end" or monitoring stations. The use of the facility's wireless network can also be considered as devices are available utilizing this technology.
- System should be designed and implemented to control access to the facility, as well as access to certain areas within the facility.
- The access control system should allow restriction levels based on individual needs and shall be an easily programmable, computer-based system.
- The access control system can be used to log and track activity in certain high-value areas of the building, as well as key exterior doors.
- The primary access control components include keypads and card access readers, designed for damage and tamper resistance with a manual key alternative at points of entry.
- Systems utilizing proximity cards rather than card swipe devices are recommended.
- The distribution and control of the keys and access cards should be established and monitored by the security department. In schools without security staff, the main door lock release control should be located in the main office and be accompanied by two-way audio and visual contact, if possible.
- During a fire emergency, the system must unlock all locks and disable any time-delay egress requirements to allow for immediate egress.
- Some schools may consider walk through or hand-held metal detectors.
- All exterior doors should have magnetic locks that are addressable onsite as well as from a remote location in the event that a lockdown or open situation is required.
- Badging systems, with all the necessary equipment required for providing cards, should be included as part of an access control system.
- Secondary means of access control may include exterior gates, exterior barriers, vandal resistant windows and glass, lexan panels and protective metal screens. The inclusion of these additional access control devices must be dependent upon individual facility needs and as deemed necessary by the district.
- Interior protection of the school should include motion detectors, door contacts and glass break sensors.

Video Surveillance

The following are recommended components and features for CCTV systems:

- Components should be IP addressable allowing for use of data cable plant for transport and network accessibility eliminating the need for static "head end" or monitoring stations. The use of the facility's wireless network can also be considered as devices are available utilizing this technology.
- Video surveillance systems should provide visual monitoring of the facility, internally and externally, 24 hours per day. The system should be used to record and provide evidence of incidents and provide a deterrence of further incidents.
- The system should be capable of transmitting over local and wide area networks using TCP/IP protocols.
- Cameras should survey the corridors, specific rooms, main entrance and exit points and all perimeter areas of the facility.
- Digital video recordings should be transmitted from each camera location and stored for a period of time as determined by the district (typically 30 days) on a digital video recorder (DVR).
- IP cameras can utilize unshielded twisted (UTP) cabling (e.g. category 6 cable). Camera locations are wired to an IDF and then utilize the LAN to transmit video over the fiber backbone to the main viewing station at each facility.
- The storage size of the DVRs shall be based upon the number of cameras and selection of recording sequence.
- The recorder should capture digital pictures from each camera at a rate of no less than five frames per second and record data and time for each image.
- Camera images should be accessible through any PC with a network connection and the proper software loaded to view and control the system.
- All cabling associated with the CCTV system should be concealed in conduit in exposed areas or in areas where access is easily available to the general public.
- The location of the main CCTV view station, containing the PC, monitor(s) and camera controls, shall be located based upon type of facility and personnel available to monitor the station. Typically, this location should be either the main security desk or main office.
- Typical camera locations shall be as follows:
    - Exterior cameras should be located at the primary entrance, entrances used by staff and entrances used by the community after school hours.
    - Exterior cameras should be positioned to cover the playgrounds, parking lots, school grounds and roof access locations.

- Interior cameras should be placed outside rooms with sensitive and/or costly equipment susceptible to pilferage or damage such as MDF and IDFs, computer labs, science labs and other labs that have movable, high-value equipment as determined by the district.

H. Audiovisual Systems

Modern audio visual communications need to be integrated and accommodated into the standard telecommunications cable plant. At this point, and for the purposes of this document, most AV systems and components should be described in Division 27, "Communications".

Video Distribution System

The purpose for a video distribution system is to offer video content to learning environments throughout the facility. The system should allow the viewing of various programming from the local cable provider. Internal broadcasting and video distribution could also be possible through video distribution equipment within the school.

The traditional cable medium for video distribution is coax. When engineered properly, this medium provides a robust signal with minimal individual components. An alternate medium is UTP (unshielded twisted pair). With the addition of transmit and receive devices at each end of the twisted pair cable, audio and video signals can be sent over category 5e or 6 cable. If a digital video distribution system is used, video can be transmitted directly over cat 5e or 6 cable.

Presentation/Display Systems

Where called for in the educational specifications and programming documents, instructional spaces should be equipped with some or all of the following components:

- A video projector (mobile or permanently fixed)
- Flat-panel displays (typically in common areas)
- VCR/DVD Player
- Amplifier and speakers
- Projection screen or whiteboard
- Interactive whiteboard

The system should provide the following capabilities.

- Projection of image from a computer to a video projector/projection screen or whiteboard and/or flat-panel monitor.
- Distribution of the audio and video signals from source equipment (e.g. media server, VCR/DVD combo) to the flat panel monitor and/or projector.
- Distribution of the video signals from the school-wide video distribution system to the flat-panel monitor or projector.

Local Sound Systems

Amplified sound systems may be considered for all large, multi-use rooms such as auditoriums, media centers, gymnasiums, cafeterias, multi-purpose rooms (i.e. cafetorium) as well as music rooms. Components may be installed in a wall-mount cabinet or be part of a rolling cart system and may include some or all of the following:

- Speakers
- Microphones (may include hand-held, permanent, wireless)
- Audio Mixer
- Amplifiers
- Source equipment (CD, DVD, PC/laptop etc.)
- Recording capability (where appropriate)

Connection Wall Plates

Wall plates for connection to video distribution, presentation systems and local sound systems should be designed into all instructional areas, shared spaces and specialty rooms. In classrooms they are typically co-located with voice/data and power outlets near the teacher's desk.

Please note that all appropriate space modifications required for the installation and optimization of visual displays and sound systems, including window treatments, lighting controls, power, conduit, cabling and equipment mounting accommodations, should be coordinated with and/or provided in the general construction scope of work and/or the IT or AV systems integrator scope of work.

I. Local Area Network (LAN) Systems

LAN components may include core or chassis type switches, edge or stackable switches, wireless access points (WAPs) and WAP controllers. In addition to data applications, LAN applications can now include audio-video, voice, building management systems (BMS) and security systems.

The proliferation of 802.11 wireless devices and power over Ethernet (PoE) compliant devices has a significant impact on switch requirements. PoE capable switches can support WAPs (wireless access points), voice-over-IP (VoIP) phones, IP based CCTV cameras, IP Speakers (part of the PA system) and other "low-draw" devices via the structured cabling system. As power over Ethernet matures, standards will address the increased power needs of new technology devices.

J. WAN Systems

WANs are used to connect LANs and other types of networks together, so that users and computers in one location can communicate with users and computers in other locations or to the Internet.

Many WANs are built for one particular district and are private. Others are built by Internet service providers or with third party funding/assistance. WANs are

often built using leased lines from either a local phone carrier or cable TV operator.

Some districts have found it economically feasible to build their own private networks by installing fiber optic cables to each school, possibly through a MAN (Metropolitan Area Network). Others are choosing to build a private wireless WAN "mesh network" that connects all the district's facilities without the time or expense of building a physical wired infrastructure.

K. Wireless Systems

Each school should plan their wired infrastructure to include and support wireless access points (WAPs). Care should be taken to implement a security solution to minimize bleed over into the exterior of each building, and to facilitate encryption and control access into the building computer network from roaming users.

It is advisable to include the expertise of an RF (radio frequency) or WiFi consultant in the planning of a wireless system. Given the nature of the materials and design intent, coverage and WiFi design may vary. Generally, one or more wireless site surveys in the project scope (identifying wireless "coverage mapping") will provide adequate planning and coverage when the facility is complete.

In order to ensure that WAPs are able to be located where necessary once the site has been turned over to the school, data jacks should be installed to allow flexibility in the wireless network design. Obstacles that may not be reflected on architectural drawings will interfere with wireless reception. Therefore, at a minimum, all classrooms, office suites, corridors, and common areas should have a minimum of one (1) data drop for a wireless AP. Large open areas such as the cafeteria, gymnasium and media center should have multiple drops for WAPs.

Drops intended for wireless should be located near the ceiling to promote better signal reception once WAPs are activated. Power for the WAPs is typically provided through power over Ethernet equipment.

L. Building Management Systems (BMS)

Building management and control systems include all the systems embedded in buildings that have traditionally used proprietary control standards. Examples of building control systems include: heating, ventilation and air conditioning (HVAC), elevators, laboratory equipment, life/safety systems, access control, intruder detection, A/V devices and event management.

BMS systems are trending away from proprietary networking protocols towards IP. This places an additional "mission critical" application onto the converged data infrastructure. It will become the IT department's responsibility to integrate their systems with the systems that run, manage, and monitor buildings and facilities.

M. Network Security

It is extremely important to carefully plan for the security of the network, its contents and its users. Firewalls are recommended for the local and wide area networks. These "network security" devices should be located in the headend network rack, and be connected to the incoming Internet feed to protect the data network resources. The firewall should provide IP security and virtual private networking capabilities, offer sufficient throughput and the ability to handle multiple concurrent connections and various encryption standards.

The firewall should have a current, upgradeable operating system. All other network security software for PC servers and desktops should be determined by the district. (i.e. anti-virus, network access protection etc.) In addition to this level of security, the district must proactively protect, via Internet filters and other tools, the students from online/Internet threats.

N. Disaster Recovery (DR) and Business Continuation (BC)

Each school, as part of its emergency planning documents, should have a plan for recovering from various levels of disasters and continuing the business of educating its students. Recent school shootings, the terrorist attacks of September 11, 2001, Hurricane Katrina, and pandemic flu threat have emphasized the importance of DR and BC planning.

In a memo to chief school administrators dated September 14, 2006 (see Appendix F for full document), the DOE recommended that districts create a continuity of instruction and core operations plan (CoI/COP). Its purpose is to "insure that a district/school can resume partially or completely interrupted critical functions within a pre-determined time period after a disaster or disruption (e.g. human error, technology failure)."[13]

The referenced memo asks the school district to identify and document essential functions and services and the assets required to deliver those services. This is to be followed by preparing a number of scenarios against which the CoI/COP is to be tested. Lastly, based upon the scenario testing, the plan is to be modified to cover situations discovered during the testing procedure.

O. Convergence

In the past, telecommunications, information technology and broadcasting all operated independently in terms of the technology used, the information transmitted and the networks (cabling) employed. Television, radio, telephones and computers were used for discrete purposes and the services provided were regulated via different systems and standards.

Technological convergence enables traditionally distinct voice, data, security, AV, building control and other transmissions to be transported over the same network and to use integrated cabling infrastructure and devices for purposes such as telephony, television or personal computing. Districts are able to add voice communications, security systems and video distribution to the LAN

[13] From September 14, 2006 memo to Chief school Administrators from Isaac R. Bryant, Deputy Commissioner State of NJ Department of Education. See Appendix F.

configuration and gain the benefits of cabling systems cost savings and reduced infrastructure maintenance costs.

P. IT Commissioning

Commissioning is the process of ensuring that systems, classically heating, cooling, plumbing and electrical, perform as designed and intended. Commissioning is an established, systematic approach that begins with the design phase and lasts through project closeout, building startup and operation by the school district.

With the growing emphasis of technology within construction projects, technology infrastructure is becoming the "4th Utility", along with Mechanical, Electrical and Plumbing, making IT commissioning an important cost-saving engineering discipline in large as well as small projects. Commissioning should be included at the inception of the design process to assure requirements are translated into effective solutions.

Information Technology commissioning should include:

- Wired & Wireless Data Systems
- Telecommunications Voice/Phone Systems
- Audio/Visual Systems
- Security Systems

Each system should have a "Commissioning" paragraph/scope within its respective CSI-section. At the minimum, "testing" and "demonstration" sections should contain criteria that allow the full performance of the system to be visible for compliance review.

This is generally performed by a third party to facilitate quality assurance (QA) and project deliverables.

IT commissioning synchronizes district requirements with design intent and the project implementation process. It also reduces change orders. Other benefits include the adherence to national, state and local standards, and quality control to validate warranties and ensure the long-term performance of the school's infrastructure systems.

APPENDICES

Appendix List

Appendix A. - Acknowledgements

As indicated by the list of names that follow, this document is the result of work by many individuals representing various perspectives of the education and educational technology communities. The New Jersey Department of Education thanks all who participated directly and indirectly in organizing, writing, and reviewing this document.

I. Steering Committee

The Steering Committee is the main working group involved in the project. It is composed of representatives of the Project Sponsors (NJDOE and NJSDA) and the Consulting Team contracted to complete the project tasks.

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Appendix B. Articulated Literacies from ISTE and Partnership for 21st Century Skills

21st Century Skills and ICT Literacy *(referenced on page 11 in Section 2)*

The Learning for the 21st Century Report published by the Partnership for 21st Century Skills (www.21stcenturyskills.org) presents six **Key Elements of a 21st Century Education** that help define the requirements for 21st century learning environments.

1. Emphasize **core subjects**.
2. Emphasize **learning skills**.
3. Use **21st century tools** to develop learning skills.
4. Teach and learn in a **21st century context**.
5. Teach and learn **21st century content**.
6. Use **21st century assessments** that measure 21st century skills.

These six key elements are described in the information that follows:

1) **Core subjects**, as defined by the No Child Left Behind Act, include:

- English, Reading, or Language Arts
- Mathematics
- Science
- World Languages
- Civics and government
- Economics
- Arts
- History
- Geography

2) Learning skills are cognitive skills that enable students to transfer knowledge and skills. Although the following list was outlined in the SCANS (US Secretary of Labor's Commission on Achieving Necessary Skills) report titled *What Work Requires of Schools* back in 1991, these "knowing how to learn" skills provide flexibility in today's constantly changing world:

- Information and communication skills
- Thinking and problem solving skills
- Interpersonal and self-directed skills

3) **21st century tools**, available in the workplace, home and community, need to be introduced as early as the elementary level and include:

- Computing devices
- Networking and other technologies

- Audio, video, and other media
- Multimedia tools

The knowledge of how to use 21st century tools to perform learning skills results in what has been defined as critical Information and Communication Technology Literacy (ICT) skills where students:

- Use ICT skills to manage complexity, solve problems, and think critically, creatively, and systematically
- Use ICT skills to access, manage, integrate, evaluate, create, and communicate information
- Use ICT skills to enhance productivity and personal development

4) Teaching and learning in a 21st century context involves creating learning environments that help students connect skills to content by:

- Making content relevant to students' lives.
- Bringing the world into the classroom.
- Taking students out into the world.
- Creating opportunities for students to interact with each other, with teachers, and with other knowledgeable adults in authentic learning experiences.

5) The following 21st century themes provide a context for **teaching and learning 21st century content** at higher levels.

- Global Awareness
- Financial, Economic, and Business Literacy
- Civic Literacy
- Health Literacy

6) Ultimately, educators must use **21st century assessments to measure 21st century skills**. The Partnership for 21st Century Skills makes three important points in their guide regarding assessments and accountability:

- Standardized tests must measure both core subjects ***and*** 21st century skills. We must measure what we value — or it will not be taught.
- Standardized tests must be balanced appropriately with classroom assessment to measure the full range of the student's skills in a timely way.
- Classroom assessments must be strengthened and integrated with the instructional process to reinforce and help students learn core subjects and 21st century skills.

To ensure that students of the 21st century master the content knowledge and ICT literacy skills required for successful participation in a global economic society as productive and content citizens, our learning environments must evolve to reflect and interact with the global community, rich with authentic, appropriate, and guided learning experiences.

NETS·S ~ National Educational Technology Standards for Students (Second Edition 2007) ***(referenced on page 11 in Section 2)***

The second edition of the NETS•S standards (www.iste.org/nets) was released in the summer of 2007. The newly released standards place greater emphasis on skills and expertise and less focus on the technology tools themselves.

These standards address six foundation areas:

- Creativity and Innovation
- Communication and Collaboration
- Research and Information Fluency
- Critical Thinking, Problem-Solving, and Decision-Making
- Digital Citizenship
- Technology Operations and Concepts

NETS·S also identifies the necessary conditions to effectively leverage technology for learning, listed as the Essential Conditions:

- Shared Vision
- Implementation Planning
- Consistent and Adequate Funding
- Equitable Access
- Skilled Personnel
- Ongoing Professional Development
- Technical Support
- Curriculum Framework
- Student-Centered Learning
- Assessment and Evaluation
- Engaged Communities
- Support Policies
- Supportive External Context

These Essential Conditions validate the Critical Success Factors listed in Section 1 - IV that were identified in earlier stages of the revision process for this Facilities Guide.

Appendix C. State Technology Plan

Preparing Today for Tomorrow:

The Educational Technology Plan for New Jersey

New Jersey Department of Education

Approved by State Board 12/5/07

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History

New Jersey's commitment to educational technology is exemplified by its long history of coordinating K-12 initiatives into an agenda for excellence for the children of this state.

In 1993, "Educational Technology in New Jersey: A Plan for Action," a five-year plan, was developed by the Department of Education. The Plan envisioned a statewide strategy for the effective and equitable utilization of technology and the implementation of the Plan at every level throughout the state's educational system.

In 1997, the New Jersey Department of Education implemented an aggressive, systemic approach in order to accelerate the implementation of educational technology in all schools throughout the state. The articulated goals were met two years ahead of time. Due to these accomplishments, the department developed new goals and benchmarks.

The Plan was updated again in 2003, with goals that were visionary in nature and supported implementation of the belief statement that: "*All students, no matter which district or school they attend, will be able to achieve the Core Curriculum Content Standards because they will have unlimited access to people, to a vast array of curriculum and instruction, and to information and ideas -- no matter where they exist.*"

The state supported educational technology implementation in New Jersey schools and the necessary infrastructure and equipment to enable it through Distance Learning Network Aid (DLNA) established in the Comprehensive Educational Improvement and Financing Act (CEIFA). Districts used the aid to provide professional development opportunities, promote electronic learning, purchase equipment to support and establish multiple networks with high-speed voice, video and data services and in certain scenarios to retrofit sites. This enabled students, teachers and administrators to have global outreach to schools, colleges, museums, libraries, science laboratories, and other resources. The DLNA allocation was placed into New Jersey State School Aid in 2003, and is no longer dedicated for educational technology expenditures.

The Department of Education's ongoing vision for educational technology in New Jersey's Schools is expressed in this current strategic Educational Technology Plan which documents the role of educational technology in promoting students' academic achievement. This plan has been updated in order to provide leadership in preparing our students for success in the 21st century.

The richness of educational technology is grounded by professional development, administrative support and vision, high speed and well-maintained infrastructure, school-wide access for administrators, students and staff all leading to increased academic achievement and global skills. Educational technology is richly embedded in New Jersey's Core Curriculum Content Standards for all students. The revised standards in 2004 included the addition of Standard 8.1 Computer and Information Literacy http://education.state.nj.us/cccs/?_desc_standard;c=8;s=1 .

Technology planning in New Jersey has shaped several curriculum-based grant programs that were implemented in selected school districts across New Jersey. Grants aligned with the goals of the technology plan have brought about replicable models of excellence on infusing technology into instructional programs. With funding from the No Child Left Behind Act, Title II, Part D, the following programs have been supported:

- Access-Collaboration-Equity Plus (ACE+)
  Established community centers that focused on improving language arts literacy skills and adult technology literacy skills.
- Kids Officially Online (KOOL)

  Piloted online learning for students in demonstrated areas of curricular need.
- Math Achievement To Realize Individual eXcellence (MATRIX)

  Increased achievement in the mathematics content area for students in grades 6 to 8.
- Students Using Technology To Achieve Reading – Writing (STAR-W)

  Increased achievement in the language arts literacy content area for students in grades 3 to 5.

The New Jersey Department of Education continues to work to shape the future of our children by supporting the acquisition of knowledge in the content area, development and application of life-long skills and preparation for success in the 21st century.

Other Departmental Technology-Based Initiatives

In addition to providing guidelines to assist districts in planning for educational technology, the New Jersey Department of Education is making strides to improve its systems to provide more timely and accessible information to school districts. The development and implementation of these technology systems is strategically planned and coordinated in order to maximize efficiencies in fulfilling the goals of the Department. Examples of projects that are currently underway are cited below.

Grant Processing System:

A web-enabled system for all entitlement grants (Electronic Web Enabled Grant system, or EWEG) that allows districts to submit their applications online was implemented by the Office of Grants Management. This system will also soon provide for a consolidated payment system that allows a seamless process from application to final payment without having to re-key data. Ultimately EWEG will also be implemented for discretionary grants. EWEG will allow web-enabled tracking, reporting and data analysis and will expedite the review and approval process of grant applications.

Teacher Certification Information System:

The Office of Licensure and Credentials has implemented a web-based Teacher Certification Information System to support and streamline its business processes, process applications and fees, provide guidance to applicants and pre-screen candidates, perform document management, and integrate the functions of the existing computer systems into a single relational database management system. The new system enables applicants to apply for and check the status of their applications for certification over the Web.

Student Database:

NJ Standards Measurement and Resource for Teaching (NJ SMART), is a comprehensive data warehouse, student level data reporting, and unique statewide student identification (SID) system. NJ SMART provides the following important resources for school districts:

- Integrated state assessment data, providing school districts with access to assessment reports that will allow easy monitoring and comparison of critical performance measures;
- Unique student identification numbers (SID), that allow students and their performance to be tracked more effectively over time, even as students transfer in and out of school districts;
- Local datamarts, which will offer the opportunity for school districts to bring together data that are currently stored in a variety of locations into one integrated data warehouse, allowing staff to access linked student data.

EDanalyzer® is available to school districts as part of the NJ SMART portal. EDanalyzer® is a web-based tool that allows school districts to view and analyze state assessment data, as well as assessment related student demographic information that are currently in the NJ SMART data warehouse. The NJ SMART system will be further developed in a multi-phased approach for years to come.

Long Range Facilities Plan and Project Application Tracking System (LRFP/PATS):
The Office of School Facilities has procured Long Range Facilities Plan and Project Application Tracking System (LRFP/PATS) software for use by school districts and their consultants to submit their long range facilities plans (LRFP). Departmental staff use the web-based system to determine approval of the districts LRFP, eligibility of projects and tracking of approved projects.

Data Collections:
The Office of Educational and Informational Technology is working to improve the data collection process in several ways. A number of applications have been upgraded to utilize the Internet as a vehicle for districts to submit data. These applications include Special Education Annual Data Report (ADR), Limited English Proficiency Reporting (LEP), Violence and Vandalism (EVVRS), Special Education End-of-Year (EOY), Chapter 192/193 Reporting/Funding and Extraordinary Aid (EXAID) to name a few. The current version of DOEnet (Windows-based) has made DOEnet data collections considerably simpler to use.

District Budget Statement System Modernization:
The School District Budget Statement initiative seeks to replace the existing outdated MS-DOS District Budget Statement application with current proven technologies. This new system will take advantage of current technology and architectures thereby reducing the effort required to maintain the system and providing a streamlined user-friendly environment for school district budget preparation. The system will provide school districts with a powerful budgeting tool that will produce reports and analyses desired by local school districts in addition to producing the required reports for the Department of Education.

These projects support achievement of Goal 4 in this state educational technology plan. By developing web-based and database applications to automate a number of processes within the department, educators will be able to electronically submit district and school-level data, grant applications and long-range facilities plans. They will also have access to timely information about the status of certification.

Vision Statement

All students will be prepared to meet the challenge of a dynamic global society in which they participate, contribute, achieve, and flourish through universal access to people, information and ideas.

GOAL 1: All students will be prepared to excel in the community, work place and in our global society using 21st century skills.

GOAL 2: All educators, including administrators, will attain the 21st century skills and knowledge necessary to effectively integrate educational technology in order to enable students to achieve the goals of the core curriculum content standards and experience success in a global society.

GOAL 3: Educational technology will be accessible by students, teachers and administrators and utilized for instructional and administrative purposes in all learning environments, including classrooms, library media centers, and other educational settings such as community centers and libraries.

GOAL 4: New Jersey school districts will establish and maintain the technology infrastructure necessary for all students, administrators and staff to safely access digital information on demand and to communicate virtually.

In a digital world, students need to learn to use the tools to master the learning skills that are essential to everyday life and workplace productivity. This proficiency is known as ICT (information and communication technologies) literacy, defined by the Programme for International Student Assessment as "the interest, attitude and ability of individuals to appropriately use digital technology and communication tools to access, manage, integrate and evaluate information; construct new knowledge; and communicate with others in order to participate effectively in society." This definition ***goes far beyond a narrow technical competency, which is a relatively low-level skill****, to including higher-level skills, critical thinking and intelligent, creative and ethical use of technology. –A Policymakers' Guide to 21st Century Skills (p.11)*

GOAL 1

All students will be prepared to excel in the community, work place and in our global society using 21st century skills.

Suggested objectives for Goal 1:

1.1 Educational technology will be infused across all curricular areas:

- aligned with both the most recent version of the New Jersey Core Curriculum Content Standards (NJAC 6A:8-3.1) and
- the International Society for Technology in Education (ISTE) National Educational Technology Standards, and
- focused on student centered, problem-based, real-world curricula to attain 21st century skills.

1.2 All students will demonstrate proficiency with educational technology, information literacy, expert decision making and complex communications.

1.3 Instruction and content materials will be universally designed to assure access for all learners through technology.

1.4 Technology will be used to pursue academic excellence for every student by supporting instruction that is within and beyond the school walls.

1.5 All students and learning communities will have ubiquitous, equitable and barrier free access to on-line resources and other distance learning technologies.

1.6 Research will be conducted to identify both emerging and promising practices in educational technology so that students will continue to excel in the community, work place and in a global society.

1.7 Research-based information will be disseminated to support the development of 21st century skills for New Jersey's educational community.

State

Examples of assistance that will be available through the New Jersey Department of Education to enhance the achievement of Goal 1:

- Maintain the New Jersey Department of Education's portal with useful and pertinent information supporting the use of educational technology across the CCCS and providing information to the educational community in New Jersey.
- Form strategic partnerships with the education and business communities to develop projects and provide resources that will enhance student achievement using educational technology and information literacy skills.
- Research both emerging and promising practices in educational technology implementation by participating in workshops, conferences/seminars at international, national, state and local levels.
- Provide research and policy support for the development and use of online courses and virtual schools.
- Identify, assist and support universal designed education to assure access to content and resources from the federal, state, county, local government, and the private sector to support necessary and effective implementation of educational technology (e.g., technology assistance).
- Collaborate with professional associations and businesses to identify and reward established educational technology projects and programs at the international, national, state, county, and local levels that are exemplary practices for the application of 21st century skills in teaching, learning, and collaboration.
- Encourage innovative educational technology programs and fill gaps in implementation through targeted grant programs at the state level.
- Conduct the annual public school technology survey and report on the results.
- Make available the results of international and national technology surveys and research with emphasis on New Jersey's results as well as related educational technology assessment information to the state's educational community and to the public.
- Model the use of technology.

Local

Indicators demonstrated by local school districts to enhance the achievement of Goal 1:

- Achieve at a minimum, a student to multimedia device ratio that equals a ratio of 4:1 with an ultimate goal of providing one-to-one access for students and staff for anywhere/any time learning.

- Provide high-speed access to the Internet for distance learning, communication and research-based activities.
- Model, maintain and share lesson plans demonstrating the infusion of technology and 21st century skills into daily school activities.
- Include in planning at the curricular levels the following concepts:
    - Implement a means for ongoing assessment of student progress in the use of technology literacy skills.
    - Demonstrate and assess student progress with the New Jersey Core Curriculum Content Standards through activities such as:
        - Student interviews
        - Student portfolios
        - Observations
        - Standards-based scoring guides
        - Surveys
        - New Jersey Statewide Assessments
        - Ongoing performance-based assessments
    - Embed technology into the learning experience in all curricular areas.
    - Implement student centered, problem-based learning environments
      ISTE: (http://cnets.iste.org/students/)
      New Jersey Technological Literacy Standards
      http://education.state.nj.us/cccs/?_desc_standard;c=8;s=1
      Partnership for 21st Century Skills Http://21stcenturyskills.org

- Support the goals of the New Jersey Core Curriculum Content Standards through the following:
    - *Technology Planning*
    - *Community partnerships*
    - *Local Foundations*
    - *Grants, where applicable, at federal, state and local levels.*

"The kids are digital natives. We have to transform teaching and learning to meet the needs of today's students." –Dr. Jeanine Gendron, Broward County Schools

GOAL 2

All educators, including administrators, will attain the 21st century skills and knowledge necessary to effectively integrate educational technology in order to enable students to achieve the goals of the core curriculum content standards and experience success in a global society.

Suggested objectives for Goal 2

2.1 All educators, including administrators, will participate in ongoing, sustained, high-quality professional development activities focused on infusing 21st century skills into curricula and instructional practices.

2.2 All districts will provide professional development opportunities and technology support for educators, including administrators, in order to enhance proficiency in the planning, funding and implementation of integrating technology-based resources and in assessing technology integration.

2.3 All school administrators will model the 21st century skills necessary to provide effective and informed leadership that supports the infusion of educational technology and encourages learning beyond the school walls.

2.4 All supervision and evaluation practices will address the effective use of educational technology for student achievement of the Core Curriculum Content Standards and success in a global society.

2.5 All educators, including administrators, will use technology tools and applications to provide opportunities for authentic, student-centered, inquiry-based learning with a real-world focused curriculum.

2.6 All educators, including administrators, will use e-mail and other interactive tools to communicate with parents/legally designated caregivers, students and other educators electronically.

2.7 All educators, including administrators, will act responsibly and ethically when obtaining and using technological resources and applications.

2.8 All schools will have an instructional technology leader who offers timely, onsite guidance and modeling to enhance teacher and administrator proficiency in using and managing technology-based resources.

2.9 All educators, including administrators, will model and/or promote the effective integration of educational technology and information literacy.

State

Examples of assistance that will be provided by the New Jersey Department of Education to enhance the achievement of Goal 2:

- Continue relationship with the Educational Technology Training Centers to promote high quality technology integration into the curriculum. (http://www.state.nj.us/njded/techno/techtran.htm)
- Assist districts in assessing the progress of teachers in infusing technology into their curricular processes.
- Develop initiatives with institutions of higher education to improve and enhance educational technology experiences for pre-service.
- Develop initiatives in support of in-service educators, including administrators, and integrate such initiatives into continuing professional development offerings.
- Provide educational technology grant opportunities that will contribute to the achievement of the Core Curriculum Content Standards, encourage innovative programs, fill gaps in implementation and support ongoing sustained professional development.
- Continue partnering with organizations that provide professional development opportunities and educational technology conferences that demonstrate technology skills and infusion of technology into the curriculum.
- Plan for the electronic delivery of state assessments, either formative or summative, that can quickly return results and analyses to educators and parents/legally designated caregivers.
- Assist in the revision of the Professional Standards for Teachers and School Leaders to specifically require technology literacy and 21st century skills in the preparation of teachers and school leaders.
- Promote the use of the Technology Standards for School Administrators (TSSA) developed in a collaborative effort among many organizations and adopted by ISTE. (http://osx.latech.edu/tssa/)
- Sponsor professional development activities that will model the use of technology and include follow-up online interactive components.
- Attend national, state, county and local workshops, conferences and seminars regarding the implementation and assessment of 21st century skills; and disseminate any pertinent knowledge gained at state technical assistance sessions.
- Offer throughout the state technical assistance sessions, and make available templates, for the development of district technology plans.
- Maintain the New Jersey Department of Education's portal with pertinent educational technology information to inform the educational community in New Jersey and to provide online professional development opportunities for educators.

- Identify emerging and innovative practices in educational technology implementation and disseminate this information to districts and schools.
- Identify, recognize and promote established resources, projects and programs at the national, state, county, and local levels that are exemplary practices for the application of technology in teaching, learning, and collaboration.
- Collaborate among all offices within the New Jersey Department of Education to promote the utilization of data tools to facilitate data driven decisions in order to maximize student achievement.
- Provide research and policy support for the development and use of online courses and virtual schools by participating in workshops, conferences/seminars at national, state, and local levels.

Local

Indicators demonstrated by local school districts to enhance the achievement of Goal 2:

• Ensure that the district's existing professional development plan includes the following activities that support integration of 21st century skills across the curricula:

- Assemble a list of current professional development activities.
- Evaluate current professional development related to curricula to assure it models and instructs in the effective use of technology.
- Disseminate the list to educators throughout the district to support their access to ongoing, effective and relevant staff development programs.
- Evaluate the effectiveness of the professional development activities throughout the district.
- Address future professional development opportunities that support ongoing, effective and relevant staff development programs that are based on evaluation results.

• Develop learning environments that promote higher order thinking skills and are supported by the district technology plan.

• Integrate the use of 21st century skills to enhance higher order thinking in daily curricular activities as documented in lesson plans.

• Assign a school-based technology coordinator or staff member specifically responsible for supporting skill development and technology infusion into the curriculum for staff and students as indicated in the technology plan.

• Include in observations a means for assessing the infusion of technology into instructional practices.

• Utilize prescriptive teacher assessments of technology skills and implementation to develop professional improvement plans for teachers and administrators.

• Provide district recognition for achievement of core proficiencies as exemplified by ISTE (standards for teachers) and TSSA (standards for administrators).
• Model the effective use of technology through the activities of administrators, faculty and staff.
• Establish a mentoring program for teachers and administrators in developing and supporting the infusion of technology across the curriculum.
• Collaborate with all New Jersey Department of Education offices in order to promote the utilization of data tools to facilitate data driven decisions in order to maximize student achievement.

For children especially, having access to technology is not a luxury, it is a social necessity." –Ben Scott; Digital Inclusion: Social Justice in a Communications Age (http://www.govtech.net/digitalcommunicites/story.pring.php?id=101324)

GOAL 3

Educational technology will be accessible by students, teachers and administrators and utilized for instructional and administrative purposes in all learning environments, including classrooms, library media centers, and other educational settings such as community centers and libraries.

Suggested objectives for Goal 3

- 3.1 All students and educators will have consistent, equitable and barrier free access to appropriate technology including technologies with universal design features that assure access for all students in all learning environments.

- 3.2 All educators, including administrators and students, will have ubiquitous and effective access to on-line resources and other distance learning technologies.

- 3.3 All school districts will provide access to the Internet and multimedia content in all learning environments that supports a student-to- multimedia device ratio that equals 4:1 with an ultimate goal of providing one-to-one access for students and staff for anywhere/anytime learning.

- 3.4 All districts, schools and classrooms will be connected to high- speed voice, video and data networks in all learning environments.

- 3.5 All districts and schools will have web sites that meet the following criteria:
  - Informative, interactive and timely,
  - relevant to school and local community,
  - allows access to email (such as web portal) and network (such as VPN) for administration and staff, and
  - meets accessibility standards (Section 508 compliant (http://www.section508.gov/) and National Instructional Materials Accessibility Standards (http://nimas.cast.org/) .

- 3.6 All educators will have access to technical support via a technician and/or other means as necessary to maintain equipment and infrastructure.

- 3.7 All school districts will establish partnerships, including, but not limited to, other public agencies and entities, educational institutions, community-based organizations and private corporations to increase opportunities for sustained technological access and broad, collaborative learning environments.

- 3.8 All districts and schools will establish partnerships and collaborate with parents/legally designated caregivers and community resources to make technology available for students beyond the school day.

- 3.9 All school districts will implement their Acceptable Use Policy (AUP) and other means to ensure that all members of the learning community are able to use technological systems, online resources and software in a safe, ethical and secure manner.

State

Examples of assistance that will be provided by the New Jersey Department of Education to enhance the achievement of Goal 3:

- Encourage innovative programs and fill gaps in implementation through targeted grant programs.
- Maintain the New Jersey Department of Education's portal with pertinent information to inform the educational community in New Jersey and to provide online professional development opportunities for educators.
    - Provide web-based resources with information on Internet safety.
    - Maintain links to Acceptable Use Policies (AUPs).
    - Provide links to sites for community access and adult literacy training centers.
- Form strategic partnerships with the education and business community to develop projects and provide resources that will enhance student achievement using educational technology and information literacy skills.
- Identify both emerging and promising practices in educational technology implementation that promote equitable access and accessibility and disseminate this information to districts and schools.
- Ensure that the New Jersey Department of Education portal will comply with the New Jersey accessibility standards.
- Identify and disseminate resources from the federal, state, county, local government, and the private sector to support student, teacher and administrator access to educational technology by participating in workshops, conferences/seminars at national, state, and local levels.
- Provide research and policy support for the development and use of online courses and virtual schools by participating in workshops, conferences/seminars at national, state, and local levels.

Local

Indicators demonstrated by local school districts to enhance the achievement of Goal 3:

- Provide access to the Internet and multimedia content in all learning environments for students, teachers, administrators and staff.
- Form strategic partnerships with other school districts, educational institutions and the business community to share fiscal and programmatic resources.
- Collaborate with community resources to establish access beyond the school day.
- Continue to provide and update:
    - high speed LANs (Local Area Network)
    - high speed WANs (Wide Area Network)
    - E-mail use
    - Technology-infused lesson plans
    - Productivity software
    - Inventory of hardware and software
    - Monitoring network use and end user needs to target technical support activities
    - Administrative software
    - A safe Internet environment
    - Acceptable Use Policies (AUP) for all users
    - Maintenance of records that authorize use of a student's personal information on district- or school-based web sites. (NJ Bill A592 http://www.state.nj.us/njded/techno/idconsent/).
    - Lists of resources for students and parents/legally designated caregivers through Web-based information, community centers, homework hot lines, teacher e-mail, teacher-developed web sites and training/workshops provided by various districts.
    - Education of administrators, teachers, and students in the ethical use of computers.

- Review school and district web sites in relation to alignment with New Jersey's state accessibility statements.
- Facilitate communication between informational technology, educational technology, assistive technology and curriculum professionals so that the district's technological resources can be used to support the learning and achievement of all students.

"Digital inclusion is, or should be, a basic right of all Americans." –Jim Baller, Digital Inclusion: Social Justice in a Communications Age (http://www.govtech.net/digitalcommunicites/story.pring.php?id=101324)

GOAL 4

New Jersey school districts will establish and maintain the technology infrastructure necessary for all students, administrators and staff to safely access digital information on demand and to communicate virtually.

Suggested objectives for Goal 4

- 4.1 All school districts will obtain and/or maintain high-speed networks, current hardware/software and Internet access which enable all students and educators to support their curricular activities.

- 4.2 All school buildings will have the equipment, connectivity and technical support necessary to provide e-learning opportunities in all learning environments.

- 4.3 All school districts will have the technical staff to support and maintain their technology resources and systems.

- 4.4 School administration will conduct a Total Cost of Ownership analysis and use the results to budget for effective implementation and support of educational technology systems in the district.

State

Examples of assistance that will be provided by the New Jersey Department of Education to enhance the achievement of the Goal 4:

- Identify and disseminate resources such as Total Cost of Ownership from the federal, state, county and local government, and the private sector, to support necessary and effective implementation of educational technology by participating in workshops, conferences/seminars at national, state, and local levels.
- Maintain the New Jersey Department of Education's portal with useful and pertinent information to inform the educational community in New Jersey and to provide information and access to online learning activities and courses for students and educators.

- Form strategic partnerships with school districts, educational institutions, the business community and other public and private entities in order to enhance student achievement using educational technology and information literacy skills.
- Identify infrastructure, emerging educational technologies and innovative strategies that support the goals of the K-12 learning environment.
- Support the development of a framework for virtual learning opportunities.

Local

Indicators demonstrated by local school districts to enhance the achievement of Goal 4:

Provide and maintain:

• High-speed connectivity to global and local resources through: ˜
  - o High speed WANs (Wide Area Networks).
  - o High speed LANs (Local Area Networks)—wired or wireless.
  - o Multimedia computers and mobile devices including cell phones and PDAs.

• Current productivity software (administrative, staff and student).
• Access to e-mail.
• Access to Internet.
• Access to E-learning opportunities for students and staff.
• Adequate annual technology budget.
• Technical support for both infrastructure and personnel.
• Maintenance and support to keep the current infrastructure fully operational.
• Timely replacement of obsolete equipment.

Appendix D. IT Plan Sample (DRAFT)

NOTE: The finalized IT Plan Instructions and IT Plan sample will be inserted when the NJSDA completes revision of the NJSDA Design Manual.

IT PLAN - SAMPLE

Complete the yellow shaded cells with the required project information. Adjust the quantities in the green shaded cells as desired.*Do not modify any other cells.*

IT Plan must be approved and signed by District Superintendent. Approved FES/School Model and approved Educational Specifications must accompany this District-approved IT Plan in order to be considered for final approval by the DOE.

Approved By:

Name | Title | Date

Project Information | **Project Description**

Name		Education Level	EC (3-4 yr olds)	ES (K - 5)	MS (6-8)	HS (9-12)	TOTAL
School District		Student Population	0	0	0	0	0
Const. Type	NC (New Construction)	Number of Classrooms	0	0	0	0	0
DOE Number		Administrative Seats*	0	0	0	0	0
SCC Number							

Specialized Spaces	Number of Rooms	Student Computers/Room**	Student Computers	Teacher computers
Visual and Performing Arts	0	0	0	0
Tech. Literacy (computer labs)	0	0	0	0
Tech. Education (CAD, graphics etc.)	0	0	0	0
Physical Education	0	0	0	0
Science	0	0	0	0
Food Services/Assembly	0	0	0	0
Food Services	0	0	0	0
Assembly/Large group	0	0	0	0
Media Center	0	0	0	0
Small Group Instruction	0	0	0	0
Multi-Purpose/Large Group	0	0	0	0

Spec #	Category	Unit Cost	Quantity	Change	Total	Cost	Difference
	E Rate Eligible Components						
E1	Firewall	$1,397	0	0	0	$0	
E2	Switches	$3,818	0	0	0	$0	
E3	Router(s)	$4,528	0	0	0	$0	
E4	Computer racks	$300	0	0	0	$0	
E5	Wireless Access Points	$215	0	0	0	$0	
E6	DHCP Server	$3,861	0	0	0	$0	
E7	Tape Back-up Server	$4,493	0	0	0	$0	
	Category Totals	**$0**				**$0**	**$0**
	Servers						
S1	Administrative	$5,095	0	0	0	$0	
S2	Instructional	$3,773	0	0	0	$0	
S3	Library	$4,067	0	0	0	$0	
S4	Backup Software	$1,010	0	0	0	$0	
	Category Totals	**$0**				**$0**	**$0**
	Computers						
C1	Students-Workstation	$2,301	0	0	0	$0	
C2	Students-Desktop	$1,197	0	0	0	$0	
C3	Teacher/Admin-Desktop	$1,245	0	0	0	$0	
C4	Teachers/Admin-Laptop	$1,617	0	0	0	$0	
C5	Students-Laptop	$1,296	0	0	0	$0	
C6	Mobile Labs-24	$32,884	0	0	0	$0	
C7	Mobile Labs-12	$16,942	0	0	0	$0	
C8	Anti-virus software	$22	0	0	0	$0	
	Category Totals	**$0**				**$0**	**$0**
	Perpherials						
	Printers						
P1	Local	$272	0	0	0	$0	
P2	Group-B&W	$893	0	0	0	$0	
P3	Group-Color	$1,108	0	0	0	$0	
P4	Individual-Ink Jet	$71	0	0	0	$0	
P5	Misc. (scanners, digital cameras etc.)	$200	0	0	0	$0	
	Category Totals	**$0**				**$0**	**$0**
	Audio Visual (AV)						
AV1	Fixed Monitor AV System	$2,175	0	0	0	$0	
AV2	Monitor AV System on Cart	$2,335	0	0	0	$0	
AV3	Ceiling Projector AV System	$1,798	0	0	0	$0	
AV4	LCD Projector System on Cart	$1,895	0	0	0	$0	
AV5	Assembly Projector on Cart	$2,363	0	0	0	$0	
	Category Totals	**$0**				**$0**	**$0**
	Totals	**$0**				**$0**	**$0**

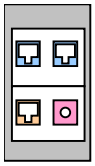
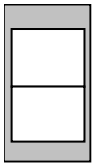
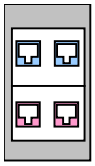
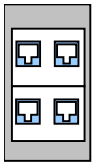
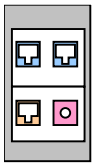
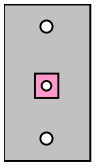
*** Administrative Seat count must be derived from approved School Model and Educational Specifications**

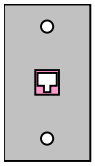
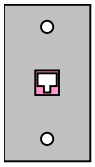
**** Computer count must be derived from approved Educational Specifications.**

Appendix E. Design Samples and Drawings

E- 1 Sample Technology Outlet Configurations

It is recommended that schools define standard technology outlet configurations for different uses and users. Designations can be modified from school to school with the exact components of each outlet adapted to local conditions. The following chart depicts the typical types of outlets defined, where it is used, the types of jacks in the outlets, and a sample graphic of the outlet. These outlet types will be referenced in the sample diagrams that follow.

Outlet	Work areas	Jacks	Graphic
T	Teacher	2 - data 1 - desk phone 1 - video	
TV	Multimedia	1 - RF connector 1 - S-video 1 - video in 1 - right audio in 1 - left audio in 1 - VGA 1 - DVI-D 1 - USB	 As Required by Design
2S	Student	2 - data 2 - video	
4S	Student	4 - data	
A	Administrator	2 - data 1 - desk phone 1 - video	
V	Video	1 - RF video	

Outlet	Work areas	Jacks	Graphic
P	Utility	1 - wall phone	
WAP	All	1 - data	

Note:

1. Data, phone and unassigned jacks are RJ-45. Video jacks are BNC or Cat 6 type.
2. Data jacks have blue bezel, phone jacks have orange bezel, and unassigned jacks have red bezels. Video jacks have red bezels.
3. Outlets mounted at receptacle height (18" above finished floor – AFF) except for:

   P which is mounted at 44" AFF

   V outlets that are mounted at approx. 7'

   WAP outlets that are mounted approx. 12" below hung ceiling

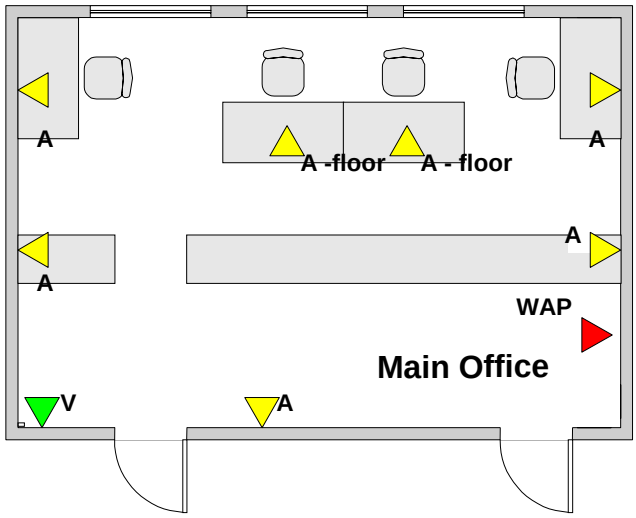
These outlet configurations become the basic building blocks for providing network services throughout the facility. These outlet configurations will enable voice, video, and data transfer from the desktop for students, teachers, school administrators, and staff as required.

Note on Outlet Recommendation samples: in new construction, backboxes and conduits will be behind walls. In renovations or technology upgrade projects where mounting behind the walls is not practical, surface mounted raceway may be used.

Outlet recommendations for sample office spaces:

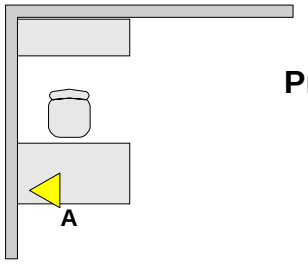
Main Office

Outlets:
7 – A (including 2 floor outlets)
1 – WAP
1 - V



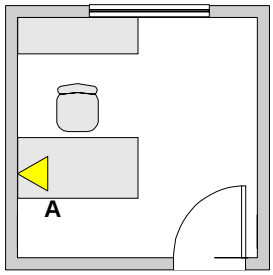
Principal's Office

Outlets:
1 – A



School Administrators
- Department Heads
- Guidance
- Health Services
- Food Services
- Athletic Offices

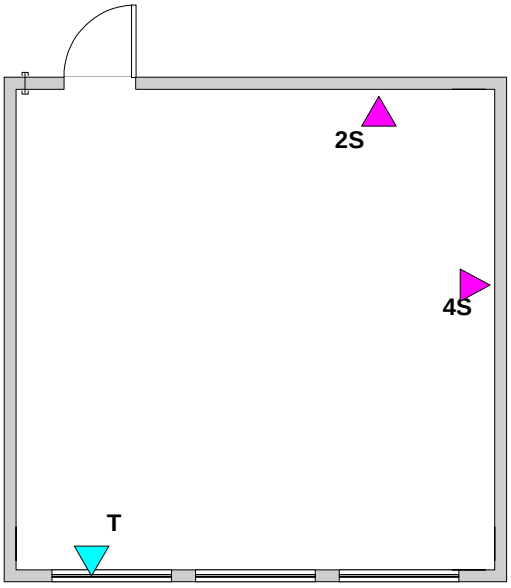
Outlets:
1 – A



Sample outlet recommendations for classroom spaces:

Standard Instructional Classroom

Outlets:
1 – T
1 – 4S
1 – 2S
Consider outlet in ceiling for mounted projector connection to the network

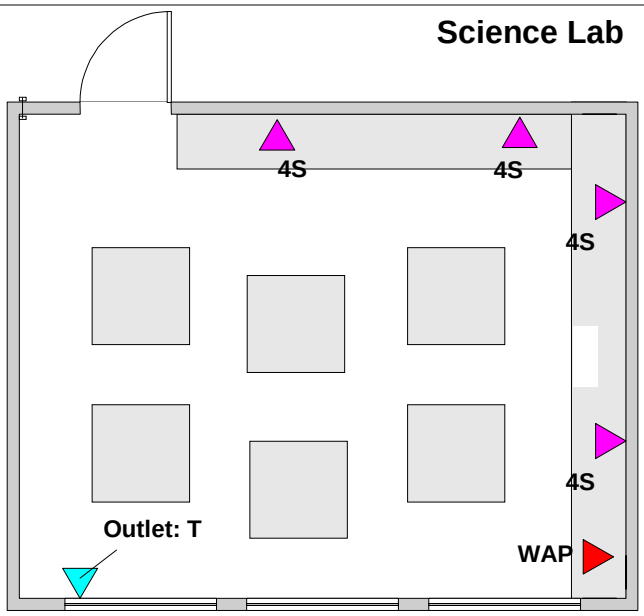


In addition to the standard classroom space, some content areas such as science labs and world languages classrooms will require unique configurations. A variety of science laboratory layouts are available for middle and high school facilities depending on available space and existing room constraints. Outlets should be positioned in a manner so that students can safely use technology tools and resources such as digital microscopes, probes, and sensors within the laboratory environment.

Sample outlet recommendations for science laboratory:

Science Classroom

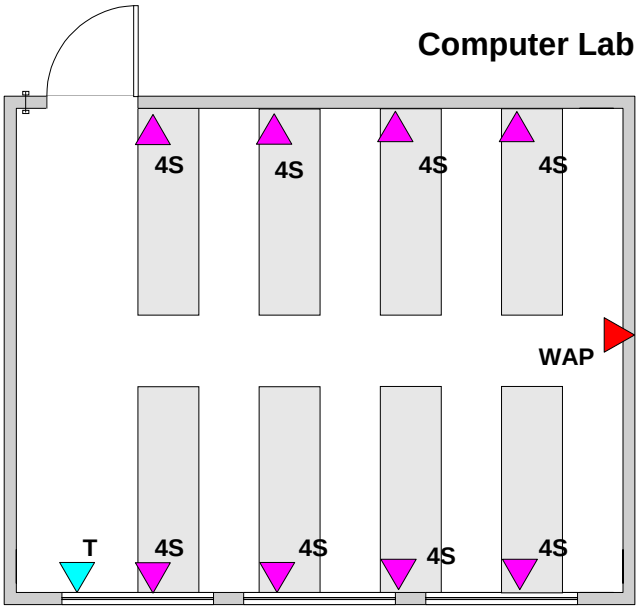
Outlets:
1 – T
4 – 4S
1 - WAP



Sample outlet recommendations for rectangular back- to- back stations computer lab configuration:

Computer Lab

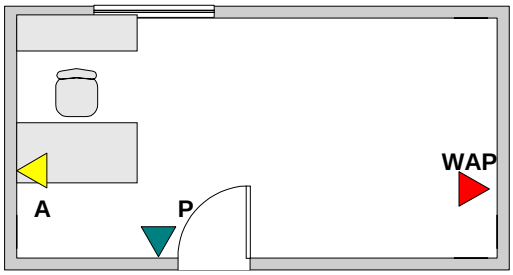
Outlets:
1 – T
8 – 4S
Consider outlet in ceiling for mounted projector connection to the network
1 - WAP



Sample outlet recommendations for Teacher's work room:

Teacher Workroom

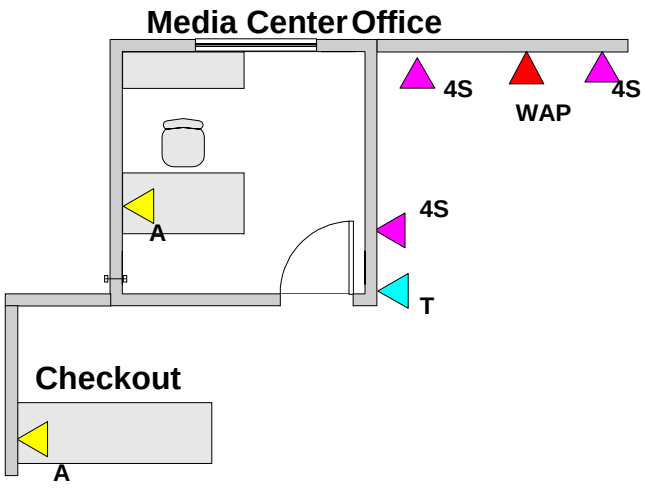
Outlets:
1 - A
1 – P
1 - WAP



Sample outlet recommendations for a typical Library Media Center office and check out area:

Media Center

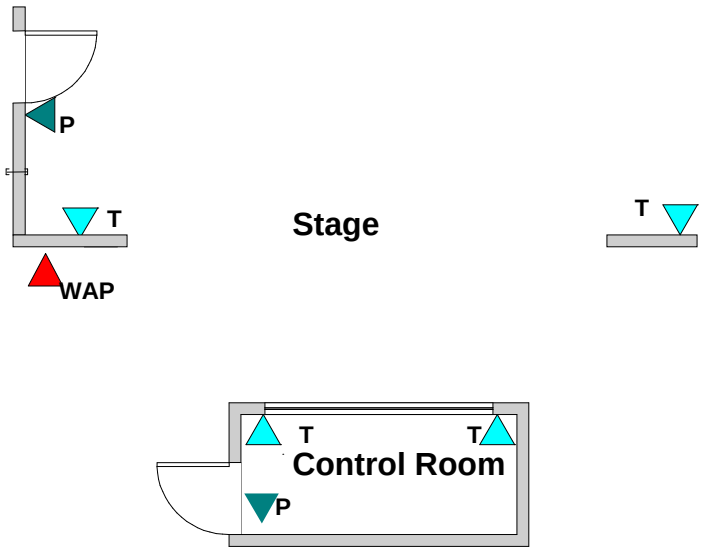
Outlets:
2 – A
3 – 4S
1 – T
1- WAP



Sample outlet recommendations for a typical auditorium/theater:

Theater

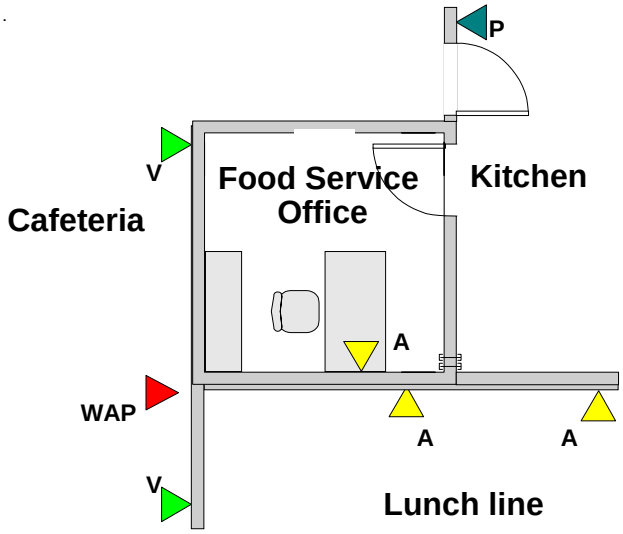
Outlets:
4 – T
2 – P
1 - WAP



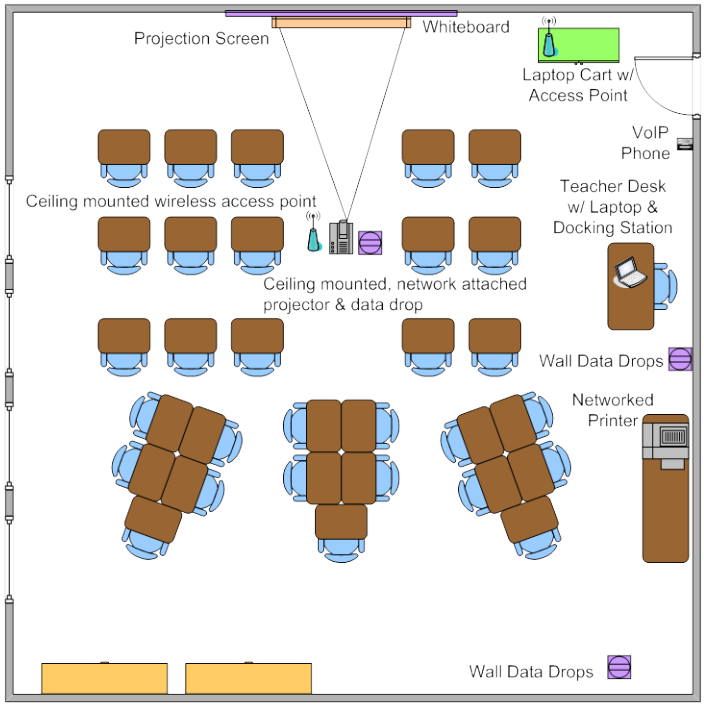
Sample outlet recommendations for typical food services office and cafeteria area:

Cafeteria

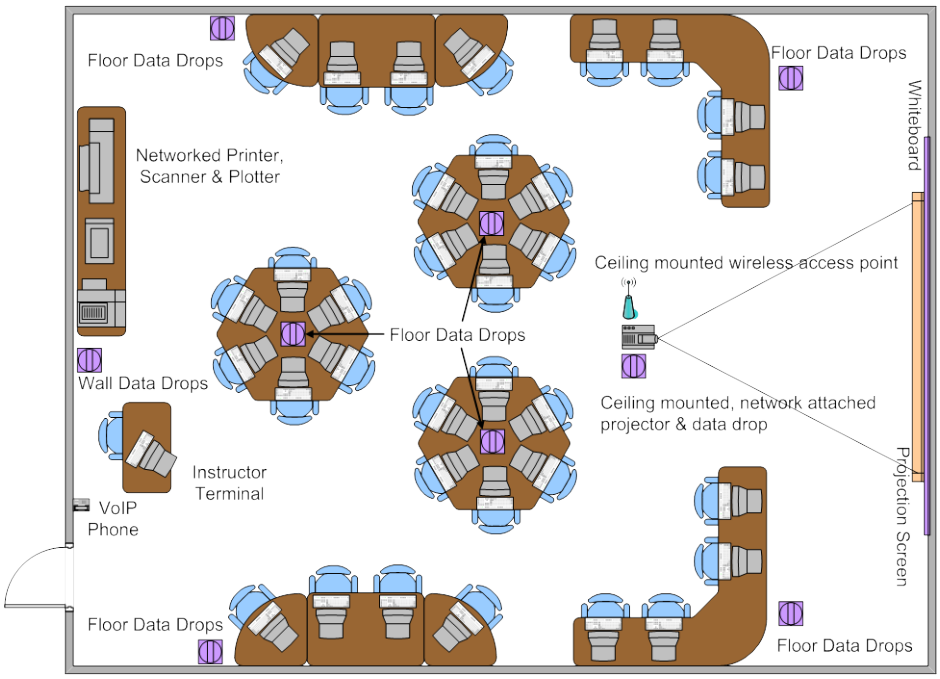
Outlets:
2 – V
3 – A
1 – P
1 - WAP



E-2 Instructional Space Furniture and Space Layout Samples

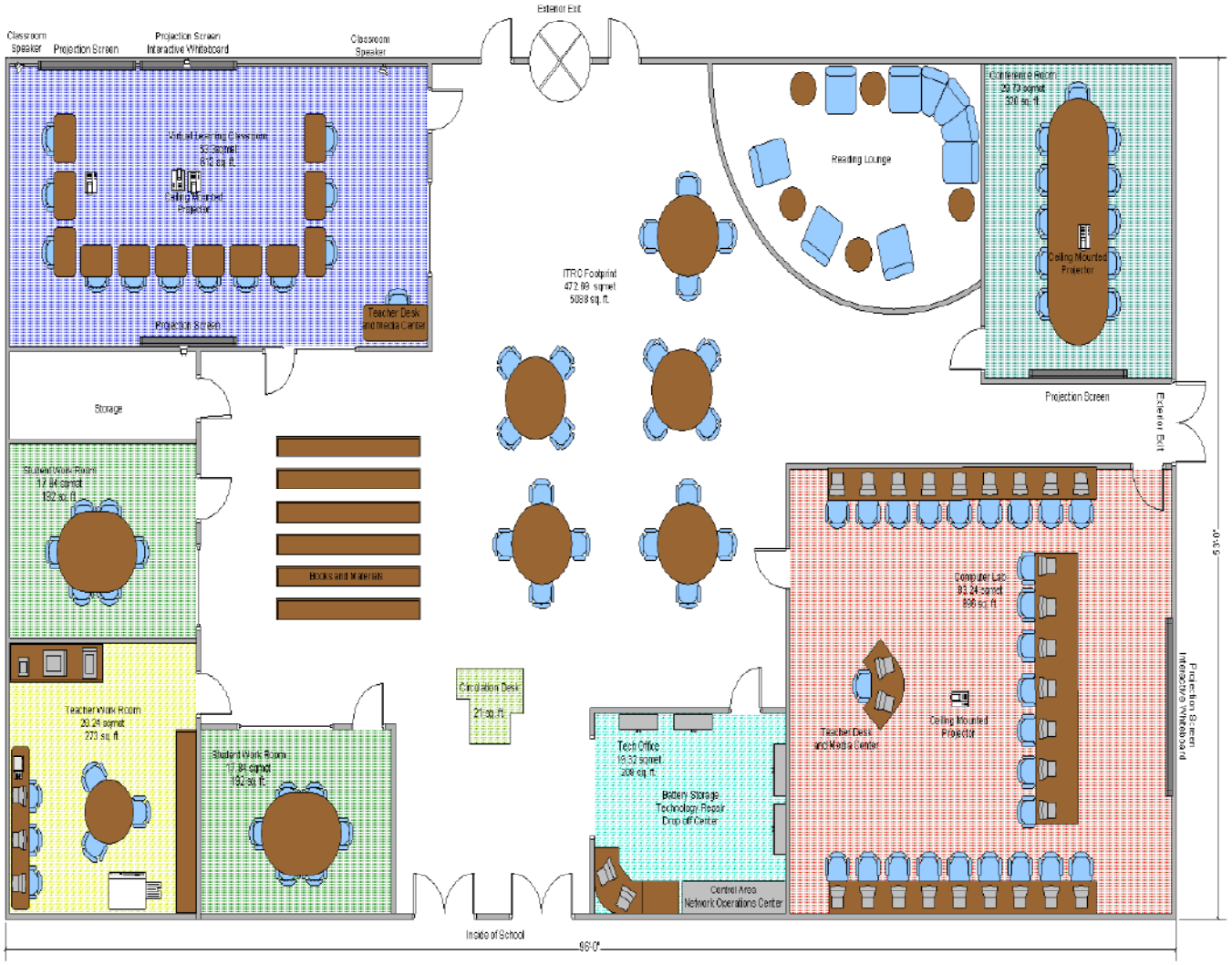


*The flexible space sample above features movable student furniture and wireless access points making it an appropriate layout for one-to-one computing environments.

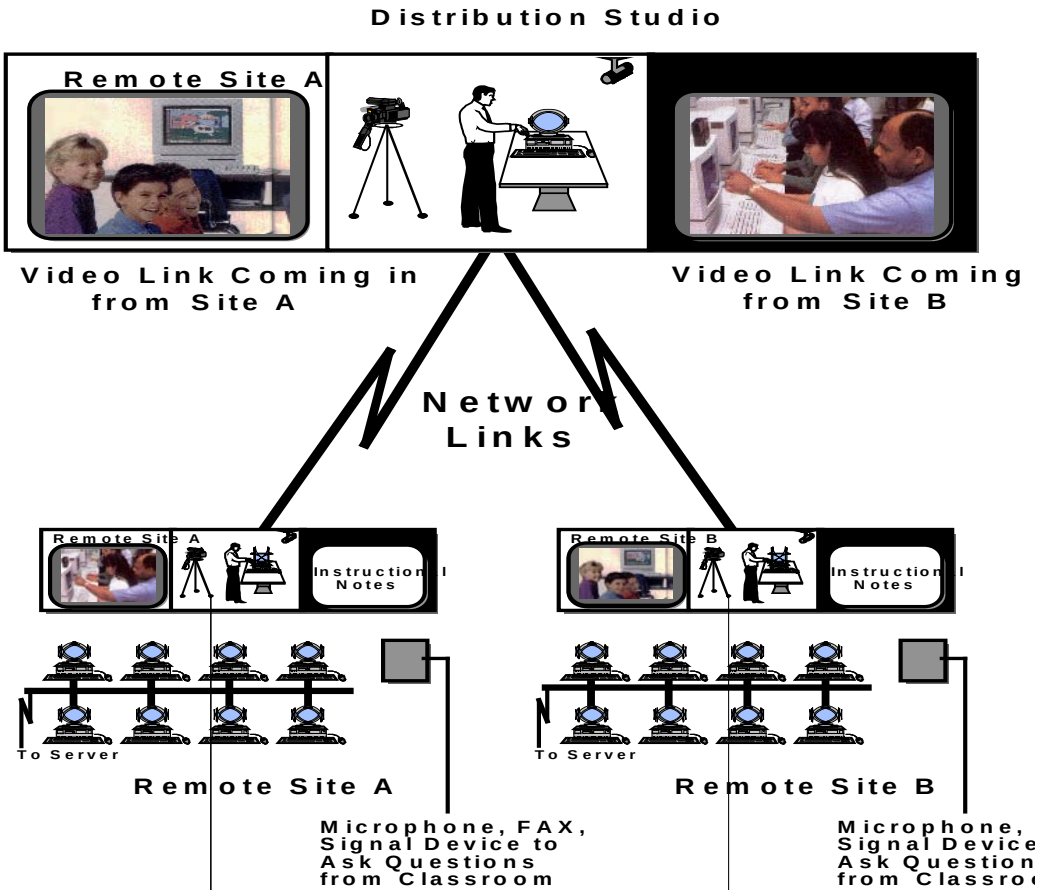


Information Resource/Media Center

Conceptual Overview: Floor Plan



E-3 DISTANCE LEARNING



- **Example: Distance Learning Classrooms Function**

Distance Learning General Guidelines

It is recommended that the distance-learning classroom include a space outfitted as required and the technology necessary to support the distance learning function. The following are general characteristics to consider for the distance learning classroom:

- The basic distance learning classroom provides seating and support for six to sixteen students and one instructor, depending on the type of system and configuration of the room.
- The room is arranged so that the remote classroom and its participants are an approximate reflection of the local room when viewed through the video monitors.
- The spaces are audibly joined so that there is an approximation of sonic continuity from one space to the next.
- The instructor in one space is able to control the camera attention and images displayed in all of the interconnected classrooms.

Distance learning spaces generally operate in four main modes:

1. As a local or remote site in a virtual classroom within the District.
2. As a local or a remote site connecting to a similar space outside the District for learning, or video conferencing.
3. As a media or program presentation space for a small group.
4. As a presentation space to present a broadcast feed from a local feed or a source via the Internet.

The instructor's station includes:

- document camera with light
- computer with the display interconnected to the presentation and conferencing systems that can be used for scheduling, control or presentation
- VHS/DVD and CD players
- System control panel

The room can serve as a presentation space or normal classroom when not needed to support distance learning.

Sample Design Types

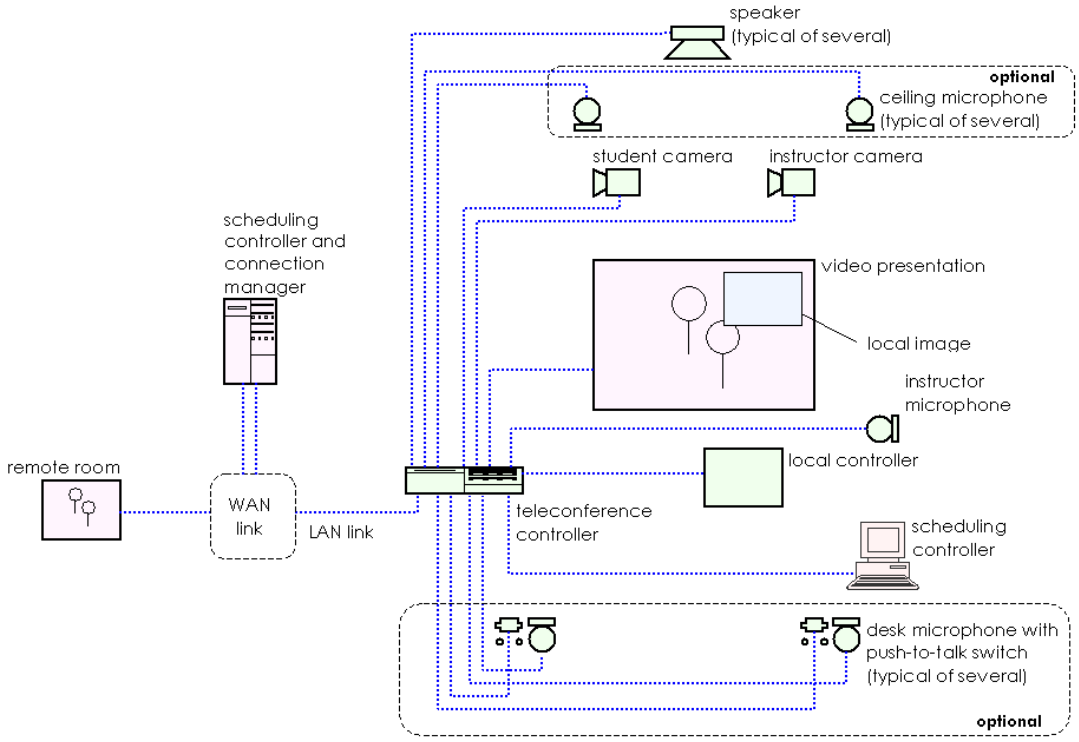
Examples of systems are of three types suited to one of three applications:

- ***Type 1:*** Small classroom, frequently in the area of the library/media center, where a transportable unit is brought in as needed to satisfy a temporary need. These classrooms can be implemented in any school or office facility and require connection only to power and communication lines. Additionally, computers with audio and video components can establish one-to-one distance learning environments provided that video to the desktop capacity exists.
- ***Type 2:*** Elementary and middle school classroom with dedicated distance-learning capabilities. These rooms are outfitted with permanent installation of the distance learning system elements as needed. These spaces are intended primarily for receipt of educational broadcasts, full-class interaction, and presentations where a local instructor monitors the class. Seating is flexible to include chairs, movable desks, or open seating on the floor.
- ***Type 3:*** High school classroom with dedicated distance learning capabilities. These rooms are fitted with permanent installation of distance learning system components as necessary. These spaces are intended primarily for instruction in a dispersed classroom environment where the primary instructor may not be present. Desks are fixed to allow direct interaction between the local student and the instructor at a remote location using a push-to-talk control scheme.

Primary subsystems in the distance learning system include:

- Teleconference controller providing audio and video signal processing, connection management and signal exchange.
- Local controller providing the means to select image, camera point of focus, audio levels and system focus to address student requests and classroom management.
- Video subsystem includes classroom cameras, media playback devices, image router and image presentation device.
- Audio subsystem includes speakers, audio playback devices, instructor microphone and student microphones.

NOTE: A scheduling controller and connection manager is presumed to exist somewhere in the domain of the distance learning classrooms administration.



Standards

Distance learning standards that assure interoperability between systems include ITU H.323 for intercommunication over Ethernet and TCP/IP network and ITU H.320 for intercommunication over ISDN telephone lines. These overarching standards drive the fundamental standards for video, audio and control coding, compression and transmission.

Design Considerations

Distance learning spaces are functionally different from other spaces in the school and must be developed according to the requirements of this function.

Design the system using modular elements that can be upgraded incrementally. Use components that meet industry standards for robustness and durability to maximize usable life.

Minimize the complexity of system repair through the use of modular sub-systems and self-contained components that interconnect through standard fittings and connectors.

Design systems to provide for operational isolation between subsystems and components.

Design provisions and system elements to minimize or eliminate maintenance that requires specialized skills or equipment.

Sample Design Type Elements

Major considerations for each of the design types are documented in the following table:

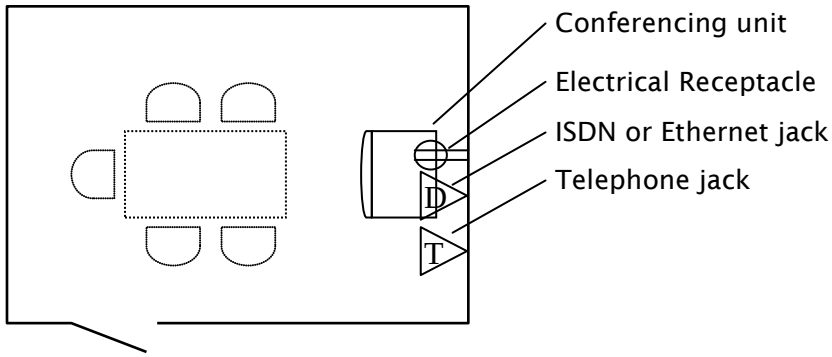
Element	Type 1: Small Classroom	Type 2: Elementary and Middle School Classroom	Type 3: High School Classroom
Teleconference controller	Integrated into unit	Installed at instructor's console	Installed at instructor's console
Local controller	Option	At instructor's console	At instructor's console.
Video display	Direct view monitor integrated into system cabinetry	Direct view monitor installed in custom millwork	Projector mounted to ceiling with screen mounted to wall
Student camera	Integrated into unit	At display millwork	Mounted to wall
Instructor camera	Integrated into unit	At display millwork	Mounted to wall
Speakers	Integrated into unit	Mounted in display millwork or in ceiling	Remote site speakers mounted to wall at display; local reinforcement speakers mounted in ceiling
Student microphones	Integrated into unit with auxiliary portable desktop unit	Mounted at display or in ceiling	Mounted on student desks
Instructor microphone	Wireless unit with auxiliary portable desktop unit	Wireless unit with auxiliary portable desktop unit	Wireless unit with auxiliary desktop unit
Student push to talk and attention request	optional	optional	Integrated into student desks to drive student camera controller and audio system

Element	Type 1: Small Classroom	Type 2: Elementary and Middle School Classroom	Type 3: High School Classroom
Instructor's console	not required	Custom assembly to include computer for presentation, document camera, DVD player, CD player and VHS player	Custom assembly to include computer for presentation, document camera, DVD player, CD player and VHS player

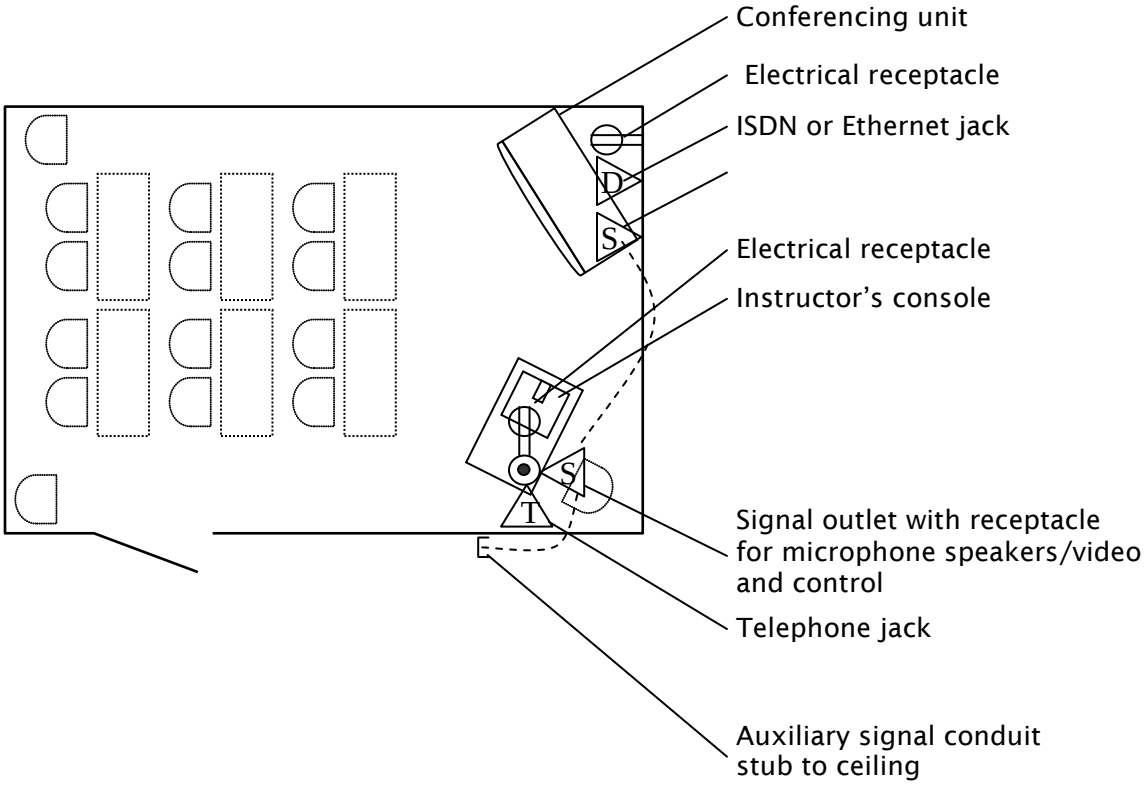
Sample Layouts

Sample layouts for each of the design types are documented in the following graphics:

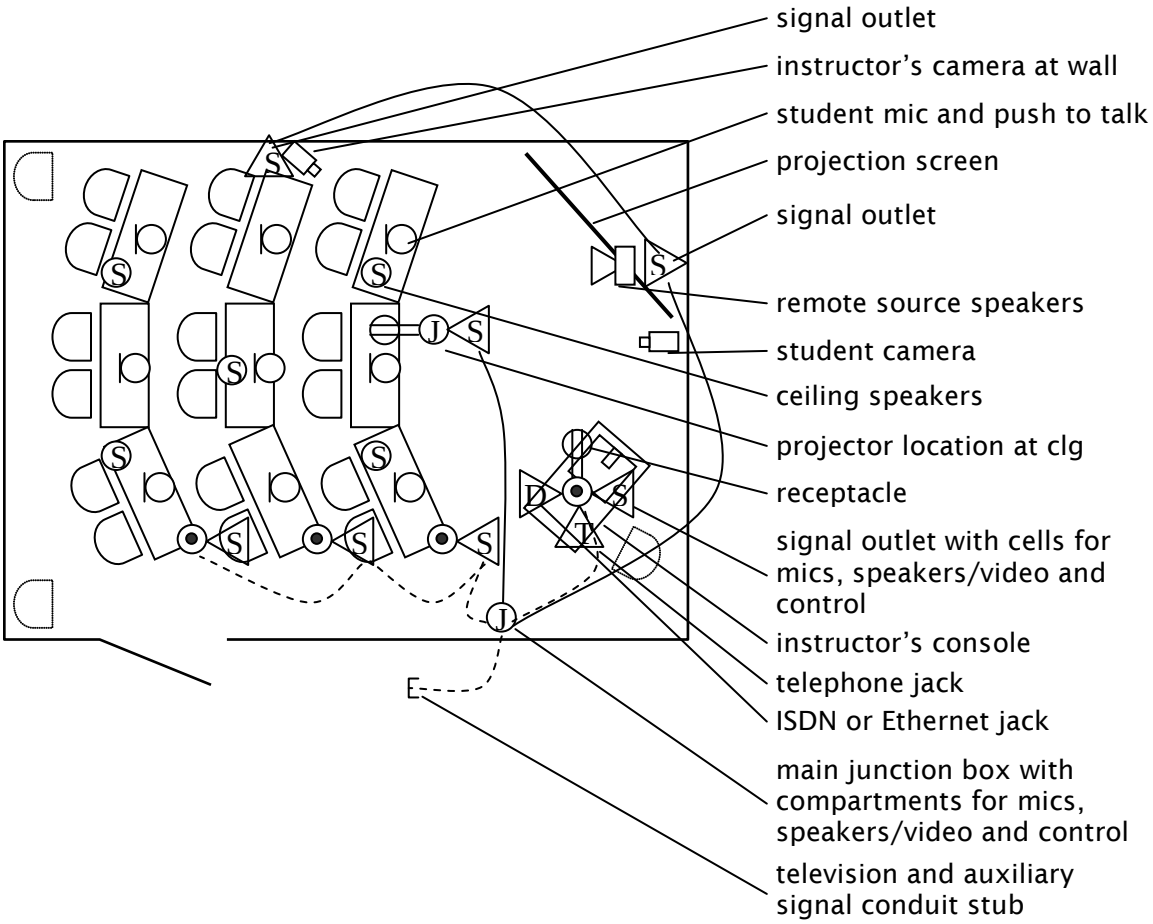
Type 1 Template: Mobile



Type 2
Template



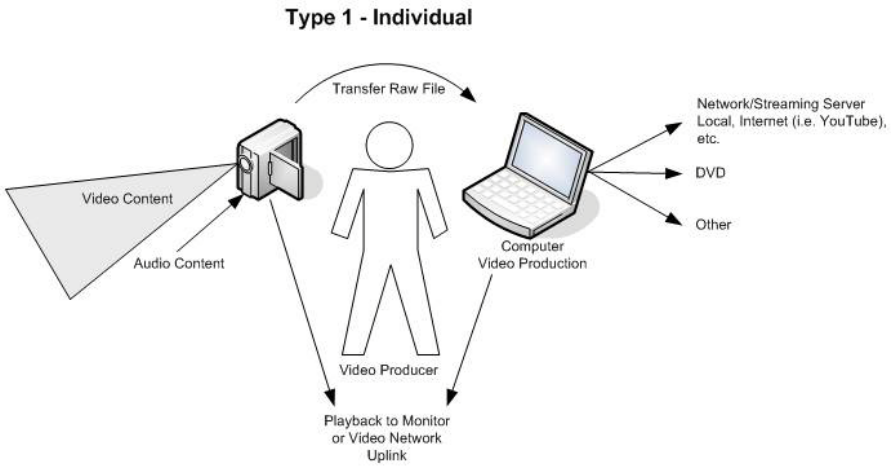
Type 3 Template



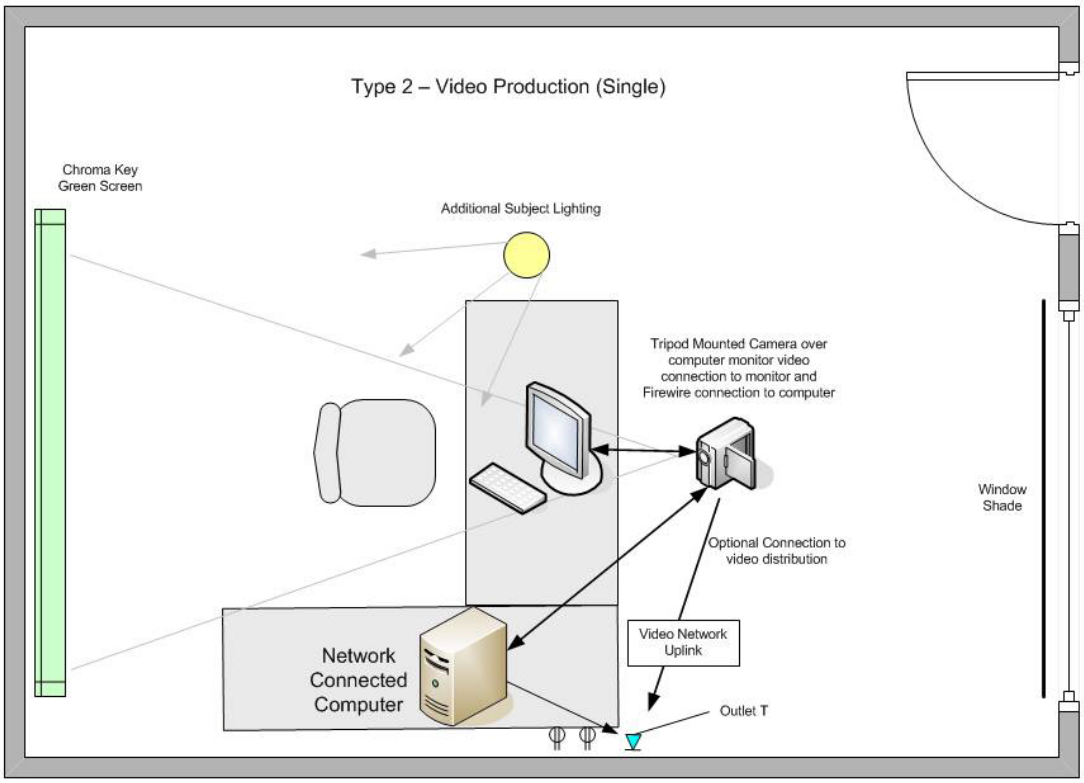
E-4 VIDEO PRODUCTION

Sample layout templates for each of the video production design types are documented in the following graphics:

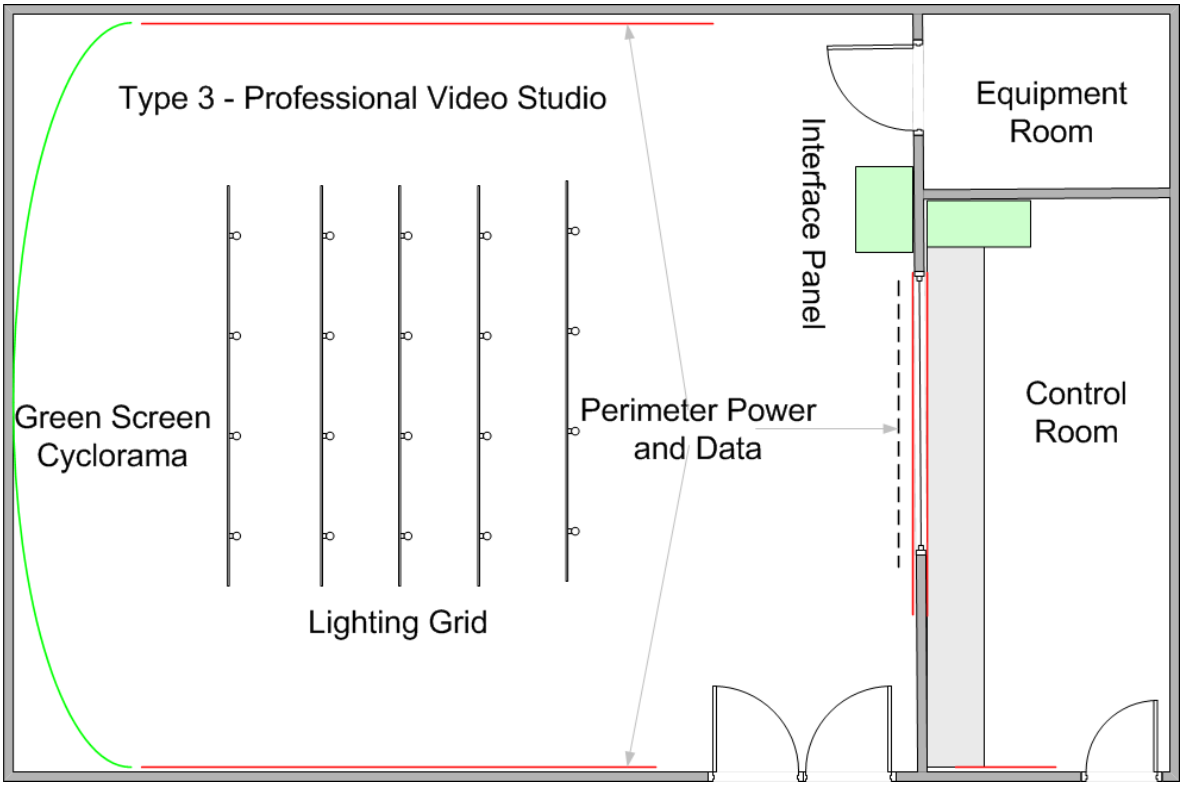
Type 1



Type 2



Type 3


Type 3 - Professional Video Studio
Equipment Room
Interface Panel
Green Screen Cyclorama
Perimeter Power and Data
Control Room
Lighting Grid

Design Considerations

Major considerations for each of the video production design types are documented in the following table:

Element	Type 1:	Type 2:	Type 3:
Dedicated Location	No	Varies, typically integrated into computer lab	Yes, two rooms with glass between, one for production control the other for the production itself
Operation	None/producer is operator	Assistance of production support is typical	Advanced support required during active production, includes production and support
Video Image Capture Equipment	Digital video camera, computer and video editing software. Optional: portable chromakey screen, advanced editing software	Digital video camera with tripod, computer with active firewire connection to camera, advanced video editing software, chromakey screen, production monitor	Multiple digital video cameras typically connected to switches for production control. full scale professional digital video cameras as required for compatibility
Video Stream Manipulation Equipment	None	None	Analog source switches as required for compatibility, camera control units, video distribution amplifiers with effects and production switch connected to distribution network, personal computers
Video Production Monitoring	None.	Connection of video monitor output to local monitor for viewing or projection of live camera capture	Full local video distribution amplifier to bank of monitors displaying video content
Video Production	Local computer, post production	Local computer, post or basic live production (digital only)	Local video production switcher with multiple source connection to broadcast network (analog and digital)
Lighting	Room lighting	Lighting enhanced with additional spot tree lighting fixture	Full independent subject lighting control grid with lighting control panel in control room

Element	Type 1:	Type 2:	Type 3:
Electricity	Battery with charger for video camera	Standard building a/c power to support equipment including video camera, computer and lighting	Separate building power a/c circuits supporting equipment and lighting; power conditioning for sensitive video equipment; consider circuit feeds from backup generator
Audio Recording and Manipulation	Recording microphone is integrated into digital video camera	Recording microphone is integrated into digital video camera or an optional external microphone	Full analog microphones with mixers, boom microphones and wireless microphones; AES/EBU and S/PDIF digital audio accommodation if desired
Room Selection/Treatment	A quiet area with limited controlled entry	If selecting a permanent area, consider location of lighting sources and their controls (windows and fixtures) as well as sources of ambient noise such as doors and hallways; avoid facilities with equipment such as bells, motors and blowers; a separate room with soundproofing is ideal; consider carpeted floor and clear wall behind subject for placement of green screen	Design room for specific purpose; complete room controls for lighting, sound and access control. Full blue or green screen chromakey, alternate staging for various productions needs and curtain backdrops
Network	No live broadcast. Video content stored on camera, transferred to computer, edited and exported to network server or to DVD for distribution Wired or wireless network access	Camera or computer connection to local CCTV or frequency agile modulator for live distribution over CCTV, and/or content stored on computer for later editing and digital distribution; potential, with proper equipment, for live digital or analog broadcast production with chromakey and appropriate digital/analog conversion	Full access to analog and digital television broadcast capabilities, including link to regional or other distribution networks; high speed network access including internet capable of supporting streaming media inbound and outbound

Element	Type 1:	Type 2:	Type 3:
Other	Standardize on media for raw video and digital formats	Standardize on media for raw video and digital formats; simple video switchers for producing more advanced productions; consideration to function as distance learning center as well	Consider HDTV production; Include capability to support VCR, DVD, Blu-Ray, and other source material for incorporation into video productions; consideration to function as support for distance learning production and distribution; consideration for Webcasting, Satellite downlink and rebroadcast

Video Distribution Issues/Strategies

As the industry progresses toward convergence, it is becoming increasingly more difficult to justify a separate analog video distribution network running alongside the data network. With the Federal Communications Commission (FCC) mandate that all television broadcasts must be digital as of June 12, 2009, schools must be certain to design and implement TV infrastructure and delivery systems that conform to the new digital mandate, and can access and distribute digital TV signals as needed.

Schools should be developing solutions for video distribution over the data network that also integrates broadcast media. This can be accomplished through the use of streaming media over the network. Classrooms and other areas where video display is required can link a local projector or other display device to a digital network hub over a standard cabling infrastructure. The end devices will become addressable with video being directed as needed to the video display locations within the school.

With respect to structured wiring and data cables in new facilities, consider a complete digital video infrastructure supporting unicast and multicast over the standard data-cabling infrastructure that is coordinated with network facilities.

If a coax-based video distribution system is still desired, general guidelines include:

- Design a 750Mhz broadband, coax cable system capable of distributing from a central location and accepting live return signals (from any outlet, e.g. location where programming sources may be available such as the video production areas) and modulating and redistributing these throughout the building. Design a homerun topology over a trunk and tap system.

- Install a bi-directional system with a minimum of two drops per classroom, one for connectivity to the local classroom monitor and the other at a location in the classroom for access for return signals or for connectivity to instructional equipment.

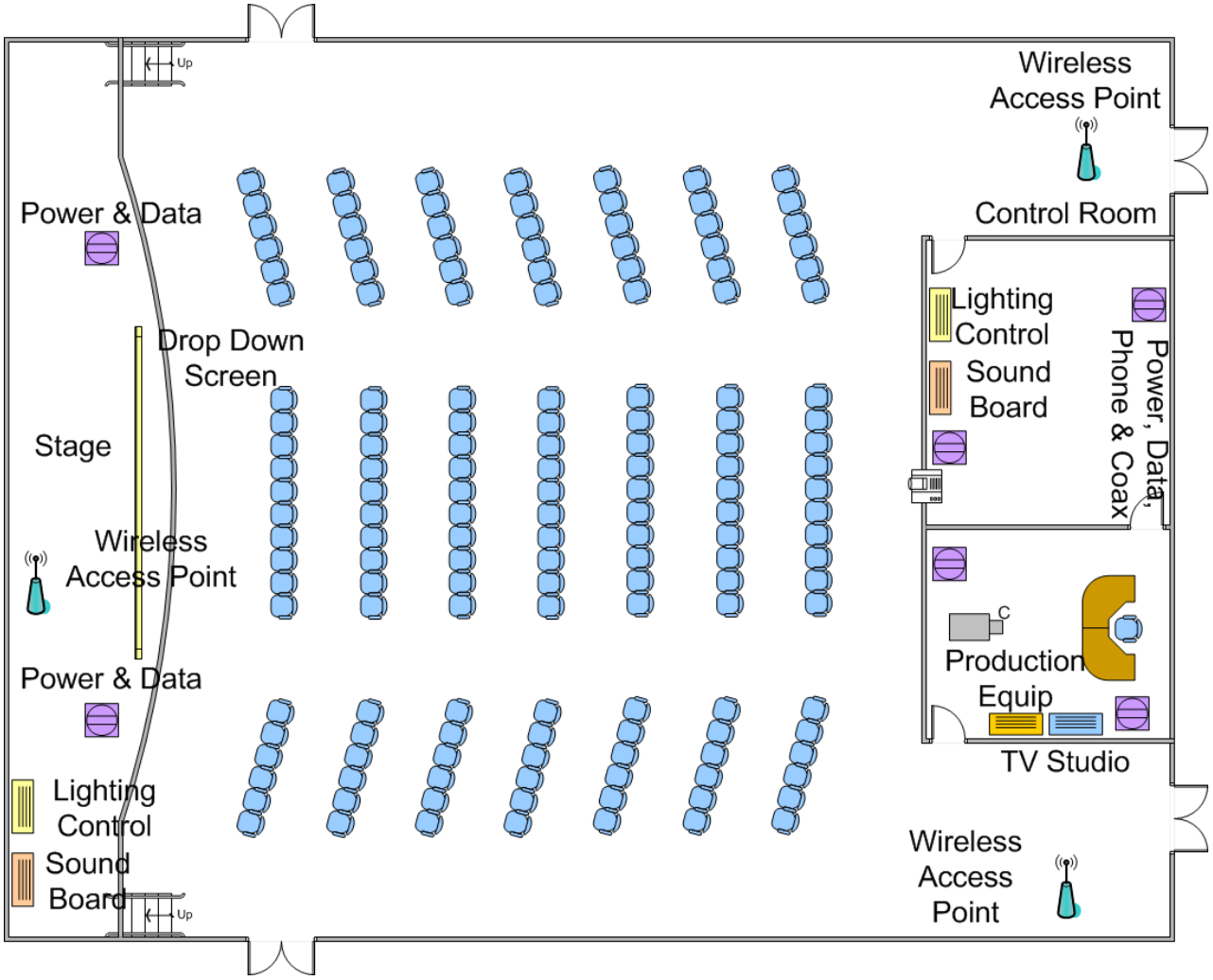
- Install addressable video drops in common areas throughout the school to allow dynamic video display.

- Install video displays in each classroom with analog and digital tuners. From the location where the monitor is mounted, extend the interface ports to an easily assessable location in the classroom, preferably where the second video drop is terminated. Consider overhead mounted projectors interfaced with analog and digital tuner and computer display.

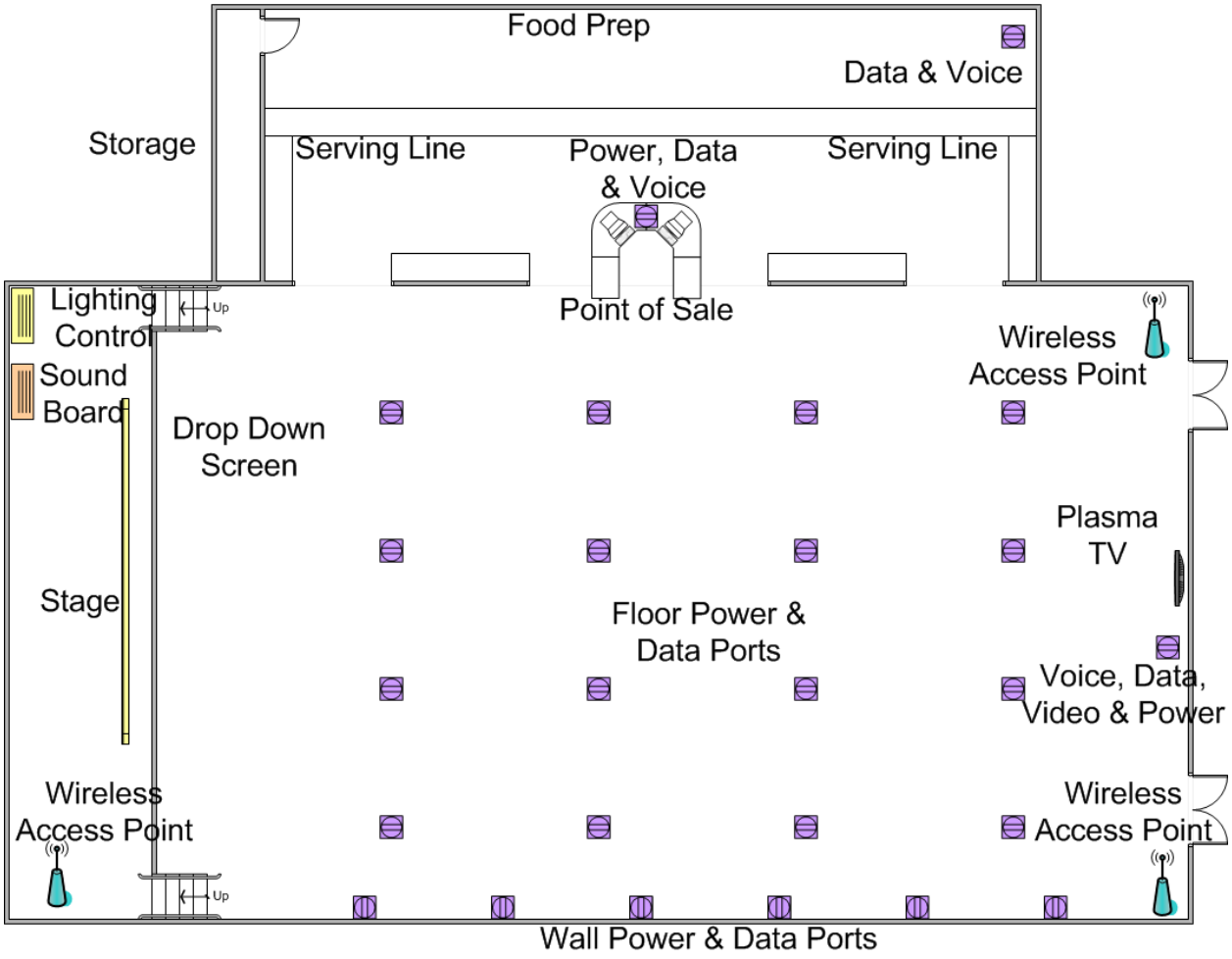
- Install video billboard/message system managed via a computer connected to a high speed network and web-based interface.

E-5 AUDITORIUMS, CAFETORIUMS & GYMNASIUM SAMPLES

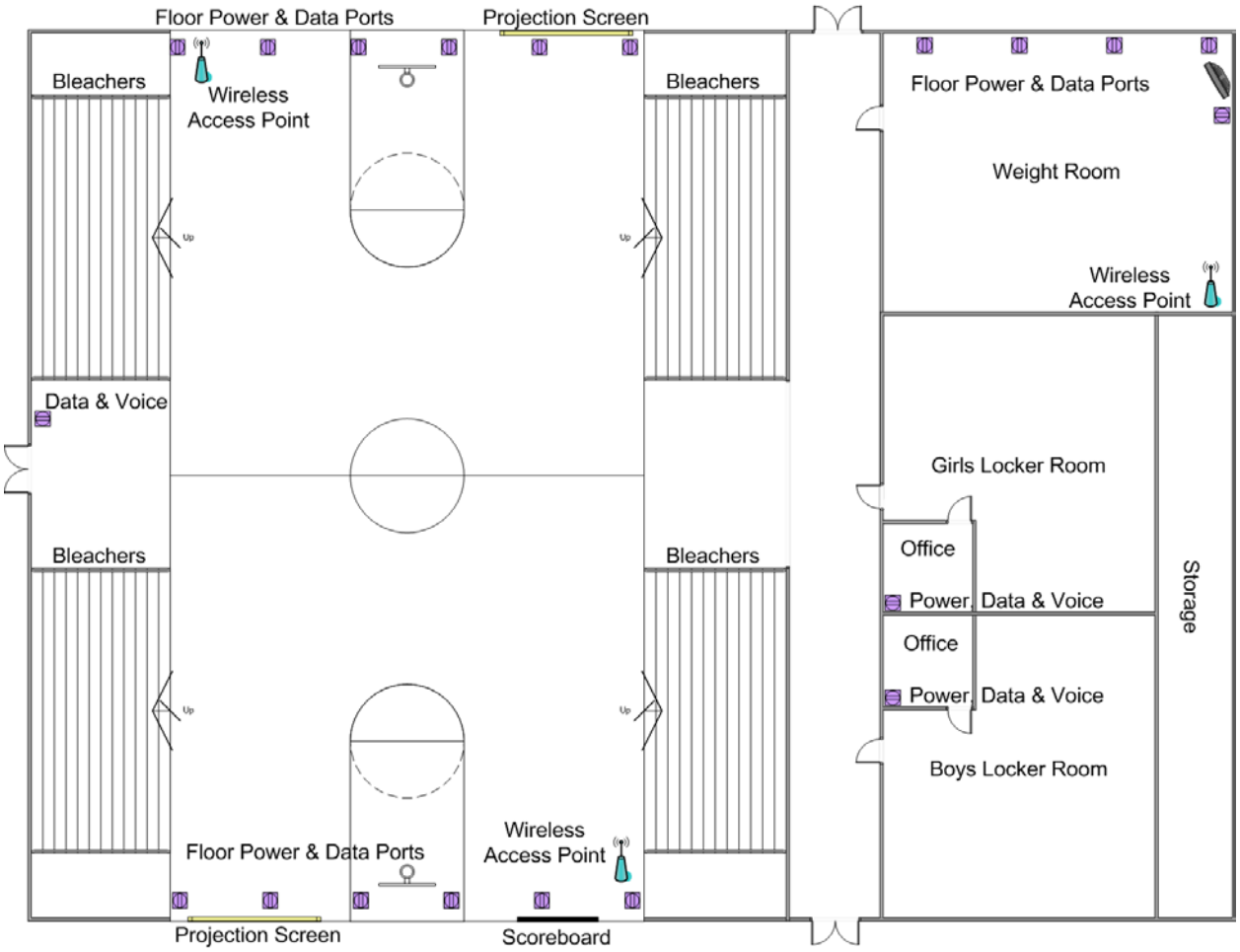
The following diagram represents a typical floor plan for an auditorium/theater:



The following diagram represents a typical floor plan for a cafetorium:



The following diagram represents a typical floor plan for the gymnasium area:



Appendix F. Continuity of Student Learning and Core Operations Planning

State of New Jersey

DEPARTMENT OF EDUCATION
PO BOX 500
TRENTON, NJ 08625-0500

JON S. CORZINE
Governor

LUCILLE E. DAVY
Acting Commissioner

September 14, 2006

TO: Chief School Administrators
Charter School Lead Persons

FROM: Isaac R. Bryant, Deputy Commissioner

SUBJECT: Continuity of Student Learning and Core Operations Planning

A number of national and local schools and districts have experienced disruptions in their operations in the past three years. The causes of these disruptions have been major incidents such as floods and school violence. In addition, many schools and districts have experienced minor interruptions because of electrical outages, water damage, and hazardous material incidents. Because of these disruptions, some schools have not been able to operate effectively for hours, days, or even weeks.

In order to provide continued operating capability in case of a disruption, each Chief School Administrator/Charter School Lead Person should ensure that any school under their jurisdiction has developed and tested a continuity of student learning and core operations plan (continuity plan). The purpose of the continuity plan is to ensure that a district/school can resume partially or completely interrupted in critical functions within a pre-determined time period after a disaster or disruption (e.g. human error, technology failure).

There are several stages included in continuity planning. First, schools must identify and document their essential functions and services. By analyzing areas such as staff capacity, communication systems, records, payroll, transportation, and special needs population, schools can ascertain what is required to deliver those services. Criticality is determined by assessing the impact of the loss of the functions or service and the associated legal requirements. Second, schools must consider a variety of scenarios and detail specific recovery steps to resume the critical functions. Schools should plan for the worst potential outcome from any disaster or disruption. Finally, once the continuity plan is developed it needs to be tested to determine the

need for modifications. This post-planning phase also should include awareness training to gain acceptance for and understanding of the plan and practice so that the plan can be implemented without delay or confusion when needed. This plan needs to be reviewed annually and modified as needed.

With this memo, the department is disseminating a planning guide recommended for developing a continuity plan. Chief School Administrators/Charter School Lead Persons may organize the development of their continuity plans in the manner most effective for their district/school.

Continuity plans are especially important now given the hurricane predictions for our region, the potential for a pandemic, and the ever-present threat of school violence and terrorism. Hurricane Katrina and recent planned school attacks have taught us that we need to be prepared.

Shortly, the department will be distributing more specific guidance on the Avian Flu and pandemic preparedness that may inform the development of your continuity plans. However, your continuity plans should assess and address an array of crisis and should not be limited to pandemic planning only.

Schools play an integral role in protecting the health and safety of their students, staff, and families. Your dedication to this ongoing effort is truly appreciated. Should you have questions, please contact Anthony Bland, coordinator for school security at (609) 633-2544.

IRB/BG/SBM
Attachment

c: Acting Commissioner Lucille E. Davy
Penelope Lattimer
Senior Staff
Susan Martz
Anthony Bland
Rochelle Hendricks
NJ Lee Group
NJ Garden State Coalition of Schools
County Superintendents

New Jersey Department of Education
Local Education Agency (LEA)

Continuity of Student Learning and Core Operations Planning Guide

School Name		**School Code**	
District Name		**County**	
Chief School Administrator		**Chief School Administrator Designee**	
# of Students		**# of Personnel**	
# of Schools		**Off Site Location**	
County Superintendent		**Contact Number (s) & Email (s)**	
Law Enforcement		**Contact Number (s) & Email (s)**	
Office of Emergency Management		**Contact Number (s) & Email (s)**	
Public Health Office		**Contact Number (s) & Email (s)**	

1. Critical Functions

   a. Identify in priority order the critical organizational functions that your district/school must maintain if schools are closed or are operating with a decreased staff. For each, list any issues/concerns/restraints that would impact your long-term ability to continue to carry out those functions. *Note: Your plan will key on these critical functions. Keep in mind that critical functions might be different depending on the time of year.*

   b. List each function and indicate how long your district/school would be able to operate off-site (one day, five days, more than 5 days, 30 days, etc.).

2. Staffing

   a. Identify who and where off-site a list of all your staff with home phone numbers (and home e-mail) is maintained. (If your district/school does not have such a list, it should be prepared immediately.)

   b. Does your district/school maintain an employee notification tree? Is it off-site? Where is it?

c. If space were limited, who are the essential/critical staff for whom space would be needed immediately?

d. Which employees could be assigned to work off-site with minimal supervision or alone?

e. List remaining employees and note whether their presence is necessary to maintain a critical function.

f. Does your district/school have any staff members with special training or credentials which make them critical to specific functions?

g. If your operation had to be divided or separated into different locations, how would you want it done (by specific function, bureau, etc.)?

Staff Site Separation Plan
List units/functions & numbers of people

h. Short Term (1-5 days) Long Term (5-30 days)

i. Does your district/school have any special equipment needs? (i.e., other than normal office/computer equipment).

3. Mail

a. Should mail delivery be delayed/stopped, identify which critical functions your district/school will not be able to carry out.

Short Term (1-5 days)	Long Term (5-30 days)
(List critical functions)	(List critical functions)

b. Does your district/school have any special/atypical mail needs?

4. Document Handling

a. By critical function, list the necessary forms and documents which your district/school uses (electronic or paper) which you would need to continue.

b. Does your district/school have a central file or location where a copy of every necessary form/document is readily available for an emergency crew? If your district/school does not currently have such a file, when will it be completed and where will it be kept? Where off-site are a set of these forms maintained?

c. If your forms and documents were unavailable for an extended period of time (over 5 days), how would your district/school continue to carry-out its critical functions?

d. By critical function, list all data files/systems necessary to maintain operations. Also, list any other special needs such as hardware, software, or e-mail connection by critical function.

5. Access to Information

a. Does your district/school have a list of all laptop computers available within your district?

b. By critical function, identify any and all paper records/files necessary to carry out that function.

c. Which paper files and records are immediately important (1-5 day period) and which become critical in the long term.*

d. Which of these file sets are already electronically stored?*

Note: Code your responses, i.e., "E=Electronic or Not E=Not Electronic, L=Long or S = Short" to avoid repetition.

6. Essential Work Communications

a. Identify your basic phone /fax/data connectivity needs for your critical staff in the case of a short-term relocation.

7. Staff Unavailable

b. If large numbers of staff are unavailable (more than half/less than half) what essential functions would not be carried out?

c. What is the minimum staffing level necessary to carry out each critical function?

d. Prioritize your LEA's critical functions if faced with large scale absences.

e. Have back-up personnel identified in-case of key staff being unavailable (i.e. district/school.)

8. Delegation

   a. Identify any authority or function that could be delegated elsewhere, both within your district or outside, to carry out a critical function.

9. Emergency Training

   a. To what extent could other personnel be trained to carry out a critical function?

   b. What resources (qualified personnel, materials, time) would be necessary?

   c. Which of your personnel could be field trained to complete critical functions in an emergency?

10. One-Day Function Interruption

    If circumstances caused a resource interruption of only ONE day, comment upon each of these areas:

    a. Critical Functions – What function(s) could not cease even for only one day?

    b. What resources (people, space, files/information, forms, documents, etc.) will you need to carry out that critical function – BE SPECIFIC AND DETAILED. Are there others who could carry out this function(s)? Could it be carried out without mail support, computer equipment/software (what are your needs)? What minimal number of staff would you need to carry those critical functions out? (Please identify who those individuals are.)

Guiding Questions for Continuity of Student Learning and Core Operations Planning

As you begin or conclude planning, you may want to consider some of these questions below to help you focus your planning efforts. The questions should serve merely as a guide to your emergency and crisis management planning.

1. If classes shut down for weeks, how will a district keep students from falling behind?

2. Has your LEA developed alternative procedures to assure continuity of instruction? (e.g., podcasting, automated phone banks, web-based distance instruction, telephone trees, mailed lessons and assignments, instruction via local radio or television stations.)

3. Who will keep the payroll running, or ease the fear of parents?

4. Has your LEA ensured language, culture and reading level appropriateness in communications?

5. Has your LEA shared what they have learned from developing your local preparedness and response plan with other LEAs as well as private schools within the community to improve community response efforts?

6. Has your LEA taken into account if any of the district's buildings will be used to handle emergency needs: (i.e., medical surge capacity, temporary housing, storage, etc.?)

7. Has your LEA notified staff of the Continuity of Student Leaning and Core Operations Plan?

8. Has your LEA notified those staff designated as "essential" of their roles and responsibilities in the plan? Has there been an exercise to test the plan?

9. Has your LEA taken into account food services?

10. Is your planning team familiar with the Incident Command System (ICS)?

As a general rule, the more effort you put into emergency planning the easier your Local Education Agency will be able to cope should the worst case scenario arise.