Texas Society of Architects

TxA School Safety/Security Work Group

Findings Report:

Security Concepts Parametric Cost Model

3 April 2019

This page left intentionally blank
to support duplex printing

Case Study Concept Overview

Immediately after the Santa Fe tragedy, the Texas Society of Architects (TxA) established a School Safety Work Group to focus on the role of architects and the built environment in school safety, as well as to contribute to the school safety dialogue by identifying resources, leading practices and sharing knowledge. Our School Safety Work Group is composed of more than a dozen leaders from top education design firms of every size across Texas, serving urban, suburban and rural school districts in every region.

One of the greatest challenges Texans face is determining what needs to be done to existing schools to bring them to an "acceptable" level of safety and security, including how much those improvements will cost. Most newer schools have safety and security design features already incorporated, but the majority of our Texas school facilities are older and need upgrades. Factors that must be considered for these facilities include age, size, educational delivery method, and campus operation plans. Due to the variations across our state, there is not a one-size-fits-all solution that can be applied to determine a cost to retrofit the concepts presented in this report.

Identifying a detailed, exact cost amount for upgrades required across the state will require such extensive data collection and assessment that it would overwhelm available resources and time to accomplish the task. Considering that time is of the essence in making needed security upgrades, we have chosen to provide a *magnitude of cost model,* estimating the cost required to address safety in retrofitting our Texas school facilities. The goal is that funds can be allocated in the near term and improvements realized sooner.

This *Security Concepts Parametric Cost Model* document was compiled by TxA to define the *magnitude* of school safety and security upgrade costs across the state and remains a work in progress. We identified and categorized the most common, safety improvements based on current leading practices, and cross-referenced them with typical school facility types. To account for the many variables in facilities, we estimated cost differences based on level of complexity or size, then estimated a percentage of facilities needing each level of improvement. The costing data for this model was derived from the collective experience of our volunteers involved in actual facility improvement projects across the state.

The projections that follow assume a well-informed estimate for the implementation of *each* concept in *every* district throughout the state. We believe districts should be allowed the flexibility to select and prioritize those concepts that best fit their needs, concerns, and political environment. This would imply that these costs represent a maximum total need *if* districts choose to implement every one of these concepts on every campus in their control. The challenge of summarizing district totals based on individual campus needs to scope the statewide cost needs could only be done in this manner.

When implementing school safety and security improvements, we cannot stress enough the importance of engaging all stakeholders at each campus to understand not just the physical condition of their facility but also its geographic location, operational plan, and the threat reporting procedures for concerns raised by faculty and staff, local law enforcement, first responders and parents. The best course of action towards making our schools safer must be a combination of

physical improvements and campus operational plans to ensure improvements are appropriate as well as effective.

Physical improvements recommended in this report help address a wide range of potential safety issues, not just active shooter threats. In addition, while this report highlights other key physical security upgrades, it should not be considered an exhaustive list of *all* the available upgrades or technology available for school facilities. Security equipment, technology and communication systems are also not included within this report as they require considerations of staffing, operational expense and recurring contract costs independent of the facility itself. Schools that are considering items such as metal detectors must take into account not just the initial cost to purchase and install the equipment; the majority of funding needed to implement this type of equipment is the cost to staff and operate it year after year. Districts should also consider the skill-set of the staff hired to operate the equipment, and the space required to accommodate the queuing of students, who typically all arrive within a short window of time. Items such as gun vaults require less space, but consideration should be given to their location, who and how they are accessed and operational plans that must be created and implemented for them.

With rapidly growing interest in school safety, many have turned to architects and the building design for solutions. As critically important as design is to school safety, we must remember that the physical building alone cannot "fix" this issue. No single solution can guarantee that a threat will not occur, only a holistic approach combining the perspectives and efforts of architects *with* administrators, teachers, campus security, local law enforcement, counselors, parents, mental health experts and others can provide the best possible solution for each campus/every district.

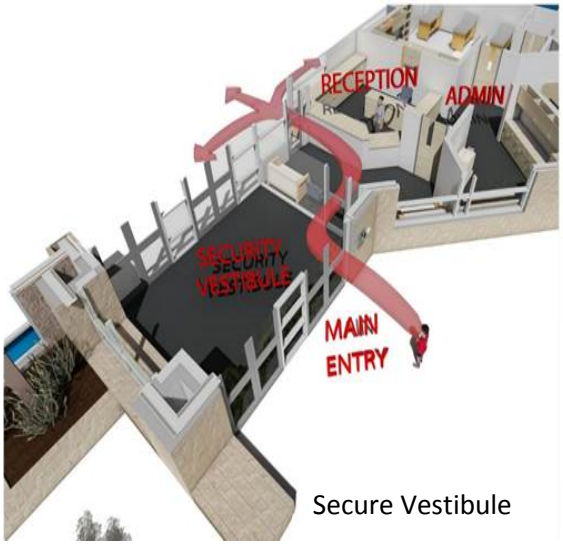
Texas architects, working through our School Safety Work Group, are committed to assisting state leaders in improving school safety. We welcome the opportunity to provide our focused efforts, experience and expertise to ensure safer schools as we all work to mitigate this threat to both safety and education.

CONCEPT 1

SECURE VESTIBULE ENTRIES

OVERVIEW

All school facilities should seek to enhance the concept of channeling all visitors through a main public entry providing a "single point of entry" through the creation of a sally port, man-trap, or captured vestibule entrance into a reception/waiting area. Visitors cannot enter the reception/waiting area of the school without the control and supervision of the reception staff, School Resource Officer (SRO) and/or security. Visitors are allowed into the reception area by an attended reception desk staff member after visual or other identification for validation of credentials and assessment of intent. If they are cleared and authorized to enter the school itself, a second door with access controlled hardware controlled by the reception staff will allow them to continue into the facility. If an interior, climate-controlled entrance vestibule is not provided, consider providing a covered queuing area exterior to the building for visitor comfort.



Secure Vestibule

The reception/waiting area should be adequately sized to accommodate a realistic number of potential visitors awaiting check-in, waiting for a staff escort into the campus, an ill child to be brought from the clinic, dropping off a student's forgotten items, etc. As such, this area should also be furnished with some seating for persons not allowed into the building, but who might be asked to wait.

It is highly recommended that the main administration area be located adjacent to the front entry of the building. This provides "back-up" to the reception staff, and enables parents, guardians and other visitors to have meetings with school staff or administrators without gaining access to the rest of the building. The reception staff should have good line-of-sight and be able to see visitors approaching the building prior to them entering the vestibule.

Consideration should also be given to include a small conference room adjacent to the reception/waiting area as a "cool down" space. Irate parents, siblings or other relatives can be directed to wait in this more private, quiet environment separated from the remaining visitors in the reception/waiting area through a one-way passage door until such time the principal, SRO or appropriate staff be made available to talk to them. By establishing a one-way pass-through door openable from within the reception area only with a key or other access control, the school staff can assess whether contact with the individual(s) is reasonable before engaging with them. This

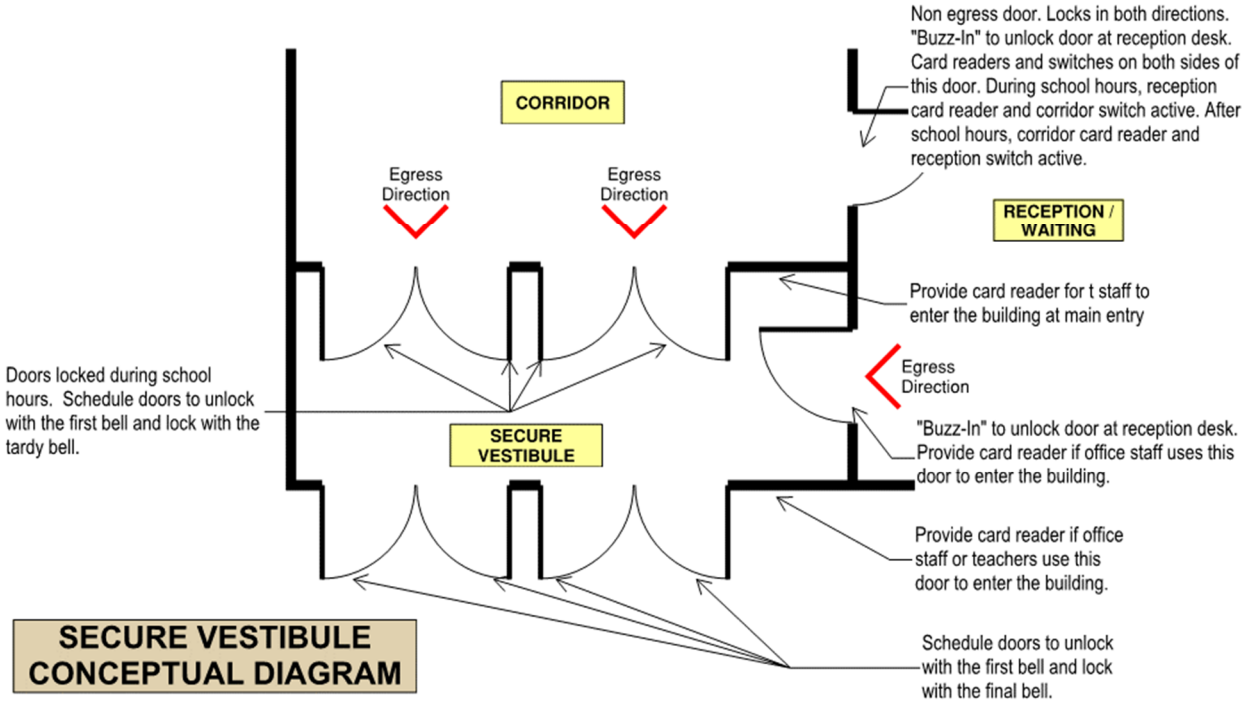
room is also fitted with an egress only door directly back outside to the public parking area allowing a belligerent or disturbed individual a choice to have a reasonable conversation or to simply leave the premises.

Note the concept of an “escape” route, or area of refuge, for receptionist/SRO to utilize in crisis situations should also be an integral part of the design solution. This area of refuge needs to be a room that, at a minimum, puts a solid locked door between the receptionist and a potential threat. This area also needs to be equipped with PA/emergency communications as well.

On campuses comprised of multiple buildings, it may be necessary to create secured vestibules in more than one location. If it is not possible to staff more than one entry to a campus, other forms of access controls should be considered at all points of entry to the campus.

WORK DESCRIPTION

Through recent experience with numerous school districts, it has been found that renovations to include secure vestibules fall into three broad categories related to complexity, which in turn affects the cost. As it is not possible to “design” all required conditions, we have found, for long range facility planning and budgeting, this construction can be categorized into three groups:



SECURE VESTIBULE CONCEPTUAL DIAGRAM

Simple Complexity (S)

A simple construction for a secure vestibule involves an entry condition and reception area that is already located along the front exterior area of the school. These may require only some additional walls and access control door hardware to create the conditions

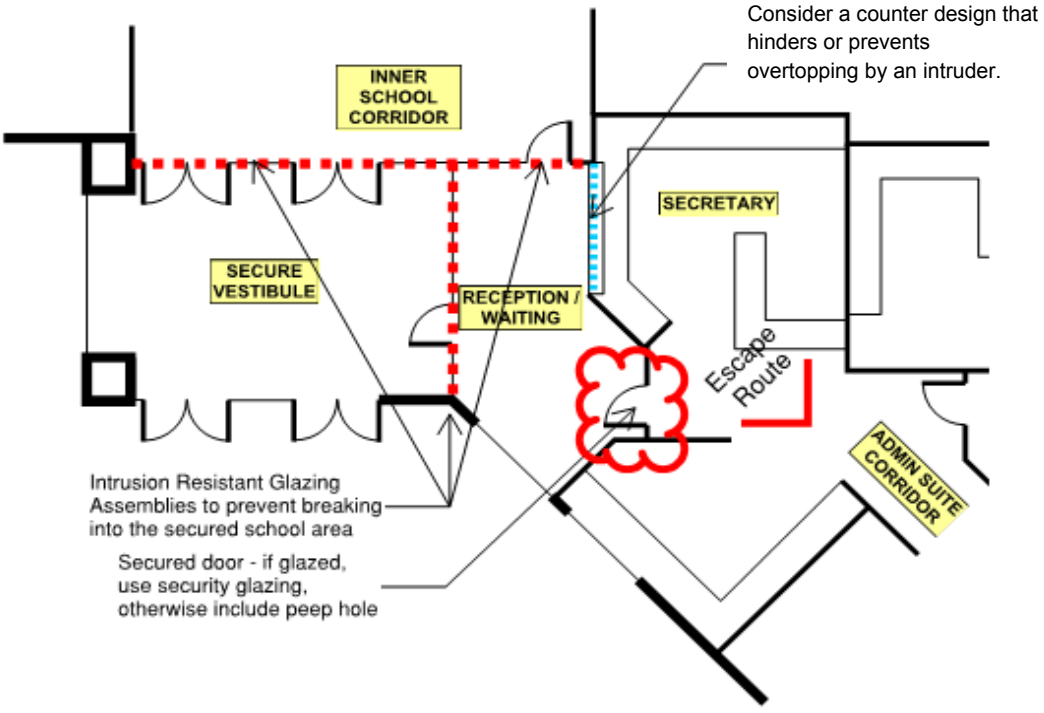
described. If natural surveillance is not already in place or able to be added from the reception area to the exterior entrance, electronic surveillance may need to be added to complete the intent of the concept.

Moderate Complexity (M)

Moderate complexity would involve more renovation than a simple construction but without the complete relocation of the administration suite or portion thereof. This condition might be an administration suite located adjacent to the door, but the wrong function is located directly adjacent to the desired vestibule location. For example, the principal's office might be the space adjacent to the entrance in lieu of the reception/waiting space.

Difficult Complexity (L)

The more difficult solution usually requires relocation of the administrative office area or at least the reception/waiting area portion of the administration suite from an internal location within the school to the exterior of the building adjacent to the front door area. This condition is prevalent in many schools designed and built in the 60's and 70's. Generally, this solution involves total renovation of a classroom or classrooms or other space adjacent to the main front door into a reception/waiting area and can often require supplemental HVAC and electrical expenses in addition to the doors, windows and additional walls required to accomplish the desired function. This conversion in turn requires re-developing the old administration suite area into academic program space to replace the lost classroom(s). Some solutions may merit some construction to the exterior of the facility to contribute to intuitive wayfinding and creation of a clearer sense of "front door", or entry to the facility.



Other considerations affecting pricing assumptions:

- New openings and existing openings that are to remain or window assemblies leading from the vestibule into the reception/waiting area and from the vestibule into the main corridor area are to be glazed to 6'-0" minimum height with intrusion-resistant (security) glazing such as School Guard SG4 or have the glazing unit filmed from edge to edge with 3M security film on the opposite surface of the vestibule. Designers may wish to discuss a UL 752 Level 3 ballistic glazing with school district security personnel and administration. Ballistic glazing thickness needs to be considered in conjunction with proposed framing. This is to prevent visitors from bypassing the intended security control by breaking the glass and entering directly.
- Existing glazing that is not code required safety glass should be replaced with security glazing or security filmed safety glass. Existing glazing that is code compliant safety glass should be removed from the frame, fitted with security film installed in accordance with manufacturer's recommendations which may include edge-edge-edge application, structural sealants/caulks and/or frame modifications
- It is ideal that at least four pathways doors have access control in this arrangement with the following intent:
    - One exterior door entry leaf into VESTIBULE from outside for staff entry after bell schedule is in occupied (school hour) mode;
    - Multiple exterior doors into VESTIBULE to be unlocked based upon supervised entry of school students during morning entry based upon the bell schedule.
    - RECEPTION/WAITING area door from the VESTIBULE for "buzz-in" by receptionist;
    - CORRIDOR door from RECEPTION/WAITING into main area of the school for "Buzz-out" by receptionist after authentication and badging. This door should be locked in both directions of travel to secure the school administration areas during after-hours events when public is allowed into the facility;
    - CORRIDOR doors into the VESTIBULE to allow for unlocking based upon supervised entry of school students during morning entry based upon the bell schedule.
- Walls that surround the VESTIBULE should extend and be tied to the structural deck above to prevent access into the school facility if the exterior doors were not latched and locked to provide a secondary secure layer. Alternately, hard ceiling may be provided in the VESTIBULE.
- Consider and discuss a counter with grille or glazing to secure the reception staff from the waiting area in the event of a violent or belligerent visitor.

PARAMETRIC COST MODELING

With cost data collected from recent construction work, projects were grouped into the three categories described above and an average cost per project using statewide average construction cost was assigned.

School district facilities were considered by the work group participants and analyzed for which category of construction they would require to achieve the concept throughout districts of varying size. Many districts, especially the fast growth group, are already applying this concept to their new facilities and therefore have a smaller percentage of their building inventory that require work, whereas older, large urban districts need significantly more renovation effort to achieve this concept goal.

Percentage estimates were applied to the state's portfolio of over 8,700 campuses based on each level of complexity and the work group's collective experience with many statewide districts to estimate the number of projects required in each category. From this product, an estimated total need of $ 2.4 to 3.6 billion was estimated for the state's public-school districts to fully implement this concept.

This page left intentionally blank

to support duplex printing

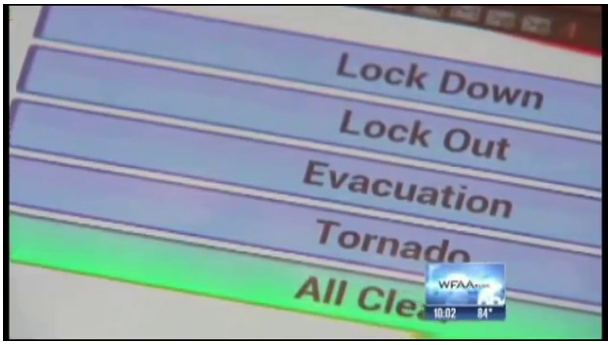
CONCEPT 2

PA Systems

OVERVIEW

With a variety of emergency communications technology options for schools, perhaps the most effective, highly recommended system is a robust intercom with backup provided using handheld two-way radios. A modern IP based intercom, public address, master-clock and mass notification system is probably the most reliable, rapid, and effective means for school staff to communicate, both internally and externally, in a crisis event.

Districts should seek to standardize the operations of its intercom systems for all campuses and provide for a minimum level of capability. While most schools have intercom/PA systems, it is unlikely that they can support the features desired in the current context. Districts should determine if the existing systems can be upgraded or need to be replaced at their campuses. An assessment should be performed to make an accurate determination and a scoping meeting held with district safety and administration teams to refine the scope of work for each campus's effort. It should be noted that there is a "tipping point" in costs where it is less expensive to start over and put in a completely new system rather than attempt to salvage components of an older system. Assessments should be cognizant of this reality.



Another important consideration is to locate the head end equipment in a secured, lockable location to prevent sabotage or disabling of the system entirely as a tactic to cripple school communications in an attack.

WORK DESCRIPTION

The aim of this concept is to provide fully operational IP platform-based systems for a district-wide school campus critical communications solution, incorporating school safety notifications, mass notification and general communications including the following minimum features:

- Two-way internal intercommunications between staff locations, all classrooms, and other teaching stations and other regularly occupied sapces during the school day;
- Scheduled bell events;
- Emergency announcements that will override any pre-programmed audio, assuring that all announcements are heard at every speaker location, both internal and external to the building;
- Emergency announcements that can be activated by a Soft Key on an administrative console, panic button, dial string, or web browser;
- Emergency announcements displayed on crawling LED displays in conjunction with audio or as “silent” announcement to teaching spaces and other areas as desired;
- Atomic Time Synchronization;
- Selectable schedule tones utilizing multiple, user-programmable schedules for each zone;
- District-wide, emergency, school group, campus and building zoned live voice paging, and messaging or pre-recorded source material (tones, music, voice)
- Web-based user interface for multi-school functionality;
- Capable of supporting multiple level priorities which shall be user-definable, allowing each location to place multiple, simultaneous priority calls;
- Call-in capability from outside the school into any classroom, zone, or entire school directly via the District telephone network. This shall allow remote monitoring, call-in annunciation, and two-way conversation from outside the facility as well as paging into the system. (Compliant with NEMA Standard SB-40 for emergency communications in K-12 Schools).
- Users shall be able to create appropriate and applicable number of automated sequences with voice instructions, tones, emails, program distribution, and relay activations and replay them;
- Automated message strings manually initiated from a single-button access on the console, on a connected telephone, a duress button, from the web-based user interface or via interface with third party systems;
- Paging and two-way intercom features shall be accessible from any system console or connected telephone for each campus;
- The platform shall synchronize its system time to the network timeserver or a web-based time server;
- Each campus installation shall be locally survivable for intercom, paging, bells, and emergencies such as lockdown, even when the district connection is unavailable;

PARAMETRIC COST MODELING

With cost data collected from recent construction work and recent bond planning efforts, campuses were grouped into three grade level classifications (ES, MS and HS) as an effort to normalize the sizes of the facilities. These could be thought of as small school, medium school, and large school as well. Campus unit costs were priced as complete, new systems with capabilities per the above.

The unit cost was generated using a lump sum cost ($50,000) for the head end equipment and general requirements that apply regardless of the size of the school and then scaled upward on a cost per classroom ($1500 each). The number of classrooms was determined by the average school enrollment divided by an applicable pupil-classroom ratio.

Based upon the TxA School Safety Workgroup's experience with school districts, an estimated percentage of facilities needing replacement intercoms was applied to the state's portfolio of over 8,700 campuses. From this product, an estimated total need of $349 to 417 million was estimated for the state's public-school districts to fully implement this concept.

It should also be noted the percentage of full replacements has been adjusted downward somewhat to account for "salvageable" components in moderate aged systems. Consequently, the number of campuses that would be affected is a higher percentage than that shown, but many would only receive upgrade efforts rather than full replacements.

This page left intentionally blank

to support duplex printing

CONCEPT 3 "Lock-down" Security

OVERVIEW

Most school districts have implemented some form of emergency operations procedure or "lock-down," "hide," or "shelter-in-place" commands to respond to an active assailant threat within their school. This normally involves defining a strategy for spaces in which the lock-down can occur. In most older schools, this area is clearly the predominantly occupied classroom or other teaching station. In many newer schools that employ a more open "neighborhood" or classroom suite concept, this is often accomplished by isolating the suite itself from the corridors or larger circulation areas. Most of these facilities were likely designed in the era of modern school security and have already implemented the layers of security.

Many older schools are outfitted with "classroom function" locksets. These function as open unless locked by a key. The intent was to allow free passage in and out of the classroom but allow the staff member to lock it to prevent theft, vandalism, etc. when the room was not occupied. From the inside, building codes require free egress, even when locked. The problem with classroom locksets is a staff member must enter the hall, find, insert and operate a key from the corridor or circulation side of the door. In an active assailant situation, this potentially exposes the staff member to the assailant. Studies have also shown in a high adrenaline, stressed condition, most persons cannot insert a key or remember which direction to turn it, much less remember where they put the key. Additionally, substitute teachers are often not issued the actual room key for key control reasons. Most of these locks have no indication of locked or unlocked from the interior of the room.

Many districts have implemented a policy of teaching with the door in locked position using the existing locksets to address this issue. Operationally, this is not ideal because oftentimes, students are permitted to leave the classroom to go to nurse's office, return a library book, go to the restroom, etc. Upon their return, someone must positively identify the student and let them back into the classroom which interrupts at least one person, can distract other students or even interrupt instruction altogether if the teacher is the one to open the door.

There are often "workaround" solutions such as placing a magnetic tab on the doorframe to prevent the cylinder or mortise from engaging in the latch strike, wedging the door open, or simply violating policy for the sake of operational convenience. These are not without problems such as having to remember one more action in the event of an actual crisis, or again, having to enter the corridor to secure the room.

WORK DESCRIPTION

The aim of this concept is to provide a door and door hardware (latch/lockset) solution that provides the security to provide enough time barrier to intrusion by an assailant to provide the necessary protection of occupants in the safe area during a lock-down situation.

There are many ways to achieve the goal of securing the lock down area and delaying forced entry. However, the goal of this concept would be to accomplish these goals as economically as possible while achieving a reasonable standard of care.

One option that fits these goals is to replace the locksets on rooms used for lockdown protection with classroom security function locksets. These locksets remain open for passage both directions until the staff member wishes to secure an unoccupied room or a lockdown protocol is initiated. Upon a lockdown notification, a thumb turn deadbolt with an interior indicator is engaged. These sets are also available with a keyed deadbolt, but for reasons noted above, these would not be recommended. This capability must be balanced with the concerns over bullying, suicide and sexual assault as students would have the ability to lock themselves in an otherwise unoccupied room.

Combined with careful lockset consideration, it is an option to harden the door assembly to prevent forced entry. Most doors have vision lites in them or side-lites directly adjacent to them to facilitate instructional observation, protect staff from false accusations and prevent assaults of students and staff through visual observation. Facility teams should consider the use of security film or intrusion resistant glazing to delay forced entry in all openings that could allow access to the interior side of the classroom. Additionally, door openings with side-lites can be replaced to reverse the door swing and place the view window on the hinge side of the door.

Another excellent solution is to retain the existing classroom function locksets secured in the locked position and ensure all doors are equipped with door closers. A magnetic hold-open device is then installed to keep the door in the open position until a lockdown or fire alarm activation occurs. This activation will release the hold-opens and the closers will close and lock the doors. This option requires no thought or action by staff or students to secure the lock down safe spaces.

With such a diverse range of existing conditions and many solutions to achieve the balance between operational convenience and true intrusion resistance it is imperative for each campus to evaluate their facility conditions, operational procedures and code requirements with a licensed design professional to determine the best course of action.

PARAMETRIC COST MODELING

With such a diverse range of existing conditions and many solutions to achieve the balance between operational convenience and true intrusion resistance, this concept is correspondingly difficult to price.

As such, the model attempts to parametrically determine an average number of doors for each facility type. The model assumes a fixed number of "other lockdown space" doors such as Art Rooms, Music Rooms, etc. and adds general purpose classroom doors to that baseline based upon average school population divided by pupil to classroom ratio appropriate to school grades included.

The total estimated cost is generated by the product of unit cost, number of doors and estimated percentage of campuses needing the improvements. From this product, an estimated total need of between $156 to 416 million was estimated for the state's public-school districts to fully implement this concept.

The percentage of campuses needing improvement is estimated based upon the TxA School Safety Workgroup's architects' regional public-school district experience. Unit costs applied range between a simple door hardware swap out and security filming of the door vision lite to more complicated corrective actions such as door and hardware replacement and installation of magnetic hold-open devices.

This page left intentionally blank

to support duplex printing

CONCEPT 4 Surveillance Camera Systems

OVERVIEW

Most school districts have no cameras or are short of cameras necessary to cover campuses and would approve of systematically expanding the capability of the video surveillance systems on a priority of need basis. Captured (non-live monitored) video images are considered today as a baseline safety and security measure for corporate, private and public entities. Surveillance cameras help promote public safety by being a 24 hour/7 day a week security presence. They act as a deterrent to crime and disorder and assist with criminal or civil investigations.

Significant upgrades may be required for existing school camera systems. Overall, we have generally found a lack of cameras for full coverage of campuses, and often the cameras in place are inoperative or need adjustments to be effective. In numerous campuses, existing cameras should be positioned more appropriately to work with available lighting, or repositioned to capture areas of known activity, so security personnel and police officers can provide appropriate response. At district discretion, the video can be shared live with local law enforcement.

WORK DESCRIPTION

Campuses will require assessments of the existing system to include the servers, IT infrastructures (backbones), monitors and cameras.

In general terms, interior and exterior cameras can be categorized as low, medium and high in terms of quantities and locations per the table below. Actual system designers should seek to maximize coverage in accordance with the priorities noted herein but at a minimum should provide the additional number of cameras indicated in the following table.

Scope	Interior Cameras	Exterior Door Cameras	Parking Areas and Campus Cameras
LOW	Provide approximately four (4) cameras to the system to monitor priority interior locations such as corridor intersections, remote locations and blind spots. Upgrade or expand server, monitors and other components as required.	Provide approximately four (4) cameras to the system to monitor exterior doors. Upgrade or expand server, monitors and other components as required.	Provide approximately four (4) cameras to the system to monitor key campus areas such as parking lots, playgrounds, bus and parent drop-off areas. Upgrade or expand server, monitors and other components as required.
MEDIUM	Provide approximately eight (8) cameras to the system to monitor priority interior locations such as corridor intersections, remote locations and blind spots. Upgrade or expand server, monitors and other components as required.	Provide approximately eight (8) cameras to the system to monitor exterior doors. Upgrade or expand server, monitors and other components as required.	Provide approximately eight (8) cameras to the system to monitor key campus areas such as parking lots, playgrounds, bus and parent drop-off areas. Upgrade or expand server, monitors and other components as required.
HIGH	Provide approximately sixteen (16) cameras to the system to monitor priority interior locations such as corridor intersections, remote locations and blind spots. Upgrade or expand server, monitors and other components as required.	Provide approximately sixteen (16) cameras to the system to monitor exterior doors. Upgrade or expand server, monitors and other components as required.	Provide approximately sixteen (16) cameras to the system to monitor key campus areas such as parking lots, playgrounds, bus and parent drop-off areas. Upgrade or expand server, monitors and other components as required.

The following table indicates an example priority of coverage for cameras on campuses broken down by grade level groupings. The District's security team should use this as a guide for discussion during planning meetings as simply a place to start. Many campuses may already have many of these locations adequately covered, so it is important to consider the existing infrastructure when determining the location for the required number of new cameras.

Video Surveillance Recommendations		
Elementary School	**Middle School**	**High school**
Site Entry Point	Site Entry Point	Site Entry Point
Pedestrian Gate foot traffic Area	Pedestrian Gate foot traffic Area	Pedestrian Gate foot traffic Area
Main Entry	Main Entry	Main Entry
Reception Area/Main Office	Reception Area/Main Office	Reception Area/Main Office
Other Entry Doors	Other Entry Doors	Other Entry Doors
Bus Drop Offs	Bus Drop Offs	Corridor Exits
Parent Drop Off	Corridor Exits	Located on lengths of Corridors
Corridor Exits	Located on lengths of Corridors	Gathering Areas Outside
Portable Exposures	Parent Drop Off	Gathering Areas Inside
Gathering Areas Outside	Gathering Areas Outside	Portable Exposures
Gathering Areas Inside	Gathering Areas Inside	Student Parking
Playgrounds	Portable Exposures	Building Perimeter
Building Perimeter	Building Perimeter	Service Courts
Service Courts	Service Courts	Student Parking
Visitor Parking	Visitor Parking	Visitor Parking
Staff Parking	Staff Parking	Staff Parking
Fence Lines	Fence Lines	Fence Lines
Hidden Areas Between BLDGS	Hidden Areas Between BLDGS	Hidden Areas Between BLDGS

PARAMETRIC COST MODELING

As noted above, the work group agreed that the only way to capture camera needs would be to define a Low, Moderate and Complex need which could be based upon size of facility, grades included, campus location within the district, etc.

The inability to assess campuses led the group to reflect upon past security camera design and construction efforts and assign several camera points to each category. The numbers assigned are 12, 24 and 48 additional camera points for the Low, Medium and High installations respectively. It would be prudent to note that some fraction of state-wide campuses do not need any improvement in this area.

The low-end unit cost per campus assumes that the school campus has functional head end equipment with acceptable capabilities and expansion capacity. The high-end unit cost assumes the additional cost of replacing the head end equipment to provide for the desired capabilities or the needed expansion of camera points.

Work group participants experiences and histories with school districts throughout the state generated the unit costs and the affected campus percentages. The product of affected campuses and unit costs generated a state-wide need of between $264 to 428 million.

CONCEPT 5 Access Control Systems

DESCRIPTION

Many districts likely may have begun work on proper access control systems in their facilities, on a limited scale but would like to enhance these systems beyond primary access points. For many of these systems. the hardware installed is within its useful service life, but some facilities may need to have the primary hardware upgraded to add additional control points.

Access control systems provide the ability to lock down doors remotely, schedule doors to unlock automatically, and provide alerts for unusual behavior. These systems can provide early warning of a potential threat, by alerting staff to a door left unsecured, as an example. Another important feature of the remote control is speed and staff protection. With access control on all exterior doors used for flow of student and visitor traffic, a lock down can be called and executed in seconds. What our group finds most often however, is a staff member must physically walk and lock all exterior doors. The cost to add access control involves multiple systems, including the District's IT backbone, surveillance cameras and existing doors and door hardware.

WORK DESCRIPTION

The scope for access control system expansion falls into three categories: Elementary, Middle and High school scales of work are noted in the table below. Note that these are minimum requirements and designers should maximize the expansion/extension of the system at each campus using the funds available to the actual project. The level of scope ranges from elementary campuses to middle schools and high schools but could equally be considered small, medium and large campuses.

Scope	Access Control Extension
Elementary	Extend the campus access control system by approximately four (4) additional exterior doors. Servers, control panels and other "headend" equipment shall be updated as required if needed.
Middle Schools	Extend the campus access control system by approximately eight (8) additional exterior doors. Servers, control panels and other "headend" equipment shall be updated as required if needed.
High Schools	Extend the campus access control system by approximately twelve (12) additional exterior doors. Servers, control panels and other "headend" equipment shall be updated as required if needed.

A planning meeting with district security director, campus administrators and other stakeholders should be held to ensure the best application and location for the access control points are established before layout and design is finalized.

Most school districts in Texas do not currently have a District-wide access control system. Over the past ten years, many school Districts have begun examining the costs of such systems because there are several features that improve safety and limit access to school buildings. School Districts can connect their Human Resources data systems to their access control system to reduce data entry and automatically activate and deactivate access cards based on employee hires and terminations. Doors that are controlled by an access control system can be scheduled to unlock on a schedule to allow students to enter at the beginning of the school day and lock with the tardy bell. Access control can also unlock when students must move between buildings during passing periods. Teachers in remote buildings can give students hall pass cards to access other buildings during class periods.

Modern access control systems can tell the difference between someone leaving the building and a door opening without authorization. Unusual or unauthorized events can send a notification for immediate attention. Access control systems that are connected to camera systems can coordinate access control events with camera recordings. System administrators can quickly skip to recordings of specific events.

Modern proximity access control cards are inexpensive and can double as photo ID badges. Library and cafeteria barcodes can easily be added to the cards. Some Districts issue cards to outside organizations who use school buildings after school hours. This policy allows the District to keep their doors locked all the time yet still allow the community to use school facilities, during certain designated times.

Access control systems connected to the duress alarm can switch the access control system to emergency procedures. Emergency procedures normally include deactivating schedules that unlock doors. In these events, some cards can remain activated, like those for first responders and administrators, while others, like student cards, can be de-activated. A delay in the deactivation of cards can give students time to run to a safe place. If the District has a central command center, that center can monitor an emergency in real time via the District's cameras, and control card activation and door locks remotely as the situation progresses. If local law enforcement also has access to the District's cameras, then they can be more prepared when arriving at a campus when they have been requested. Such a capability increases the speed of locking down doors, alerts appropriate response personnel and reduces the need for staff to physically lock down main access doors.

PARAMETRIC COST MODELING

As noted above, the work group agreed that the most appropriate way to determine rough order of magnitude costs for access control needs would be by campus type as elementary, middle and high schools which could also correspond to small, medium and large campuses.

The inability to assess campuses led the group to reflect upon past historical costs in design projects and bond plans for typical size schools and complexities. Similar to security camera design considerations, the group assigned several access points to each category. The numbers assigned for the Elementary, Middle and High School categories are shown in the previous table. It would be prudent to note that some fraction of state-wide campuses does not need any improvement in this area.

The low-end unit cost per campus assumes that the school campus has functional head end equipment with acceptable capabilities and expansion capacity. The high-end unit cost assumes the additional cost of replacing the head end equipment to provide for the desired capabilities or the needed expansion of access control points.

Cost are indicated assuming only exterior doors are to receive the system. Many schools are attempting to provide all classroom doors with access control systems. Implementing access control with this approach would increase the cost of this concept significantly.

Work group participants experiences and histories with school districts throughout the state generated the unit costs and the affected campus percentages. The product of affected campuses and unit costs generated a state-wide need of between $316 to 488 million.

This page left intentionally blank

to support duplex printing

CONCEPT 6 Exterior Lighting

OVERVIEW

For both safety and security reasons, districts should consider requirements for lighting their facilities after dark in areas to include exterior doors, drives, drop off zones, parking areas, ahtletic areas, building perimeters, and canopies from buildings to parking areas and between buildings. Building perimeter lighting is generally not specific on the level of required illumination and should be determined based upon campus location and sense of need. The exterior lighting assists to reinforce natural surveillance, accentuate points of entry, make pedestrian pathways safer and provide other safety and security considerations.

There are two general schools of thought regarding after-hours lighting of school campuses. One thought is to have a minimum level of consistant illumination to facilitate natural surveillance and act as a deterrent to persons due to the visibility. The other thought, “dark campus”, is supported by some policing entities since it allows rapid recognition of an illumination source that does not belong. Districts should make their own decision with regards to which approach they feel best meets their local needs. Hybrid solutions can also be implemtened with modern lighting systems and controllers such as dimmable LED fixtures, motion detection and other interactive control strategies. Districts must also be cognizant of jurisdictional energy and light pollution codes and ordinances.

Districts should give consideration on a campus-by-campus basis whether to provide a well lit or a dark campus strategy for after hours lighting and campus security. Another viable security strategy to consider is the use of using motion detectors when the facility is not occupied to startle or alarm persons that are not supposed to be around the schools after dark, but also would save energy as they would remain off most of the time.

Districts should assess after-hours lighting at school campuses, primarily in the “building perimeter” requirement to determine if there are any areas lacking at least minimal coverage to deter negative behavior and consider supplementing these dark hiding places with additional building wall pack lighting.

Alternately, Districts might investigate control strategies that use time clocks, dimmable lighting systems and motion sensors. For example, exterior lighting could operate continuously in a timed or photocell operated "dusk to dawn" model if equipped with proper control equipment. Within the timeframe from dusk to midnight districts could operate all lighting at 100% levels. At midnight the system could reduce lighting levels in parking areas and other specific zones to 30% while maintaining light at the main entry at a different percentage, for example 50%. Beginning at 6:00am or when personnel normally begin to arrive the lighting system could be raised to 100% until the system turns off at dawn.

WORK DESCRIPTION

School facilities that need to increase lighting levels can accomplish the goal through the installation of building wall packs and pole lights in parking areas and walkway areas. Since resources are limited, the implementation of lighting under this scope will need to be done under a prioritized basis for both the parking lot pole lighting and building wall packs. It is preferable to meet industry norms at a limited number of specific areas of priority versus evenly distributing inadequate lighting throughout a campus.

For example, if there are insufficient resources in the district's budget to fully light a parking lot to the level indicated in the standards, it is preferable to meet the standard on an area of the parking lot(s) closest to building entrances that might be used after dark. Building wall packs should be placed in areas where after hours activities might occur such as gym or main entrances and "hidden" or dark areas where illegal or undesirable activities would more likely occur.

Designers should consider the location and condition for the lighting to optimize its installation and coverage. Areas where pathways need lighting and facial recognition are desirable should consider the mounting height of the fixture. Building wall pack fixtures are generally the most economical, but in some cases, canopy mounted or even pole mounted fixtures may be best to accomplish the intent for lighting around and adjacent to the buildings.

Building lighting and parking lighting have been categorized based upon need into three categories, low, medium and high scopes as described below:

Scope	Building Lighting	Parking Lot Lighting
Low	Provide approximately four (4) new wall or canopy mounted fixtures.	Provide approximately two (2) light standards with appropriate luminaires.
Moderate	Provide approximately eight (8) new wall or canopy mounted fixtures.	Provide approximately four (4) light standards with appropriate luminaires.
High	Provide approximately sixteen (16) new wall or canopy mounted fixtures.	Provide approximately eight (8) light standards with appropriate luminaires.

Districts are encouraged to provide as much lighting in as many appropriate locations as possible within the budget limitations of the project.

PARAMETRIC COST MODELING

Work Group members estimated the needs of the districts they work with in the 3 categories described above to determine a total state-wide cost need for full implementation to be between $90 to 120 million.

Unit costs were based upon a range of cost from simple to more complicated installation effort and the number of additional fixtures described in the table above.

This page left intentionally blank

to support duplex printing

CONCEPT 7

Perimeter Fencing

OVERVIEW

Fencing more formally announces the restricted, private space of the campus and reduces pedestrian traffic from crossing the campus without authorization. Many school campuses also use fencing in strategic locations to separate pedestrians from bus and auto traffic to "prevent" pedestrians and cyclists from entering inappropriate areas or to "funnel" pedestrians to appropriate entries to the school or campus.

Fencing can also be used as a campus perimeter barrier to delay entry, acting as a first line of defense in a "layers of security" strategy.

WORK DESCRIPTION

Campuses that elect to include perimeter fencing as a hardening strategy should include a minimum of a 4-foot chain link fencing, gates and/or vestibules. Chain link fencing should be specified with knuckled selvages on the fabric in lieu of twisted to prevent puncture and cutting injuries and reduce school liability. The type of fabric should be coordinated with project requirements and district expectations. Fabric with heavier zinc or aluminum coating or polyvinyl chloride (PVC) coatings may be desired in some locations due to climate of more corrosive environments for durability/longevity and/or aesthetic purposes. It is often found on campuses as a wayfinding aid or to separate pedestrians from bus or auto traffic or to prevent pedestrians and cyclists from entering inappropriate areas.

For an upgraded level of security, campuses could employ six-foot or even eight-foot fencing for campus perimeters. For additional security against unauthorized intrusion, particularly into the "back of the house", more private play yards and play grounds, consider replacing chain link fencing with one of the following:

Eight-foot Ornamental Fencing: One option for increasing the perimeter intrusion delay is a system known as rake-able ornamental fencing. This type of fencing is more difficult to scale quickly as it offers little or no foothold in the fence face profile but simultaneously does not look institutional nor create a hazard by presenting spikes or outrigger.

This fencing can create a very aesthetic perimeter while yielding a more resistant system. We would suggest installation of eight-foot tall perimeter fencing to further increase the perimeter security and reinforce the leading practices recommendation of "single point of entry" control concept.

This type of fencing panel can easily adapt to sloping terrain applications by being hinged in its construction, also known as articulating or self-raking.

Eight-foot Anti-climb Fencing:

Another option for increasing the difficulty of quickly overcoming the perimeter line of security is a fencing type known as anti-climb. These fences are designed to be very difficult to obtain any footing or hand hold, making them difficult to scale. This type of fencing is made of powder coated welded wire fabric.

PARAMETRIC COST MODELING

The costs presented for fencing are calculated parametrically using the following guidelines. Elementary schools are assumed to have fencing applied full perimeter on a 10-acre site with a 25% upscale for offsets, insets, secondary fences, gates and other special features. Middle schools and high schools are calculated based upon 20-acre and 40-acre sites respectively.

These calculations are again subsequently applied to the approximate percentage of each type of campus where improvements would be required.

Low unit costs represent minimal, four-foot chain link fencing while the high unit cost represents the eight-foot ornamental or anti-climb fencing type upgrade. The reality is more likely to be a combination of fencing types due to a variability in threat, location on the campus, or aesthetics and may be a mixture of chain link fencing and these other types.

The estimated cost for fencing requirements applied throughout all public-school campuses throughout the state is between $ 500 million and almost $ 1.7 billion.

This page left intentionally blank

to support duplex printing

CONCEPT 8

Door Numbering

OVERVIEW

Campuses should have clearly numbered doors, both interior and exterior, for use not only in wayfinding by campus and building occupants but also for clear coordination and communication by emergency response teams. When emergencies occur, the rapid response of emergency workers to the incident can be critical. Many schools have dozens of doors providing entrance and egress to their buildings. During an emergency it may be necessary for responders to gain access through the door closest to the emergency scene. Numbering external doors can be extremely valuable to emergency responders and will also assist students and staff in acclimating themselves to door locations in case of an emergency.

In the Work group's experience, many campus exterior doors are not clearly and sequentially numbered. This could lead to misidentification and possible incorrect emergency response in a crisis response situation.

Interior doors in most districts are generally numbered but labels may be found above the door, beside the door strike or with "homemade" numbers or names that can be ambiguous and lead to confusion. Fire escape maps need to accurately reflect current room numbers.

Consideration should be given to having teacher names removed from doors as identification to prevent "targeting" of staff members by persons intent on causing them harm or simplifying access to a student in a kidnapping situation.

WORK DESCRIPTION

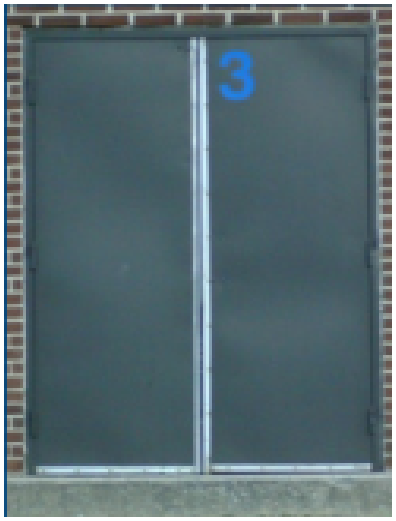
Exterior doors should be numbered in a manner that makes intuitive, logical sense. The main entrance should always be #1 for every school and numbering should proceed clockwise around the school from #1. Consider the use of alphabetical prefix in multiple building campuses, beginning with M or A for the main building (visitor check-in location) in conjunction with sequential numbers or simply sequential numbers as appropriate. Portables, modular buildings and temporaries should use "P", "M" or "T" as a prefix to their sequential numbering.

Exterior door numbering should be distinguishable from the nearest street or other vehicle pathway in view of the door. Numbers should be Arabic in clearly legible, high contrast reflective font and materials. Glass doors typically work best with white numbering.

Consideration should be given to architectural compatibility and building aesthetics. Exterior numbering should be permanently attached to or incorporated into the building exterior and located on, adjacent to or above the door. In multiple door assemblies, each door leaf need not

be labelled separately, only the opening itself. Exterior doors should also be labeled from the interior side to match the exterior number.

The Center for Safe Schools has published a well written Model Door Numbering System for exterior doors. See https://www.safeschools.info/



Exterior Door Numbering Examples

Interior doors should be numbered in accordance with any clear, unambiguous system. It is likely that doors are already numbered in most of the district facilities. The effort should involve replacing missing numbers, reconciling doors that have more than one number associated with them, etc., but could include a complete re-numbering of the facility doors.

PARAMETRIC COST MODELING

Like the other concepts, the cost is presented in a range of unit costs from minimal to an upgraded solution and is calculated based upon Work Group experience and estimated number of campuses that need this improvement.

Estimated effort to properly number door is approximately $45 to 90 million on a statewide consideration.

CONCEPT 9

Key Control

OVERVIEW

All building main entries should continue to be fitted with a Knox box or equivalent key and floor plan vault at the main entrance to the building or the front door.

Key control is a serious concern for school Districts, particularly large ones, as the cost to re-key if a grand master is lost or falls into the wrong hands can be overwhelming. Knox has developed new technology that replaces the locking core in existing boxes and vaults with an electronic key fob that allows logging of box operation, allowing Districts to know who opened the box and last had possession of the grand master key. These keys are kept on a charging station dock that has data access wherein the key's unique PIN code authorization can be updated, credentials changed, etc. from the master control station at any time. A complete audit trail of fob usage is kept by the master control system as well.

Districts may want to investigate the Knox eLock System or continue to monitor the advancement of key control systems.

WORK DESCRIPTION

Installation should include adding key control boxes at the main entries of all school campuses that do not currently have them. These key control lockers should contain one of multiple copies of the facility's master key and a simple, concise floor plan for first responder use and coordination.

PARAMETRIC COST MODELING

Campuses that needed key control boxes were estimated as a percentage of the state's total campus inventory to determine number of boxes needed. The range of costs are for simplest minimal size box installation to either a larger box, retrofitting of g cores or other enhancement.

Cost range for the state to fully implement this concept is estimated to be between $ 5 and 7 million.

CONCEPT 10 Duress Alarms

OVERVIEW

Duress alarms or "panic" buttons allow audible or silent communication with emergency responders. Buttons can be tied into access control systems and can initiate audio or silent mass notification announcements. These alarm buttons can reduce first responder time in the event of a campus emergency.

WORK DESCRIPTION

Provide hidden duress alarms or "panic" buttons at the reception area and one additional location within the administration suite, such as the principal or assistant principals office, for redundancy. Provide a third button in the receiving/kitchen area of the school.

Buttons should be installed in a "hidden" place and protected with a cover or an extended rim to prevent accidental activation by bumping the button.

Although wireless systems are made, the preference is for these to be hard-wired. The system does not need to be addressable or notify responders which button in the facility was pressed, only what campus is requesting response. System should tie into the existing fire alarm annunciator panel if capability exists or should have an independent controller and external phone line or other reporting connection.

Upon activation, the system should send a signal to the district police, local 911 dispatch system and /or other first responders as determined by the District and if the facility has them, release all magnetic hold-opens to create a lock down condition and lock down exterior doors with access control hardware.

PARAMETRIC COST MODELING

With cost data collected from recent construction work and the Work Group experience, the team estimates what fraction of the 8,700+ campuses in the state of Texas need to be upgraded with duress alarm buttons.

Estimated need for this concept is between $25 to 45 million.

Texas Society of Architects

TxA School Safety/Security Work Group
Security Concepts Rough Cost Opinion Model

8701	TX Statewide campuses (estimated) [1]
1,011,933,000	TX Total Square Footage (estimated) [2]
5,440,500	TX total students (SY18-19 estimated) 3

Student Demographics [4]			Campus Estimations [5]			
% of total students enrolled grades PK-5	49.00%	2,665,845 students	504	avg. enrollment/campus	yields	5287 campuses
% of total students enrolled grades 6-8	22.25%	1,210,511 students	710	avg. enrollment/campus	yields	1705 campuses
% of total students enrolled grades 9-12	28.75%	1,564,144 students	915	avg. enrollment/campus	yields	1709 campuses

Recommended Concepts	Estimated Unit Cost [6] Low-End	High-End	Estimated % of state Campuses Affected [7]	# of state Campuses Affected [8]	Estimated Doors per Campus or total [9]	Estimated Access Points per Campus [10]	Subtotal Cost ($ Millions) Low-end	High-end
1 Secure Vestibules								
1a Simple Complexity	$ 100,000	$ 150,000	11%	957			$ 95.7	$ 143.6
1b Moderate Complexity	$ 250,000	$ 375,000	26%	2262			$ 565.5	$ 848.3
1c Difficult Complexity	$ 625,000	$ 937,500	32%	2784			$ 1,740.0	$ 2,610.0
1d Already in Place			29%	2502			$ -	$ -
2 PA Systems								
2a Elementary Schools	$ 73,000	$ 84,500	49%	2591			$ 189.1	$ 218.9
2b Middle Schools	$ 86,000	$ 104,000	48%	818			$ 70.3	$ 85.1
2c High Schools	$ 101,000	$ 126,500	52%	889			$ 89.8	$ 112.5
3 "Lock-down" Security								
3a Elementary Schools	$ 800	$ 2,400	50%	2643	30 doors		$ 63.4	$ 190.3
3b Middle Schools	$ 800	$ 2,400	53%	904	48 doors		$ 34.7	$ 104.1
3c High Schools	$ 800	$ 2,400	57%	974	74 doors		$ 57.7	$ 173.0
4 Surveillance Camera Systems								
4a Low Need	$ 18,000	$ 43,000	20%	1769			$ 31.8	$ 76.1
4b Moderate Need	$ 36,000	$ 61,000	36%	3132			$ 112.8	$ 191.1
4c Complex Need	$ 72,000	$ 97,000	19%	1653			$ 119.0	$ 160.3
4d No requirements			25%	2146			$ -	$ -
5 Access Control Systems								
5a Elementary Schools	$ 42,500	$ 70,000	76%	4000		5 points	$ 170.0	$ 280.0
5b Middle Schools	$ 60,000	$ 90,000	64%	1085		10 points	$ 65.1	$ 97.7
5c High Schools	$ 95,000	$ 130,000	50%	849		20 points	$ 80.7	$ 110.4
6 Exterior Lighting								
6a Low Need	$ 15,000	$ 19,950	44%	2317			$ 34.8	$ 46.2
6b Moderate Need	$ 26,250	$ 34,913	44%	744			$ 19.5	$ 26.0
6c Complex Need	$ 45,938	$ 61,097	46%	781			$ 35.9	$ 47.7
7 Perimeter Fencing								
7a Elementary Schools (10ac)	$ 115,500	$ 385,000	36%	1903			$ 219.8	$ 732.7
7b Middle Schools (20ac)	$ 163,342	$ 544,472	49%	827			$ 135.1	$ 450.3
7c High Schools (40ac)	$ 231,000	$ 770,000	38%	641			$ 148.1	$ 493.6
8 Door Numbering								
8a Number Exterior Doors	$ 250	$ 500	56%		51,099 doors		$ 12.8	$ 25.5
8b Number Interior Doors	$ 100	$ 200	30%		324,617 doors		$ 32.5	$ 64.9
9 Key Control								
9 Key Control	$ 1,250	$ 1,750	49%	4234			$ 5.3	$ 7.4
10 Duress Alarms								
10 Duress Buttons	$ 4,500	$ 8,000	65%	5670			$ 25.5	$ 45.4

Footnotes

1 From latest TEA Facility data - 2017 (includes charters). Assumes new schools and closures/consolidations are approximately equal

2 Estimated by taking 186 square feet per student. Metrics by Monte Hunter, Parkhill, Smith & Cooper, 2017

3 Estimating by extrapolated using growth rates from latest 6 years TEA enrollment data

4 Student Enrollment Estimations from average grade range groupings in last 6 years of TEA enrollment data

5 Determined iteratively by adjusting average enrollments to balance campuses with known state totals

6 Unit costs are based upon Work Group experience, cost guides and recent construction actuals. Construction cost only, no "soft costs" included. Assumes reasonably sized project effort and could vary considerably in larger or small sized procurements

7 Percentages are based upon work group member's familiarity with the school districts they serve and their estimation of facility infrastructure and needs

8 The product of % campuses affected and the estimated number of campuses serving that grade level grouping or at the indicated level of requirement

9 Based upon a sample count of representative facility floor plans

10 Based upon a sample count of representative facility floor plans

Costs are current as of March 2019 and should be escalated to future dates. Cost do not include soft costs such as A/E fees or contingencies.