

DHS / S&T / RSD Tools for School Safety

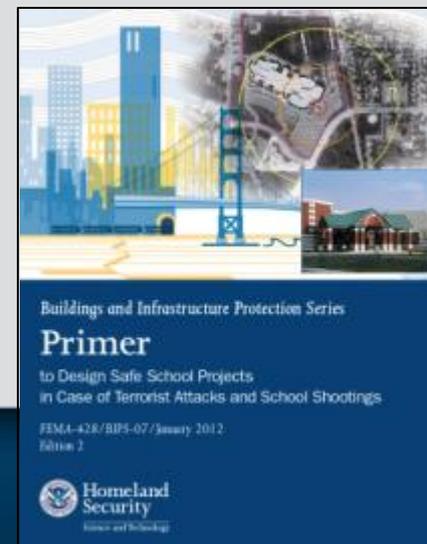
BIPS 04 and 07

Buildings and Infrastructure Protection Series

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Science and Technology
Homeland Security Advanced Research Project
Agency (HSARPA)

Hartford, Connecticut
July 15, 2013



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Schools & Safety



- U.S. building codes set **minimum** standards for life safety for **fire & natural disasters**
- Building codes do **not** address protective design for **blast loads, toxic releases or school shootings**
- Schools are not currently fulfilling essential function to protect children from hazardous events due to **lack of funding & knowledge on how to reduce vulnerabilities**



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Schools & Safety

Key Elements in School Design

High Performance

Promotes the use of standards beyond life safety in the public and private sector. This means that after a disaster event, the school will continue to provide basic functions even under limiting circumstances.

(Based on Public Law: U.S. Energy Independence and Security Act [EISA] of 2007)

Resilience

Promotes infrastructure resilience, the capacity that may be created in schools to resist disaster events and continue operating in the aftermath of disruptive events.

(Presidential Proclamation on Critical Infrastructure Protection – December 2010)

An All Hazard Approach

Determines, promotes, and disseminates mitigation and protective measures against all hazards: explosive blast, shootings, CBR, earthquakes, floods, winds, wild fires. Also considers, energy efficiency, environmental sustainability, and climate change factors.

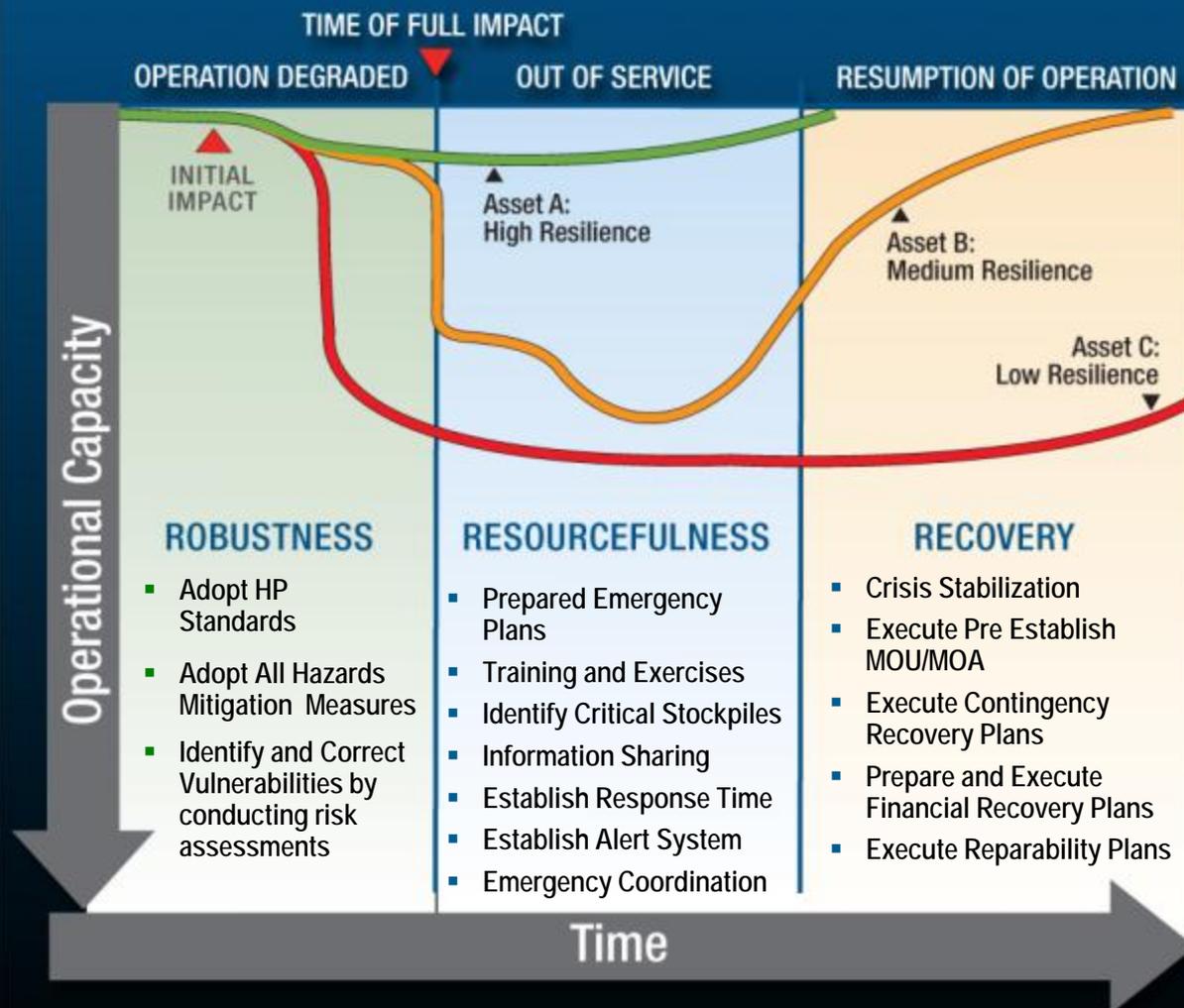
(Based on Title V., Section 504, Authority and Responsibilities [6 U.S.C. 314], of the Stafford Act)

Resilience

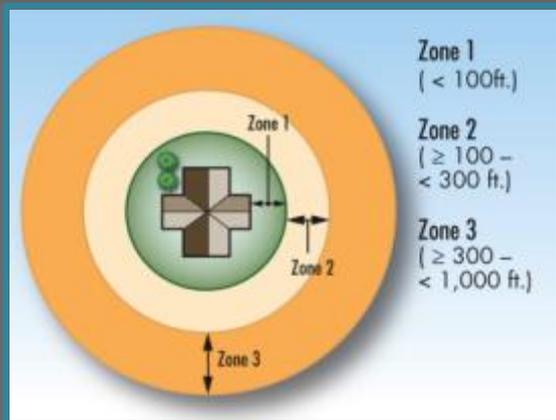
Resiliency and Risk Continuum

Infrastructure resilience is the ability to reduce the effects of the magnitude and duration of disruptive events on the physical environment

The main objective is to reduce loss of lives, economic damage, and the loss of functionality or services as a result of catastrophic events



School Risk



Man Made		
Threat Type	Threat Scenario	Location
<ul style="list-style-type: none"> Internal Attacks External Attacks 	<ul style="list-style-type: none"> School Shootings Explosive Blast CBR Releases 	<ul style="list-style-type: none"> In the School In Zone I In Zone II In Zone III
Natural Disasters		
Natural Hazard Type	Event Scenario	Critical Components
<ul style="list-style-type: none"> Earthquakes Flooding Wind Landslide Fire (resulting from EQ, Floods & Winds) Snow Storms and Ice Events 	<ul style="list-style-type: none"> Ground Shaking Ground Failure Stillwater Storm Surge Hurricane Tornado Extreme Rain & Lightning Wildfires Sea Level Rise 	<ul style="list-style-type: none"> Site Architectural Structural Mechanical Electrical Fire Protection Operations Equipment Physical Security

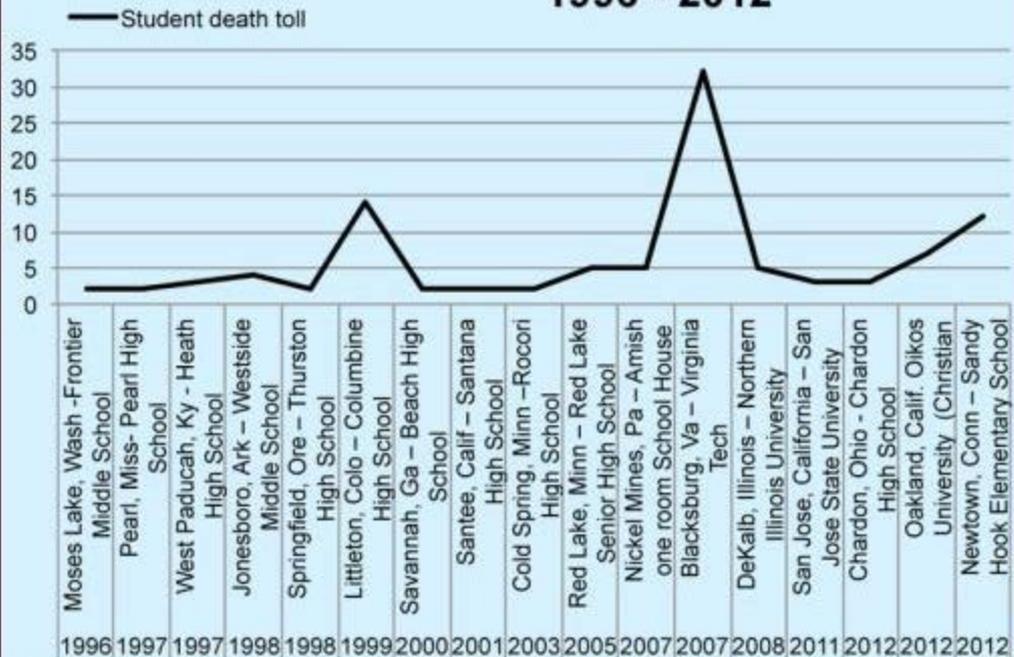


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School Risk

**Student Death Toll (more than 2)
1996 - 2012**



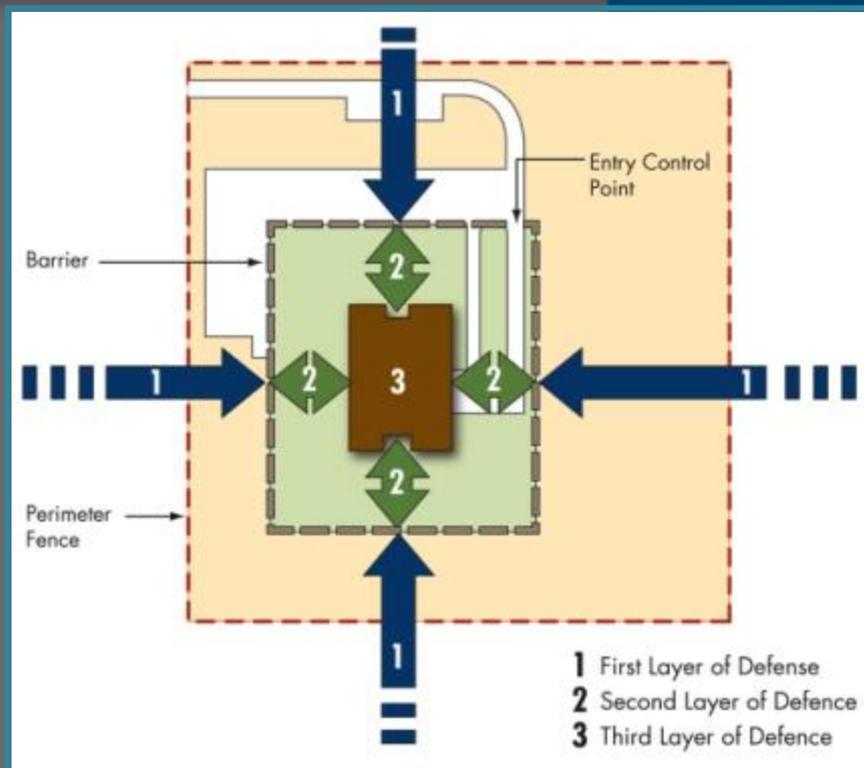
- Between 1989 & 2009, 41 shootings occurred resulting in 75 dead and 154 injured
- In 2003-2004 the number of firearm incidents & explosive possessions was 7,478 in 4,875 schools
- The number of incidents involving a knife or sharp object was 30,193



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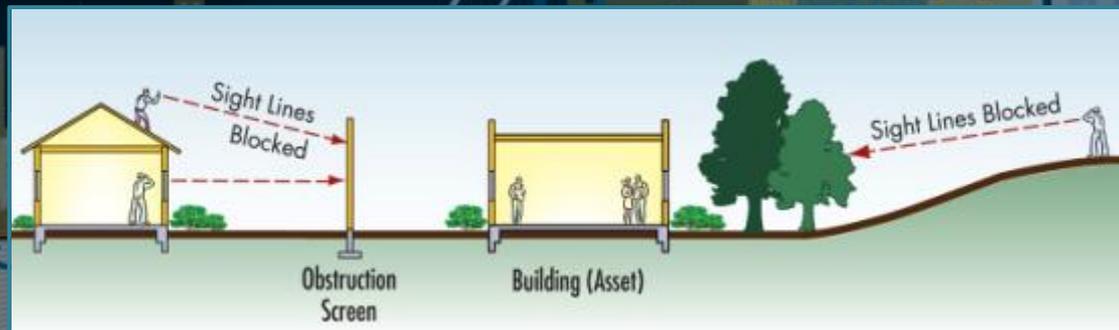
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School Risk



Active Shooter

- Single Shooter
- Team of Shooters
- Snipers
- Elevated Position
- Ground Position
- Hostage Taking
- Individual Hostages
- Multiple Hostages



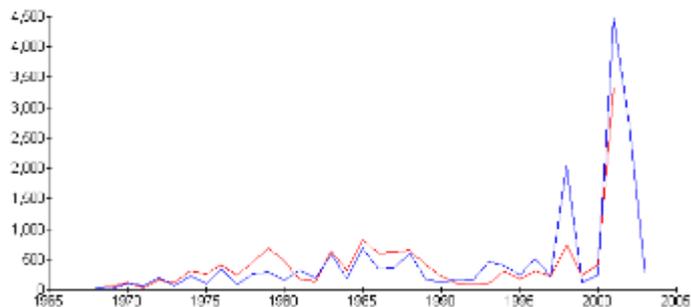
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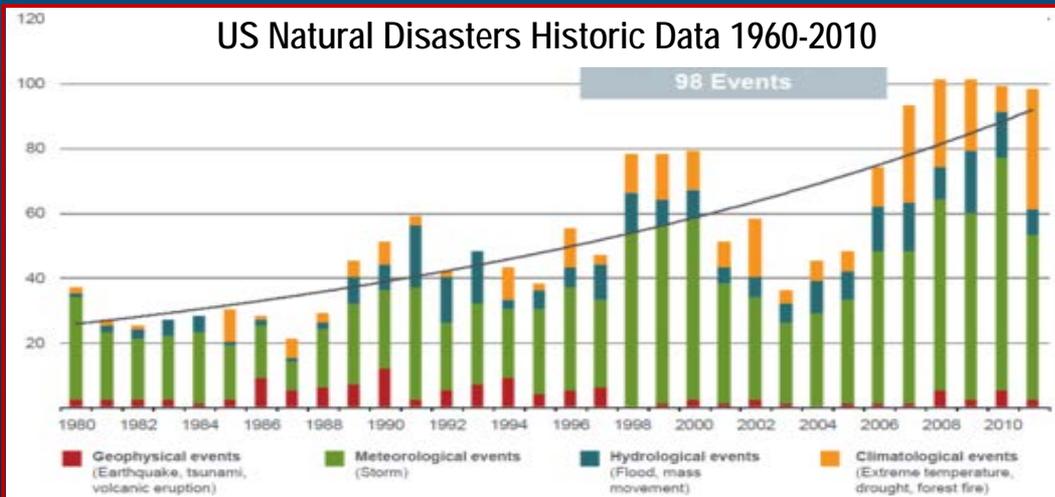
School Risk

- Over 300 students and teachers died in Beslan (Southwest Russia) as a result of a terrorist attack to School No. 1 (K1-K11)

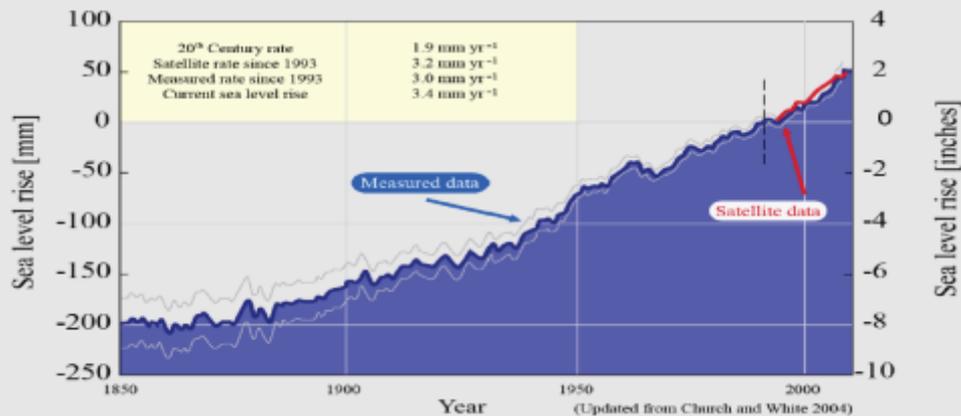
International Terrorism Fatalities
1965 - 2006



US Natural Disasters Historic Data 1960-2010



Sea Level Rise in the 20th Century



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General Concerns



Desirable School Design

- Provide for health, safety, & security
- Enhance teaching & learning
- Serve as the center of the community
- Allow for flexibility & adaptability to changing needs
- Protect against natural hazards
- Protect against man made hazards
- Use of daylighting & comfort control
- Design for durability & energy efficiency
- Design with a long-life/loose-fit approach: allow for internal change & flexibility
- Outcome should result from a planning/design process that involves all stakeholders.

- Protective measures could be in conflict with the objective of providing an open learning environment
- Obtaining the right balance is smart school design



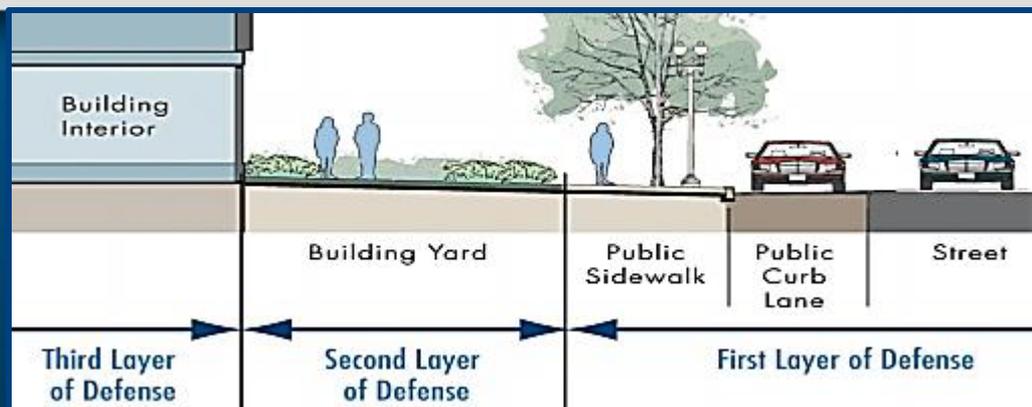
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General Concerns

Situations

- Most attacks involve children which makes response more difficult
- Although probability of attack is low, consequences are very high
- Shooting incidents evolve rapidly & may last very short time before response can arrive or effectively intervene



- Shooting & situational status can be hard to assess by first responders
 - Number of shooters
 - Position & location of shooters
 - Location of injured
- Shooter may lure students to evacuate the building to shoot large numbers at a single point
- Shooters may commit suicide by the time or when police arrives
- Most common weapons used in shootings are rifles & handguns



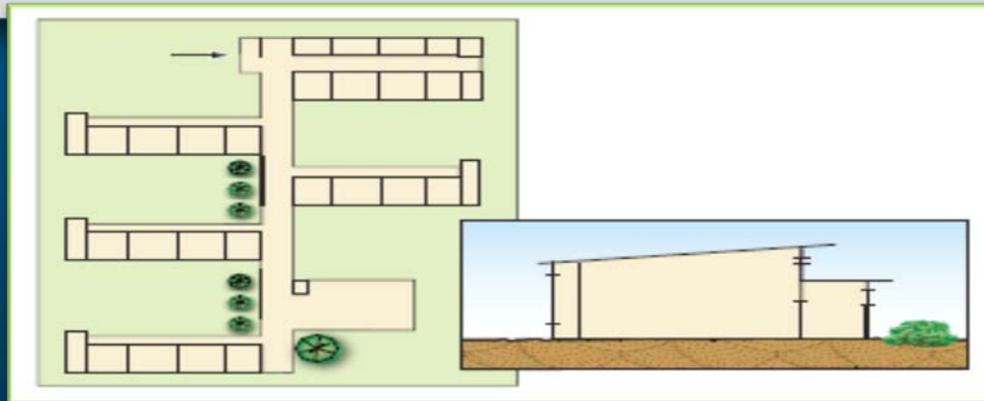
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General Concerns

Vulnerabilities

- Schools can be complex structures
- Old schools & many modern ones may not satisfy security or safety issues
- If neither the threats nor the consequences can be reduced, risk reduction & protective measures to reduce vulnerabilities must be the main focus



- Major vulnerabilities include:
 - Lack of capabilities to stop an intruder from entering & roaming
 - Unguarded grounds & multiple exit doors provide easy access for shooters
 - Lack of multiple exit doors limit escape routes
 - Poor communication among first responder units attending the site
 - Lack of places for students to hide or barricade

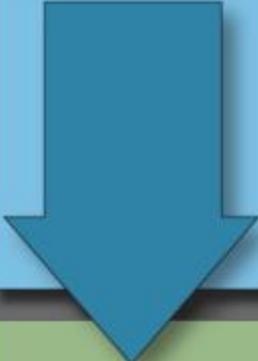


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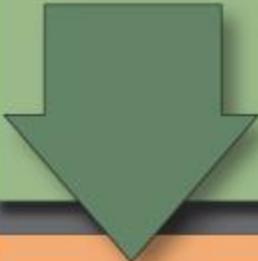
Schools & Risk Assessment

Threats & Hazards



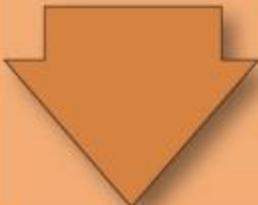
- Probability of school shootings & man-made & natural hazards
- **Schools can do very little to reduce probability of these events. In the case of school shootings US Secret Service found existing data too unreliable to create a uniform strategy**

Consequences



- Adverse effects of attacks or hazard events reflecting losses sustained as a result of such an incident.
- **Schools can reduce losses by improving preparedness & response capabilities**

Vulnerabilities



- Weaknesses of site characteristics, school functions, operations & systems that contribute to losses
- **Schools can reduce losses by adopting appropriate protection & safety improvements**

IRVS Family

IRVS Basic

Assess risk and resilience for buildings, subways, and tunnels. Fast and accurate based on built-in check list. All computational algorithms are embedded in the tool. (Completed in 2011 and is widely used. [Accessible at DHS website](#))

IRVS/ ISC

Automates all steps of the ISC Standards. Assess risk and resilience of federal and leased buildings. Module 1 has been completed and is being used by multiple agencies. Module 2 to be completed early in 2013

IRVS Cloud

To continue the development of a cloud of information tool which will include natural and man-made disasters and climate change data. Designed to establish the exposure of a particular set of assets/facilities (To be completed in 2013)

IRVS Schools

To develop a advance the IRVS version to assess schools. This version will be capable to assess all hazards and the risk of schools shootings. (To be prepared)



IRVS Overview



Facility Security Level Matrix

Factor	1	2	3	4	Score
Access Control	Low	Medium	High	Very High	3
Surveillance	Low	Medium	High	Very High	2
Facility Population	<100	100-1000	1000-10000	>10000	1
Facility Size (sq. ft.)	<100,000	100,000-500,000	500,000-1,000,000	>1,000,000	1
Threat to Target Agencies	Low	Medium	High	Very High	2
Sum of the above					9
Preliminary FSL	I (5-7 pts)	II (8-12 pts)	III (13-17 pts)	IV (18-23 pts)	2
Intangible Adjustment				(none)	
Final FSL					2

FSL: 2

Intangible Adjustment: _____
 Comment/Justification: _____
 Note: If you supply an intangible adjustment under the [Adjustment] tab, a Comment/Justification is required.

The FSL is determined above. By determining which countermeasures are applicable to the FSL, a baseline LOP is identified and listed here. If after Risk Identification and Assessment, the Baseline LOP must be customized, you may change it on this form.

Baseline LOP: 2

Comment/Justification: _____
 Note: If you customize the 'Baseline LOP' you are required to supply a comment/justification. These comments will be included in the final report.

Print Close

- **Designed to assess risk and resilience** for buildings, subways, and tunnels
- **Improves the security of a facility at a minimum cost** by allowing the selection of most critical vulnerabilities and most cost effective mitigation measures
- **The knowledge for calculations is embedded in the tool.** Calculations are:
 - **Rapid** – It takes around 2 to 3 hours to assess a buildings
 - **Accurate** – results are very reliable and verifiable
 - **Analytical** – It illustrates the degree of interactions among hazards and provide scores for resilience
- **Assessments can be conducted** by law enforcement personnel, federal and city government staff, members of the FPS and GSA staff and private sector members

IRVS Commendations & User

From: Friedland, Jeff [<mailto:JFriedland@stclaircounty.org>]
Sent: Thursday, December 06, 2012 9:58 AM
To: Kennett, Mila
Cc: Flynn, William; Serino, Richard; Thomas Sands (SandsT@michigan.gov)
Subject: Follow up

Ms. Kennett,

I would like to provide you a follow up to the Integrated Rapid Visual Screening (IRVS) training that we received in late September. First and foremost, the Ipad application has been extremely beneficial to our team members. During October and November, the team was able to conduct twenty-two (22) assessments averaging 2.75 hours per assessment. The technology has enabled us to save 16 man hours per assessment (352 total so far). Furthermore, IRVS allows us to now address all hazard sand resiliency in our assessment process which we are finding as simplifying data for the new THIRA requirement

We did work with Mr. Ryan for a tool that would assist us in presenting our findings to each facility. One recommendation would be to develop a video that covers each section of the report and how to present the findings.

I cannot tell you enough how much our team enjoys this tool and the benefits that it provides not to mention the cost savings in a tough economy. I have included the IRVS project in a "whole community" paper that I utilize in my travels. IRVS has made a tremendous difference in our program in two short months! I will provide an additional update in March 2013.

THANK YOU SO MUCH for assisting our program.

Jeff Friedland

Jeffrey A. Friedland
 HSEM Director
 St. Clair County
 200 Grand River
 Port Huron, MI. 48060
 810 989-6965

Current Users of the IRVS/ISC (released 10/12)

U.S. DHS S&T Security

U.S. DHS Immigration and Customs Enforcement

U.S. DHS Federal Protective Service Division National Protection and Program Management Directorate

U.S. Department of Homeland Security — Infrastructure Protection Division

U.S. DoD Force Protection Agency

U.S. DoD Defense Threat Reduction Agency

U.S. Bureau of Engraving and Printing

Smithsonian Institutions

U.S. Department of Interior - Bureau of Indian Affairs

U.S. National Archives and Records Administration

U.S. General Services Administration

U.S. Courts

U.S. Department of Justice

U. S. Department of Health and Human Services

U.S. HHS Centers for Medicare & Medicaid Services

Arlington County, Virginia

IRVS FOR COMMERCIAL BUILDINGS

IRVS FOR FEDERAL BUILDINGS

IRVS Risk & Resilience Dashboard

Risk and Resiliency Summary

RVS Building/Facility:

Facility ID#:

Assessment Date:

Site Type:

Scales Scores and Color Mapping

Risk Color Scale	0-30	30-50	50-70	70-100
Resiliency Color Scale	100-70	70-50	50-30	30-0

Summary Categories	Internal Intrusion	Internal Explosive	Internal CBR	Explosive Zone 1	Explosive Zone 2	Explosive Zone 3	CBR Zone 1	CBR Zone 2	CBR Zone 3
Total Consequences (%)	66.83%	59.61%	57.91%	61.97%	59.33%	69.13%	57.41%	61.75%	65.10%
Total Threat (%)	27.18%	66.34%	62.83%	85.34%	58.67%	49.69%	84.00%	71.16%	53.30%
Total Vulnerabilities (%)	8.92%	61.04%	61.62%	56.01%	57.28%	57.10%	57.42%	56.99%	60.93%
Total Risk Percent (%)	25.30%	62.26%	60.75%	66.66%	58.42%	58.10%	65.18%	63.03%	59.57%

Summary Categories	Earthquake General Shaking	Earthquake Ground Failure	Flood Stillwater	Flood Velocity Surge	Wind Hurricane	Wind Tornado	Wind Other	Landslide Rainfall	Fire From Earthquake	Fire From Blast	Fire From Arson
Total Consequences (%)	61.31%	59.45%	61.04%	59.50%	61.30%	61.97%	61.33%	61.47%	61.15%	63.67%	62.90%
Total Threat (%)	0.00%	0.00%	77.76%	78.22%	54.31%	48.44%	52.10%	62.05%	0.00%	67.89%	29.80%
Total Vulnerabilities (%)	30.30%	35.30%	35.34%	41.30%	42.99%	38.99%	39.50%	33.16%	2.04%	3.19%	3.12%
Total Risk Percent (%)	0.00%	0.00%	55.15%	57.71%	52.31%	48.92%	50.16%	50.19%	0.00%	23.97%	18.02%

Resiliency Scales (%)

Performance Measure	Time Measure	Robustness Measure	Resourcefulness Measure	Recovery Measure
48.6%	47.3%	43.4%	48.6%	49.3%

Total Risk All Scenarios (%)	Resiliency (%)
60.88%	23%

Multihazards Interaction Matrix

... will result in this change for other hazards:

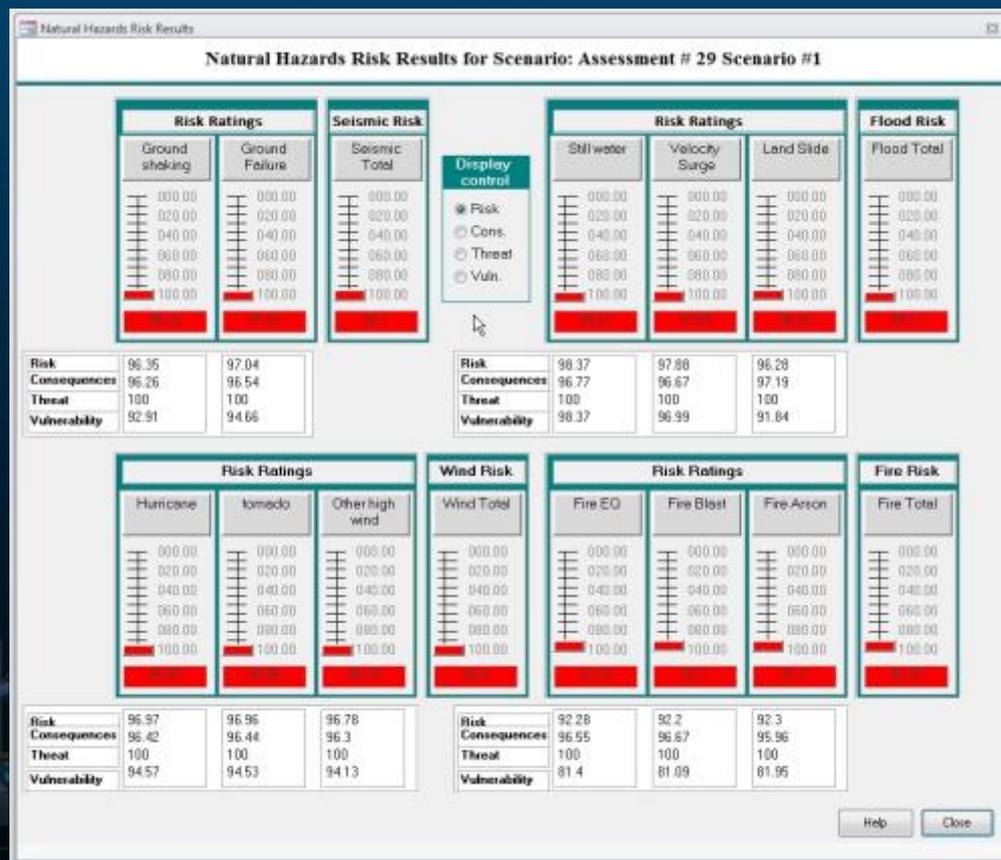
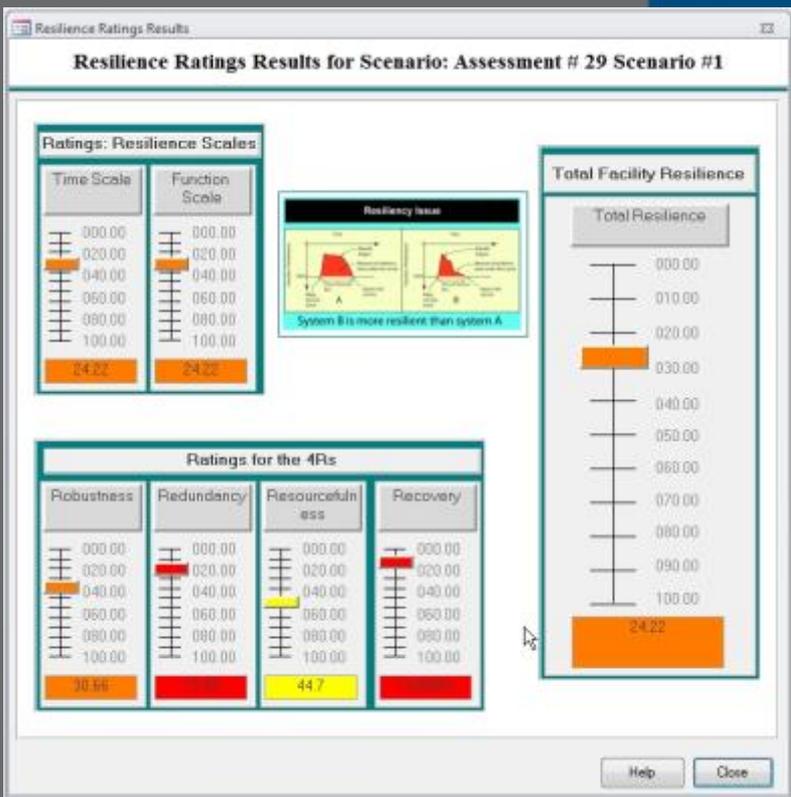
a change in:	Blast	CBR	Seismic	Flood	Wind	Fire
a change in Blast	100.0%	9.3%	33.0%	9.7%	47.5%	22.6%
a change in CBR	12.7%	100.0%	0.0%	16.8%	1.2%	5.2%
a change in Seismic	55.5%	0.0%	100.0%	35.9%	50.7%	16.3%
a change in Flood	7.5%	9.6%	16.7%	100.0%	8.8%	10.2%
a change in Wind	68.2%	1.3%	43.3%	16.3%	100.0%	16.1%
a change in Fire	83.2%	14.1%	35.7%	48.4%	41.5%	100.0%

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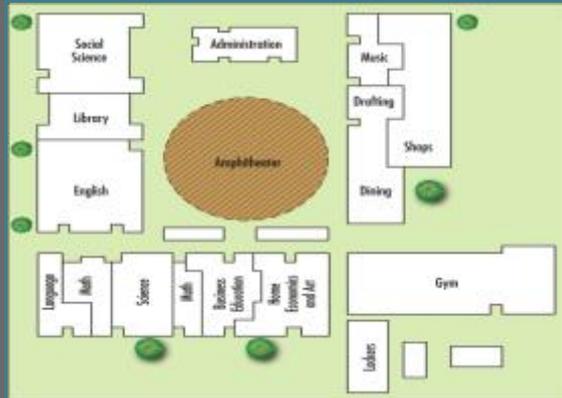
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IRVS Risk & Resilience Dashboard



BIPS 07



- Risk assessment can be a tool to identify **major vulnerabilities** & initiate **major school improvements**
- School vulnerabilities should be assessed on an **individual basis** & utilize particular circumstances
- Risk assessments should be prepared using an all hazard approach including school shootings, natural & man made hazards
- **DHS/S&T/RSD** has developed a **comprehensive checklist** that can be used to conduct risk assessments for schools (See Appendix F of BIPS 07)

School Building Vulnerability Assessment Checklist



The School Buildings Vulnerability Assessment Checklist is based on the checklist developed by the National Clearinghouse for Educational Facilities that combines the nation's best school facility assessment measures into one list for assessing the safety and security of school buildings and grounds. It covers school surroundings, school grounds, buildings and facilities, communication systems, building access, control and surveillance, utility systems, mechanical systems, and emergency power.

It allows a consistent security evaluation of designs at various levels. The checklist can be used as a screening tool for preliminary design vulnerability assessment. In addition to examining design issues that affect vulnerability, the checklist includes questions that determine if critical systems continue to function in order to enhance deterrence, detection, denial, and damage limitation, and to ensure that emergency systems function during a threat or hazard situation.

The checklist is organized into the 6 sections listed below. To conduct a vulnerability assessment of a building or preliminary design, each section of the checklist should be assigned to an engineer.



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BIPS 07

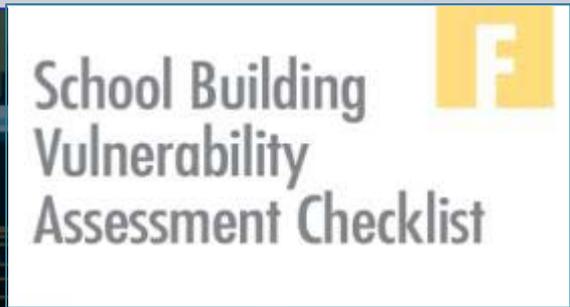
Section 3 Building Access Control and Surveillance Vulnerability		
Section	Vulnerability Questions	Guidance
3.17	Are window hardware and frames in good condition, and are transom windows or other window configurations that have clear security weaknesses either permanently closed (provided they are not to be used as a means of emergency egress. or reinforced with slide bolts or other security devices?	If windows are not in good condition and are clearly a security weakness, measures should be taken to secure the window.
3.18	Are windows located strategically, providing natural light and natural surveillance, while providing sufficient stand-off distance and the means to deter vandalism and forced entry?	Glass replacement is the highest routine maintenance cost for some schools. Consider incorporating skylights (but only if roofs are fully protected from climbers), solar light tubes, clerestory windows, and light shelves in lieu of normal-height windows in exposed or vulnerable locations. Some school districts prohibit skylights because they are considered impossible to protect from climbers. Clerestory windows allow for ventilation, light, and privacy while minimizing wall penetrations, but do not allow for natural surveillance. California suggests that ground floor windows be eliminated where possible on the building perimeter, but this must be weighed against the need for natural light and ventilation in occupied areas and the loss of visual surveillance of school grounds.
3.19	Are windows designed to serve as a secondary means of escape blocked by screens, security grills, louvers, awnings, or other devices, and are they readily opened from the inside?	In Florida, security grills or louvers may be used if they open in one operation with the secondary means of egress.

1. Adapting the IRVS to Schools

Recommendation

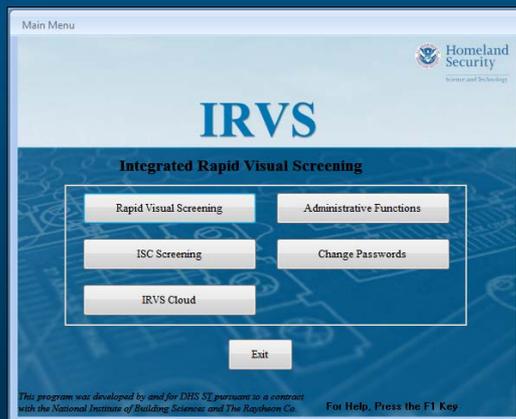
IRVS Threats
Internal Intrusion
Internal Explosives
External Explosives
Internal CBR
External CBR
EQ Ground Shaking
EQ Ground Failure
Flood Still Water
Flood Velocity Surge
Wind Hurricane
Rainfall Hurricane
Landslide Rainfall
Fire from EQ
Fire from Blast
Fire from Arson

Example of Threats be Added to the IRVS for Schools
High Speed Traffic in Vicinity
School Bullying/Abuse
School Drug Use/Abuse
Ballistic Attack Internal- Single Shooter
Ballistic Attack External- Single Shooter
Ballistic Attack Internal- Several Shooters
Ballistic Attack External- Several Shooters
Sea Level Rise
Others +



2. Preparing a Course Based on IRVS & BIPS 07

Recommendation

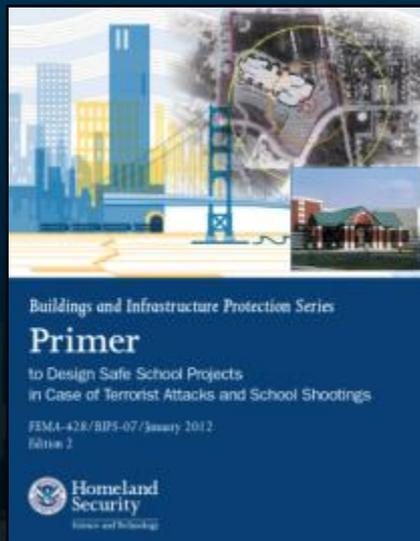


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Recommendations
from Sandy Hook
School Design
Process

IRVS Software,
Manual, and Course
for School Safety
Design and
Assessments Studies



Benefits of this Approach



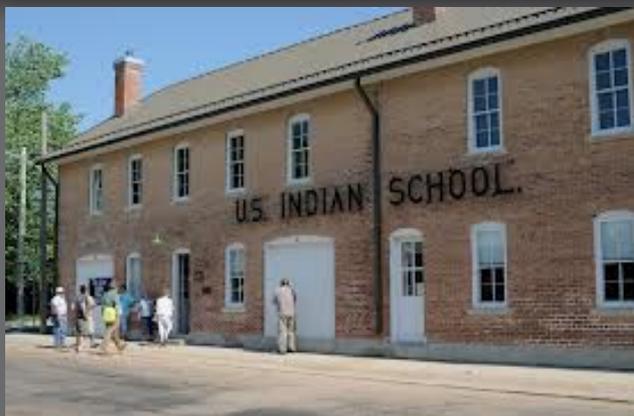
- Show how-to aspects on how to save lives of students & teachers
- Understand effective design methods & accurately determine threat, vulnerability & risk
- Learn how to minimize impacts resulting from all hazards
 - Save time & money by using existing IRVS and BIPS 07 technology
- Standardize design & evaluations & manage long term programs
- Improve safety & security of schools by prioritizing required improvement actions



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Example IRVS & BIPS 07 Users



- The Bureau of Indian Affairs is using the IRVS (ISC version) & BIPS 07 as check list to assess over 100 colleges & school buildings. Assessments include 2 Federally funded colleges, 8 large dormitory style-high schools & 10 office buildings
- The Office Emergency Management in Katy, Texas is using the tool to assess 60 school each one with between 650 and 4,400 students

Methodology:

- IRVS is conducted & reviewed with the facility manager
- The check list is reviewed with school coordinators & staff

Benefits/Results:

- Good results: well organized process and actionable results



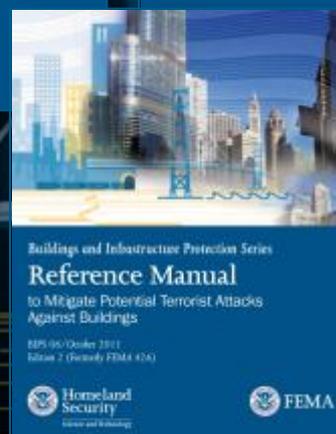
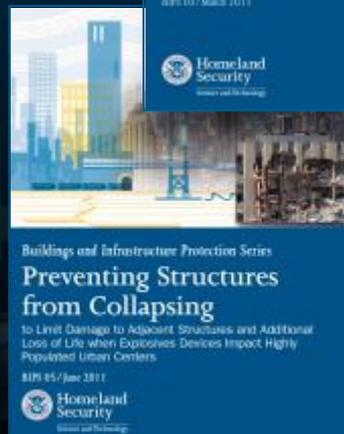
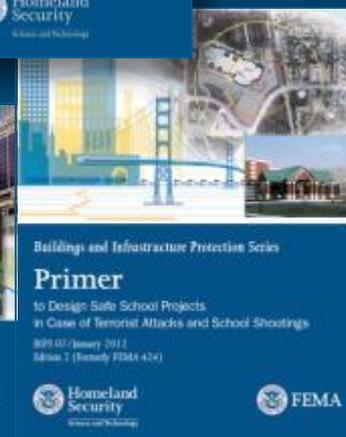
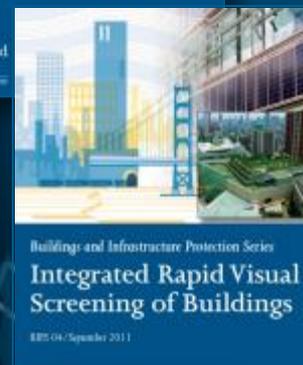
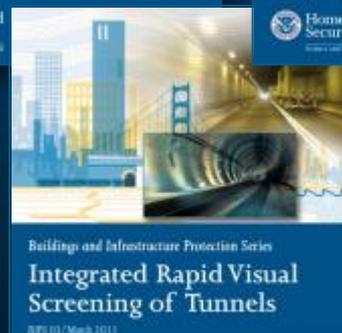
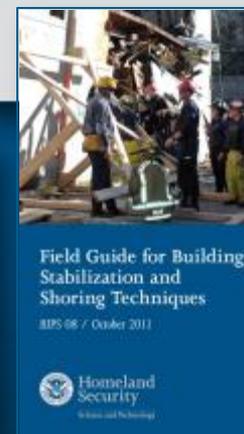
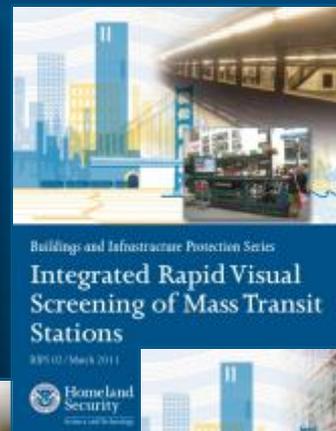
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BIPS Publications 2008-2012

Publications

- **BIPS 01** - Aging Infrastructure: Issues, Research, and Technology
- **BIPS 02** - Integrated Rapid Visual Screening Series (IRVS) for Mass Transit Stations
- **BIPS 03** - Integrated Rapid Visual Screening Series (IRVS) for Tunnels
- **BIPS 04** - Integrated Rapid Visual Screening Series (IRVS) for Buildings
- **BIPS 05** - Preventing Structures from Collapsing and Urban Blast
- **BIPS 06** - Reference Manual to Mitigate Potential Terrorist Attacks against Buildings
- **BIPS 07** - Primer to Design Safe School Projects in Case of Terrorist Attacks and School Shootings
- **BIPS 08** - Field Guide for Building Stabilization and Shoring Techniques
- **BIPS 09** - Comprehensive Approach to the Stabilization of Buildings
- **BIPS 10** – High Performance Based Design



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