



ARE SAFETY MEASURES ADDRESSED IN THE DESIGN OF OUR RESIDENTIAL BUILDINGS?

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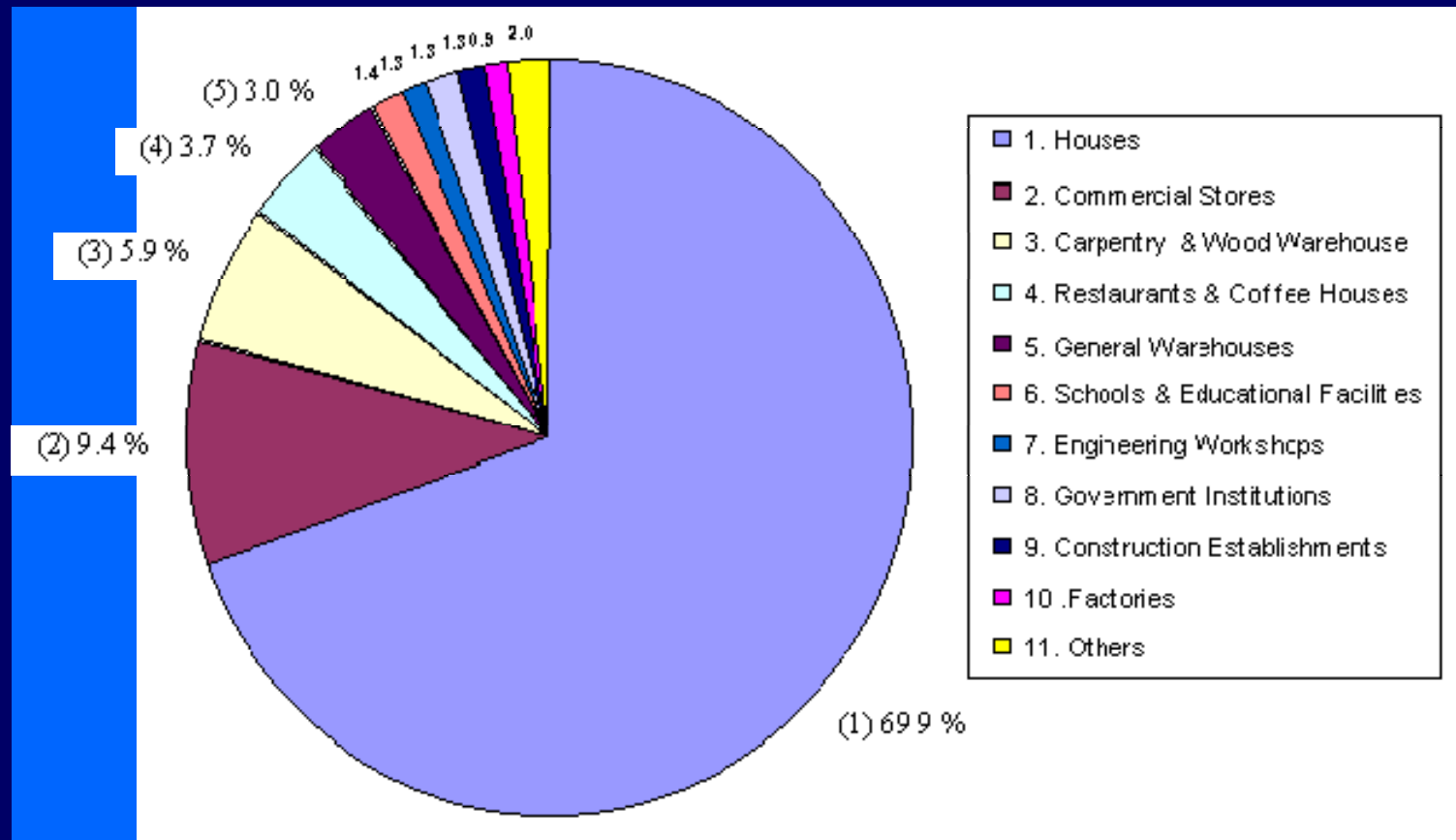


INTRODUCTION

- Fire is a major hazard in Saudi residential buildings with the highest 4-year average of 69.3% among all types of buildings.
 - Electrical shocks are reported as the major cause of accidents with 37% of all causes.
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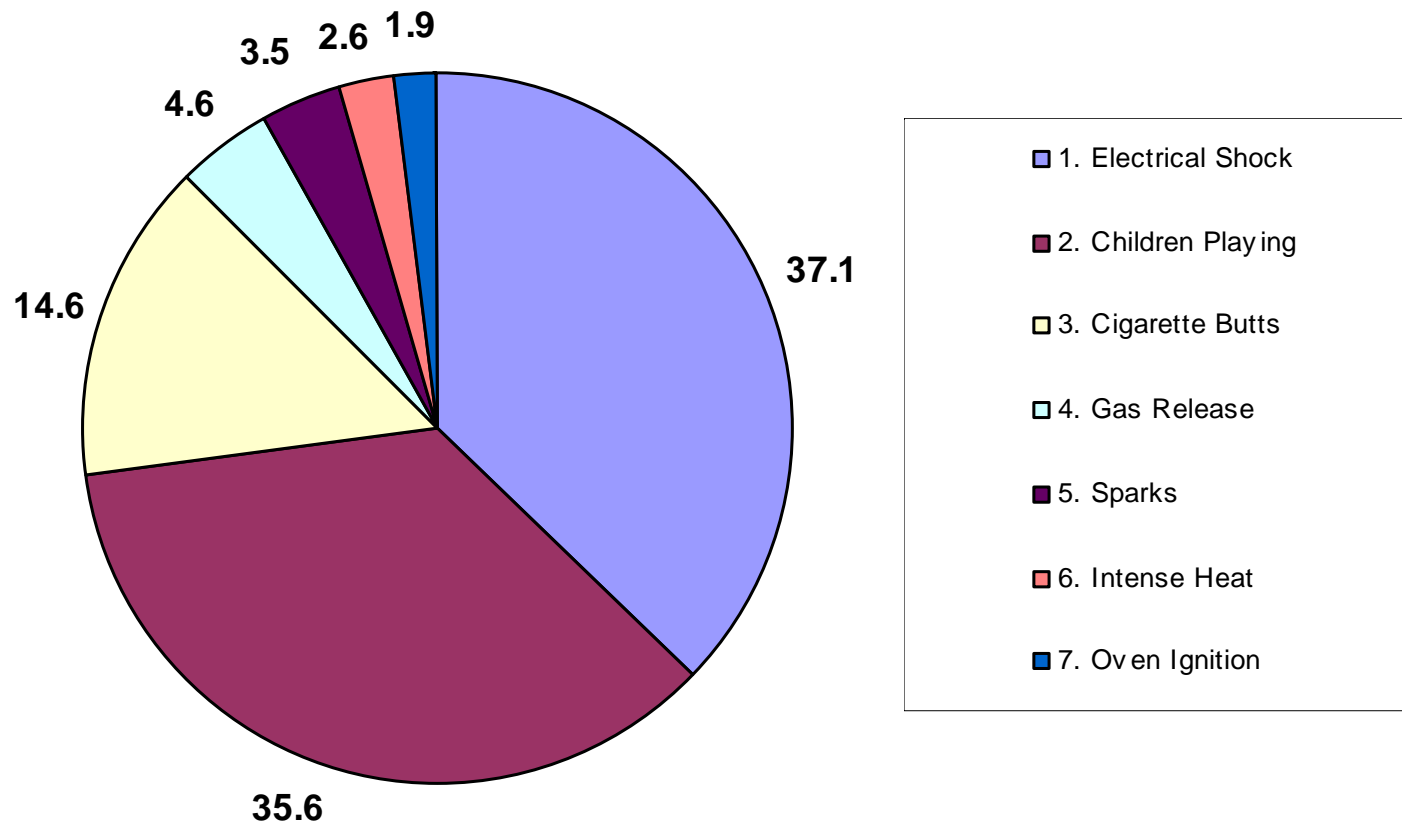
Fire Accidents by Building Type

The percentage of building types (4-year average) burnt in Saudi Arabia (GCDA, 1416H-1419H; 1996-1999).



Building Fires by Cause

The percentage of causes of fire accidents (4-year average)
(GCDA, 1416H-1419H; 1996-1999).





OBJECTIVES

The objectives of this study are to:

- Present the results of a field assessment of safety practices in the design of typical residential buildings in Saudi Arabia
 - Identify related common safety design deficiencies.
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OBJECTIVES (Cont.)

- Present a simple systematic safety compliance checklist based on existing local safety instructions and international safety codes and standards.
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LOCAL BUILDING SAFETY REQUIREMENTS

- Design drawings are examined by the GCDA before issuing the building permits for:
 - Commercial building projects; or
 - Projects consisting of four stories or higher (high rise buildings)
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LOCAL BUILDING SAFETY REQUIREMENTS

The designer proceeds with safety design based on:

- His own experience; and
 - Available local safety requirements (instructions).
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BUILDING SAFETY REQUIREMENTS

- At present, the Saudi Arabian Standards Organization (SASO) is developing a Saudi Arabian Building Code.
 - Even with the developed/adapted codes, further clarifications, simplifications and necessary training are required.
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BUILDING SAFETY ASSESSMENT

In order to **assess** the extent to which building **designers** address **safety** measures in their design, a **survey** of many **design offices** was conducted and analyzed.



SURVEY DESIGN AND ADMINISTRATION

The survey questionnaire was divided into seven sections as follows:

- General information;
 - Municipality requirements;
 - Civil defense requirements;
 - Client role;
 - Fire and smoke control measures;
 - Electrical safety measures; and
 - General safety measures
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SURVEY DESIGN AND ADMINISTRATION

The questionnaire was distributed via mail and through personal visits to many design offices in the cities of:

- Riyadh,
 - Dammam,
 - Al-Khobar,
 - Makkah,
 - Jeddah, and
 - Taif
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SURVEY DESIGN AND ADMINISTRATION

- 102 completed questionnaires were received out of the 112 distributed (i.e. 91% response) as follows:
 - 32 from Dammam and Khobar,
 - 23 from Riyadh,
 - 19 from Makkah,
 - 18 from Jeddah and
 - 10 from Taif.
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SURVEY ANALYSIS

A four-point scale was used as follows:

- *always*: 4 points,
 - *most of the time*: 3 points,
 - *sometimes*: 2 points,
 - *rarely*: 1 point,
 - *never*: 0 point.
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SURVEY ANALYSIS

An Effectiveness Index (EI) of each question was calculated as follows:

$$\text{Effectiveness Index (EI)} = \left(\frac{\sum_{i=1}^n f_i w_i}{\sum_{i=1}^n f_i} / 4 \right) \times 100$$

Where:

f_i = frequency of responses to criterion i ,

w_i = weight of responses to criterion i , and

n = number of answer choices = 5



SURVEY ANALYSIS

The Effectiveness Index (EI) was categorized as follows:

➤ **Extremely effective:**

$$3.75 \leq AV \leq 4.00 \quad \text{or} \quad 93.75 \leq EI \leq 100$$

➤ **Highly effective:**

$$3.50 \leq AV < 3.75 \quad \text{or} \quad 87.50 \leq EI < 93.75$$

➤ **Very effective:**

$$3.00 \leq AV < 3.50 \quad \text{or} \quad 75.00 \leq EI < 87.5$$

➤ **Moderately effective:**

$$2.50 \leq AV < 3.00 \quad \text{or} \quad 62.50 \leq EI < 75.0$$

➤ **Ineffective:**

$$2.00 \leq AV < 2.50 \quad \text{or} \quad 50.50 \leq EI < 62.5$$

➤ **Extremely ineffective:** $AV < 2.00$ or $EI < 50.0$



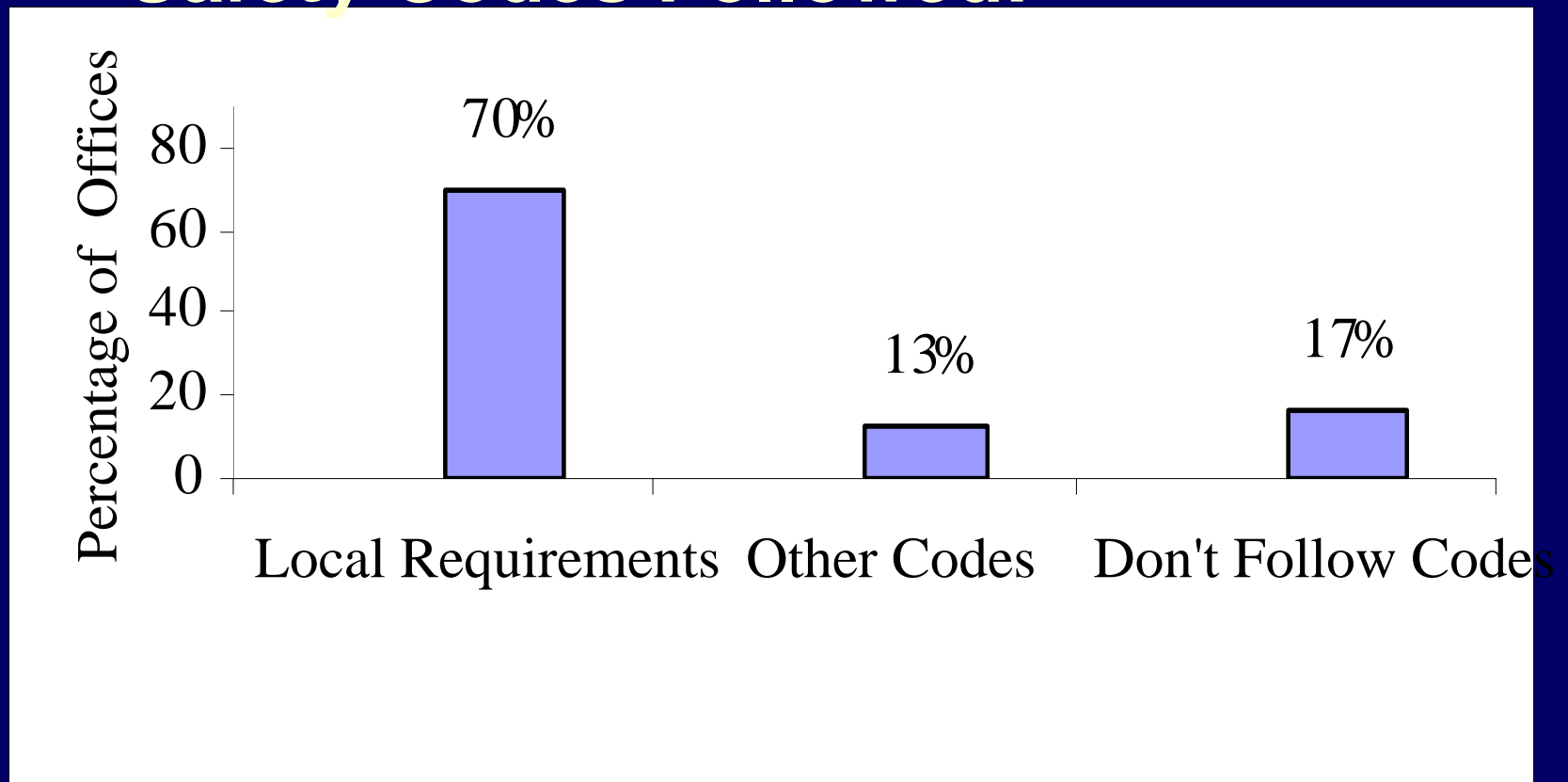
DISCUSSIONS OF THE RESULTS

General Information

- The average years of experience of responding offices is 13 years.
 - The respondents expressed themselves as follows:
 - 46% architectural engineers
 - 31% architects,
 - 21% civil engineers, and
 - 2% mechanical/surveying engineers
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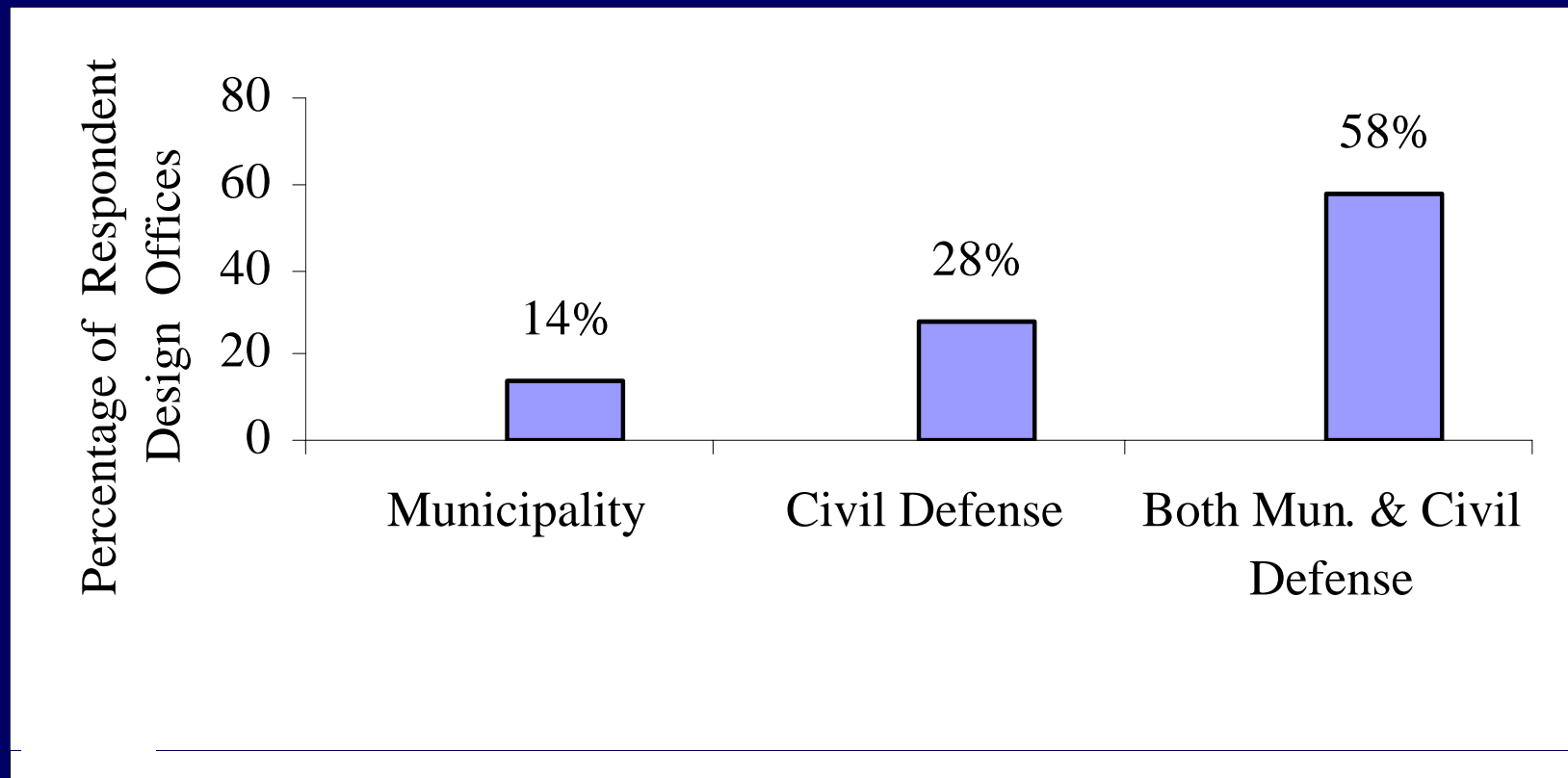
DISCUSSIONS OF THE RESULTS

Safety Codes Followed:



DISCUSSIONS OF THE RESULTS

Safety Responsibility:





Municipality Requirements

Municipality safety design approval requirements:

- Extremely ineffective for villas and LRAB (EI of 12% and 20.8%, respectively),
 - Moderately effective for HRAB (EI of 65%).
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GCDA Requirements

- Most of the surveyed design offices are not aware of safety regulations for villas or LRAB (EI of 21.8% and 32.0%, respectively)
 - The majority of the surveyed design offices are aware of the GCDA safety regulations for HRAB (EI of 78.5%).
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Fire and Smoke Control Measures

- Moderately effective provisions of exits and circulation in the design of villas and LRAB (EI between 62.5% and 75.0%).
 - Extremely ineffective considerations of other fire and smoke control measures (EI of less than 50%).
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SAFETY COMPLIANCE CHECKLIST COMPONENTS

- Safety compliance checklist was then developed
 - The compliance checklist aims at guiding building designers ensure minimum safety design requirements for new residential buildings.
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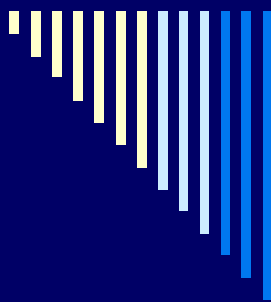
SAFETY COMPLIANCE CHECKLIST COMPONENTS

- Building identification
 - Occupant load
 - Location on property
 - Exterior finish
 - Number of exits
 - Exit access
 - Exit dimensions
 - Exit illumination
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SAFETY COMPLIANCE CHECKLIST COMPONENTS

- Stairways
 - Handrails
 - Fire alarm system
 - Smoke detectors
 - Fire extinguishing systems
 - Electrical issues
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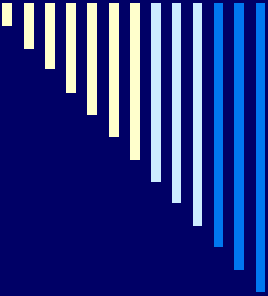
CONCLUSIONS AND RECOMMENDATIONS

1. There is a major deficiency in fire and smoke safety design of villas and LRAB.
 2. The only available information is the safety instructions by GCDA.
 3. Local building safety codes should be developed and enforced.
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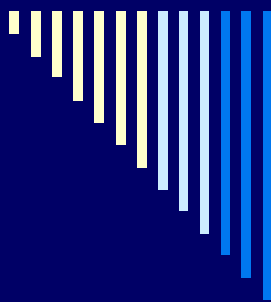
CONCLUSIONS AND RECOMMENDATIONS

4. The codes should be detailed, clear and easy to use by designers.
 5. Safety design should be a prerequisite for issuing building permits.
 6. Safety design in buildings must be laid out by qualified architects/engineers.
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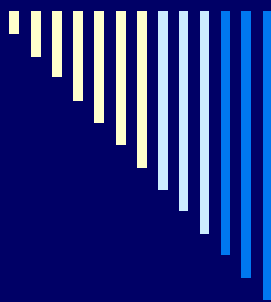
CONCLUSIONS AND RECOMMENDATIONS

7. Necessary college and on the job safety training should be provided to building designers
 8. Authorities should insure safety compliance before providing the necessary services.
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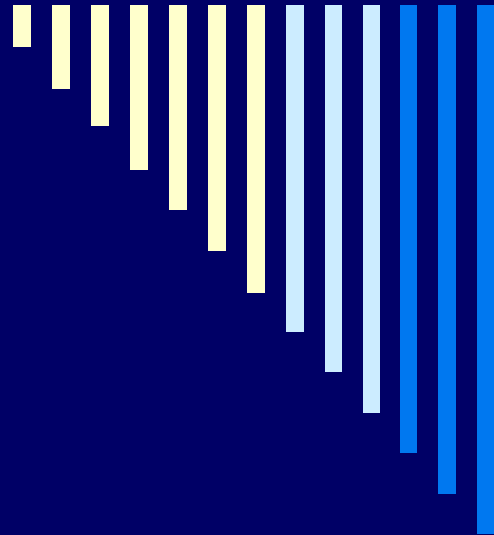
CONCLUSIONS AND RECOMMENDATIONS

9. Continuous public safety awareness and educational programs should be conducted.
 10. The proposed safety compliance checklist is highly recommended for use by designers and safety authorities.
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CONCLUSIONS AND RECOMMENDATIONS

12. The proposed compliance checklist does not, by any means, replace or free the concerned user(s) from referring to and complying with established safety codes requirements.
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THANK YOU

