

CHILD CARE IN MULTISTOREY BUILDINGS

AUSTRALIAN BUILDING CODE
VERIFICATION FOR PERFORMANCE

Presented by Stephen Burton

WHY WE ARE HAVING THIS DISCUSSION

- The BCA in its development back in the 1980's (FCRC) had no studies of child evacuation in buildings over 2 or 3 storeys. Not foreseen at the time
- International Building Codes (UK, US, ERU) have conditions for assessing Children in the evacuation process
- Australia does not. The NCC has no DtS measures to safely allow children to evacuate from a high rise building in an emergency
- Child Care and Aged Care in high rise is a recent development (Brisbane Town Plan 2014 and BCC, Victorian City Plan)
- Department of Education approvals do not look at fire safety in detail but we once did - like legislation Qld used to have MP5.4
- This study is to make the Building Industry aware of the issue and give some tools to verify performance
- Its time to create change before a child has to die to recognise that change is needed in building codes

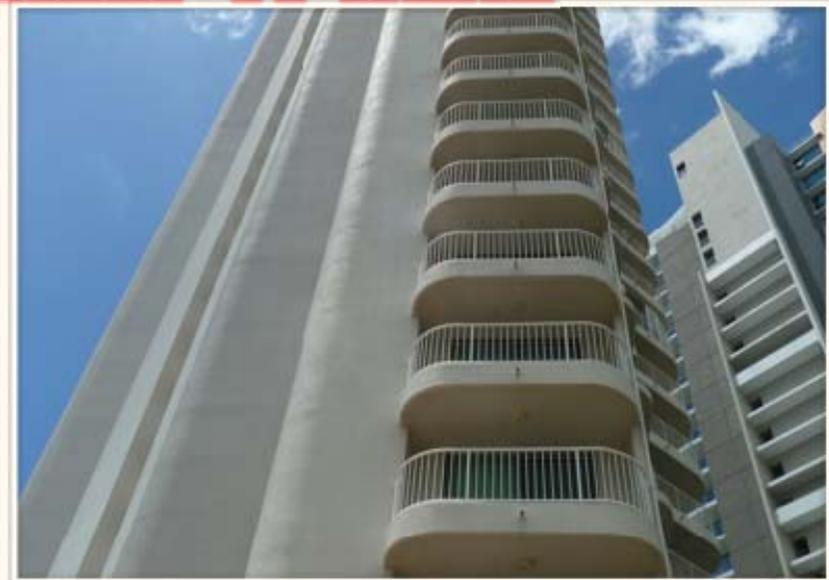
ABOUT THIS SEMINAR

- What the BCA contains currently for Child Care in High Rise. No head in the sand (or basket) on DtS fits all
- What State legislation requires of the Department of Education
- What federal Department of Education requires of operators
- How to assess the safe evacuation of children – NCC 2019 proposals
- What design tools to use to facilitate a safe design for evacuation
- Concept design, policies, education and planning to be considered



1. BCA AND CHILD CARE IN HIGH RISE BUILDINGS

- Does NCC2016 or 2019 facilitate safety for Children in High Rise. Based on the Fire Code Reform Centre studies 1980's - No
- NCC Volume 1 Class 9a - Early Childhood Centre or School as defined
- **Assembly building** means a building where people may assemble for: educational purposes in a school, early childhood centre, preschool, or the like;
- In NSW (Part), Early childhood centre means a preschool, kindergarten or child-minding centre for the care or training of more than 5 children.
- **Assessment Method** means a method used for determining that a Building Solution complies with the Performance Requirements.
- NCC is Performance Based - Does DtS meet performance for Child Care in a high Rise Situation NO is the situation



SECTION A - NCC

- **A0.1 Compliance with the NCC is achieved by satisfying the [Performance Requirements](#). That is First and Foremost**
- **Assessment as Class 9b — “an [assembly building](#), including a trade workshop, laboratory or the like in a primary or secondary [school](#), but excluding any other parts of the building that are of another Class”**
- **Does not really sound like a Child Care definition when relating to high rise applications**
- **We will make comparisons regularly to Class 9c: Aged Care for many reasons. I suggest using Class 9b is not acceptable in the NCC 2019**
- **So what is needed to meet A0.1 if DtS is used as a Class 9b in high rise, over 3 levels. What’s involved? Does NCC 2016 satisfy performance?**

SECTION C FOR CLASS 9B

- **C1.10 Fire hazard properties** :(a) The fire hazard properties of the following linings, materials and assemblies in a Class 2 to 9 building must comply with Specification C1.10
- **These are lower for Class 9b than Class 3, 9a**
- **Wall and Ceiling innig materials are group 1 or 2 (unsprinklered)**
- **Compartment Sizes C2.2 is Type A = 8000m² - that's a large floor**
- **Type A separation requirements and construction of fire isolated exits and Floors, Fire Walls in Spec C1.1 = FRL 120/120/120**
- **Up to 25m - no sprinklers, over 25m Sprinklers**

SECTION D FOR CLASS 9B

- **Performance Matters -**
 - **DP3 Where people could fall (a) 1 m or more**
 - **(f) constructed to prevent people from falling through the barrier; and (g) capable of restricting the passage of children;**
 - **DP3(g) does not apply to—**
 - **(a) fire-isolated stairways, fire-isolated ramps, and other areas used primarily for emergency purposes, excluding external stairways and external ramps**
- **This clause fails to meet the actual Performance requirement of DP3 a)**
- **Even Class 1 stairs need this. This is a total contradiction WHY?**

SECTION D FOR CLASS 9B

- **Performance Matters - DP4**

Exits must be provided from a building to allow occupants to evacuate safely, with their number, location and dimensions being appropriate to—

- . (a) the travel distance; and
- . (b) the number, **mobility** and other characteristics of occupants; and
- . (c) the function or use of the building; and
- . (d) the height of the building; and
- . (e) whether the *exit* is from above or below ground level.

- **How are children catered for here - they must be under DP4 based on b) the number, **mobility** and other characteristics of occupants**
- **However, the D-t-S provisions do not prescribe accessible solutions for occupants with age disability despite the mandatory Performance Requirements requiring exits and warnings being appropriate to the number, mobility and characteristics of occupants**

DP3 - WHAT THIS MEANS

- **What DP3 states is that a child is not catered for in a fire isolated exit like adults are**
- **It does not allow for the restraint from fall of an infant or small child in an evacuation**
- **What if the stairs are to an older NCC or BCA edition**
- **It means that a Child Care Facility using a fire escape is at risk of a death or injury under both the DtS and Performance**
- **That's setting us up for failure**
- **However, from DP4 the reasoning is very simple. If we can get things right for the most vulnerable building users, children and the aged, we get them right for everyone else also, so look at alternatives.**



CHILDREN AND STAIRS

- **The BCA was developed (1980' s) with no infant or child evacuation assessment, speed of travel or studies that accommodates fire evacuation from height. (Fire Code Reform Centre)**
- **What is known now is that Child Care in high rise was never a consideration in the BCA of old. This is a new and modern phenomenon**
- **What is needed is a fresh look and understanding that children in high rise for evacuation changes with age and the density of adult carers varies to cater for the movement of infants and children**
- **Abilities to traverse a stair is developed in the assessment tools for Fire Engineers from International and local studies. (Ferm Engineering and Chris Buck)**

STAIR DESCENT DEVELOPMENT

- Infants are at greater risk from falling down stairs than toddlers or older children (National SAFE KIDS Campaign, 2004)
- Stairs pose a potential danger for newly mobile infants and toddlers. Nearly, 1 million people are treated in hospitals for falls on stairs and steps each year, and in 2002 (Bayley, N. (1969).

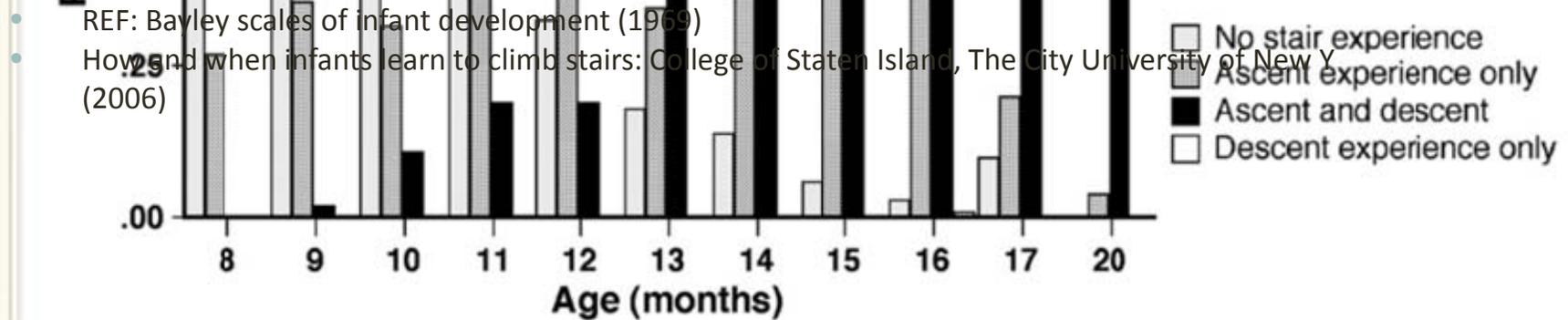


Fig. 1. Distribution of infants' skill on stairs by infants' age at the time of parents' report (n = 732).

2. DEPARTMENT OF EDUCATION

- The federal government introduced a National Code for Child Care and Education - ACECQ
- Licences to run a Child Care facility changed and States now adopt a version of the Federal requirements and manage licensing of state Child Care premises
- The Federal Government funds these centres with subsidies and grants and Child Care rebate to parents
- Education must meet NQF requirements but fire safety is not included, unlike overseas
- Announced 13 February “ Ministers have agreed to changes to the National Quality Framework (NQF) intended to strengthen quality in early childhood education and care while at the same time reducing red tape”



CHILD CARE LEGISLATION

- **The National Quality Framework (NQF) is an agreement between all Australian governments to work together to provide better educational and developmental outcomes for children**
- **(NQF) operates under an applied law system, comprising the Education and Care Services National Law and the Education and Care Services National Regulations. Under the National Law and National Regulations, approved services are required to base their educational program on an approved learning framework**
- **This framework does not include Fire safety training to our children in the base syllabus or specialist training modules**
- **So how does this compare to International Education Levels - We look at the NFPA and some of the Asian systems of education**

LEGISLATION - WHO'S IN CHARGE

- To operate they need an approval from various state authorities, but mainly the chief executive administering the “Education and Care Services National Law (Queensland) Act **2011**
- An objective of the Acts is to ensure the safety, health and wellbeing of children - so in assessing applications, this is a requirement
- The childcare National Law has weakened protections for children in multi-storey buildings, transferring reliance to Building Law
- Queensland's withdrew the Child Care Act and QDC legislation (QDC MP5.4), but nothing was added to the NCC 2016 fire safety sections to compensate. States adopted to the new National Laws
- Premises applications are relying on a 25 year old building code (NCC) and an unreliable building certification processes in each state to address fire evacuation measures - so is that appropriate for high rise child care assessments

LEGISLATION - WHO'S IN CHARGE

- Premises applications go to the Department of Education to verify compliance
- The work practices and placements are contained in government guidelines for Children's Services regulated at State and Territory levels. For Queensland that is the "Education and Care Services National Law (Queensland) Act **2011**".
- The aspect of Fire safety in the premises, procedures and performance is not assessed by them. It is a loose referral to the building approval only.
- Plans and details must be submitted and other approvals also gained from the State Planning and Building authorities. Assessment Criteria for development In a Centre Zone (city e.g. **PC1, PC2**). This is where new Child Care locations will be added and have been added, in multi-storey buildings
- Planning instruments for placement of a childcare centre within the community in the past made centres only acceptable if on ground or no higher than 2 levels
- So this means the Building Certifier is in charge of child fire safety and the approval of this aspect. No other referrals are occurring beyond this currently except QFES

CHILD CARE FIRE TRAINING

- **The States undertake the registration and auditing and licensing of operators in Child Care and Education**
- **There are 2876 registered centres in Qld**
- **There are many new centres planned and large corporate buyouts and Investment Companies are moving into the market**
 - <http://www.greenfinancegroup.com.au/commercial-finance/childcare-centre-finance/tips-for-buying-a-childcare-centre/>
- **The Victorian Government alone has committed \$50 million over four years to support local governments and other service providers to invest in early childhood infrastructure**
- **No moneys have been allocated for fire training in Early Childhood centres**
- **NFPA in the US runs the Child Care training program**
- **Asian countries include significant child education on evacuation in emergencies, fire, tsunami, earthquake, etc.**

NFPA FIRE EDUCATION

- Learn Not to Burn® (LNTB) has served as the pillar of NFPA educational programs for more than 40 years.
- The need for life saving fire prevention education is clear. Fire-related injuries and deaths take a huge toll on the public's health. In 2009 in the United States, someone was injured in a fire every 30 minutes and someone died every 175 minutes
- Their **10, 30 and 60** Minute mini-lessons is a helpful strategy life safety educators can implement in a variety of settings and buildings.
- Use of the “Sparky Fire Dog” campaign to attract child attention to the activities of fire safety, since 1950 <http://www.sparky.org/>
- Free access to their materials and videos is offered and dedicated programs can be arranged through the NFPA education division
- This will be presented to the new ACEQCA board this year to consider for Australian Fire Safety education programs

CHILD INJURY - FIRE

- The annual cost of unintentional injury and death to children 0–4 years of age in Australia is estimated to be 1.5 billion dollars (Moller 1998).
- For specific causes of injury and death the top five most costly among children under 5 in Victoria were: falls (\$22m); poisoning (\$12m); fire, flames, and burns (\$8m); hit, struck, or crush injury (\$7m); and motor vehicle traffic (\$4m) (Watson & Ozanne Smith 1997)
- Fire is the third largest after falls



SPARKY THE FIRE DOG

NFPA SYNDICATED TRAINING PROGRAM



3. WHAT THE DEPARTMENT OF EDUCATION REQUIRES OF OPERATORS

- THE DUTY OF CARE FOR CHILD SAFETY
- SAFE ENVIRONMENT TO STAY AND PLAY
- REGISTRATION OF EMPLOYEES OR CARERS
- TRAINING AND PROCEDURES FOR STAFF
- EDUCATION STANDARDS FOR THE CHILDREN

FIRE SAFETY REQUIREMENTS

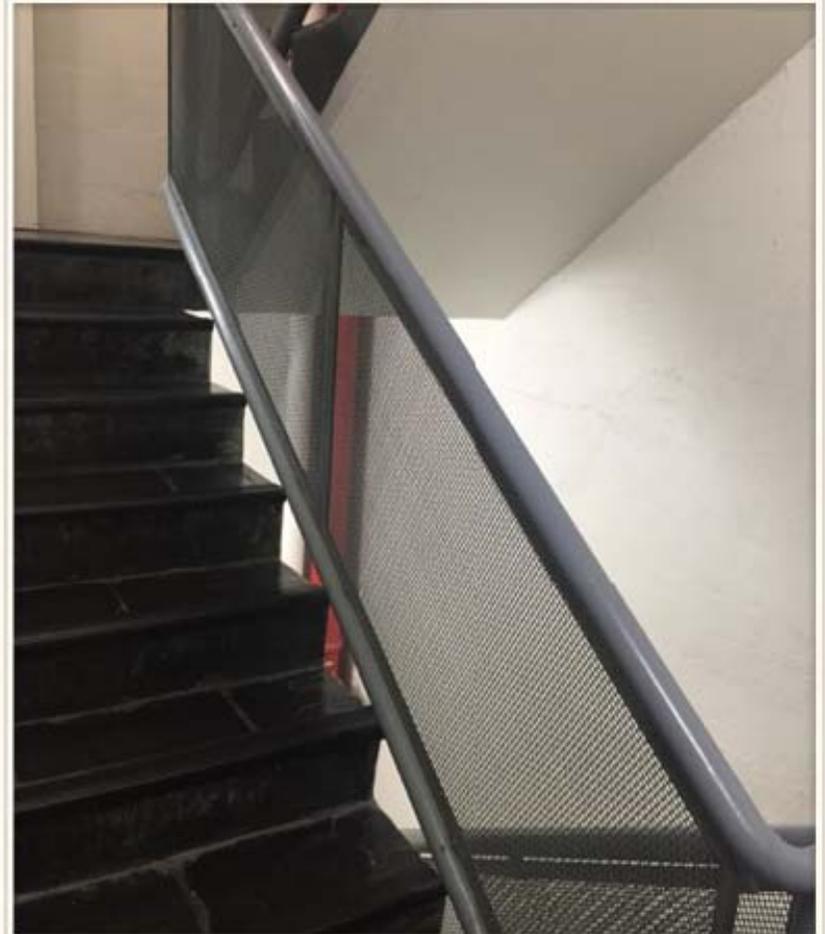
- In **2015** “...the ABCB undertake further research to identify deemed-to-satisfy provisions for emergency egress for people with disability with a view of making changes to the Building Code as soon as possible.”
- Children and Infants are people with a disability - age. They don't hear or understand fire alarms, they are kept in confined areas like a cot or secured play area, they are unable to walk or negotiate stairs, they do not read or respond to smoke and fire, they can't see exits.
- To evacuate those with a disability is generally left to administrative evacuation management procedures located outside of the BCA
- So how do you include these people into the egress provisions of the NCC. Clearly they do not exist in NCC **2016, only the performance. A0.1 states, we must meet the performance provisions.**

FIRE SAFETY REQUIREMENTS

- The nature of the problem is twofold.
- Firstly it relates to life safety and the inability of children (disabled)being able to evacuate buildings in the event of an emergency
- Secondly, the nature of the problem involves obligations under disability legislation for Landlords and Licensees to ensure, that equitable access to and within buildings, including its fire safety features, is provided for people with disability - which a child of **1 -24** months or **2 -5** years applies
- It is unlawful to discriminate against a person because of their disability
- But children have no voice in this, only the parents and community who take on the issue.
- This is purpose of this presentation. Child Care is not in the main stream of design, but it needs to be. Especially in high rise locations.

FIRE SAFETY REQUIREMENTS

- Building management practices supplement the needs of occupants with disability through the establishment of evacuation management procedures and Personal Emergency Evacuation Plans (PEEPs -**AS 3745**), which are designed to address the needs of the person in relation to the specific characteristics of the building. In child care this is staff/child ratios.
- This example is the fire escape of a child care facility in Europe
- Protection from falls inside a fire exit stair in Brisbane Child Care exit
- PEEPs are not a requirement of the NCC yet they are recognised as a necessary and effective measure to have staff respond to an emergency to address those inadequacies of the built environment - due the current DtS situation

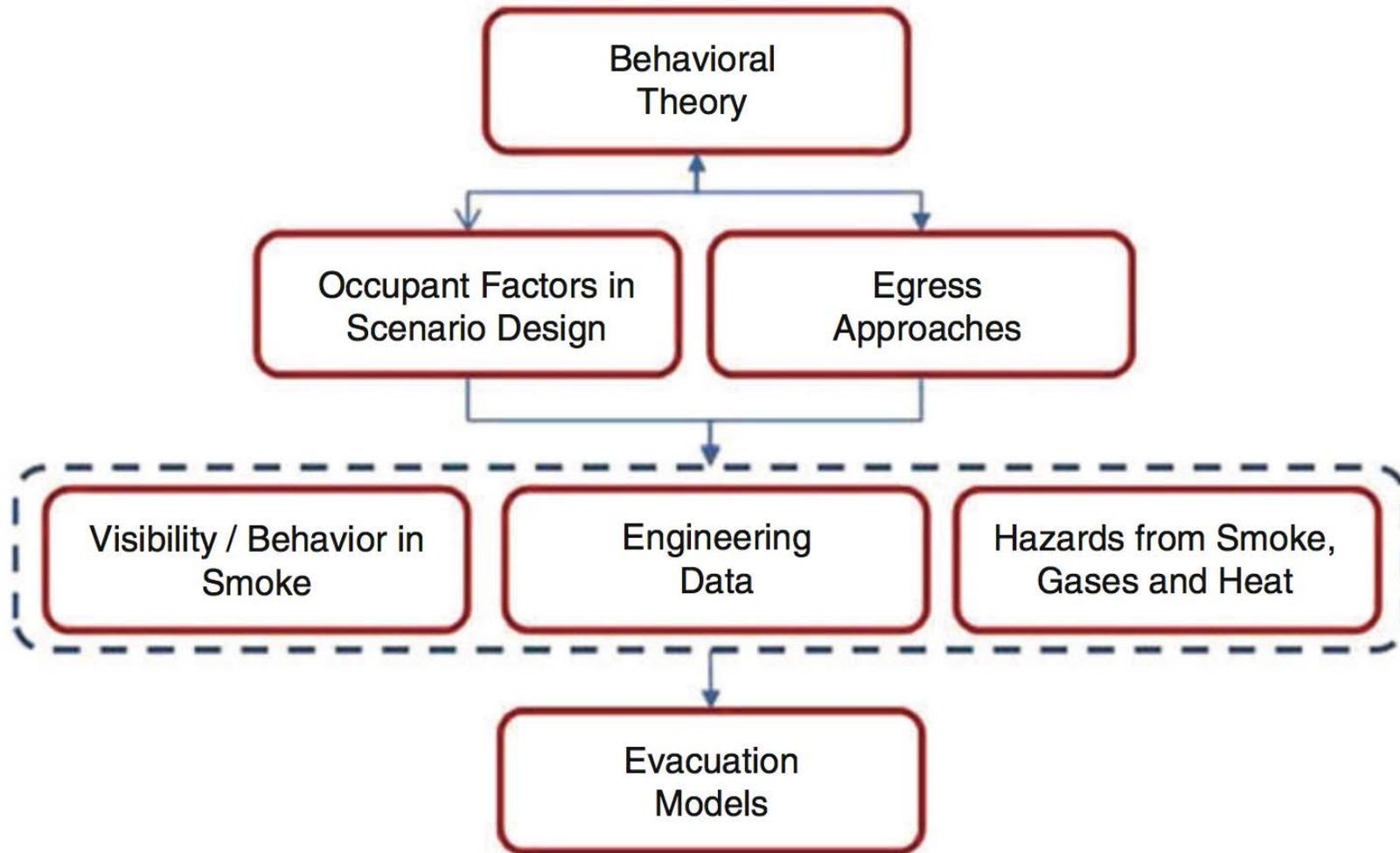


4. HOW TO ASSESS THE SAFE EVACUATION OF CHILDREN

- Hazards around and the Children's Behaviour in Emergency Events?
- What is the response time of child in an emergency?
- What is the response time of the carer in charge of a group of children
- What speed can they collectively find the exit, assisted egress method
- How do they evacuate, stairs, ramp, lift, other
- What do other occupants do in the process
- What tools do we have to make such assessments, data and models



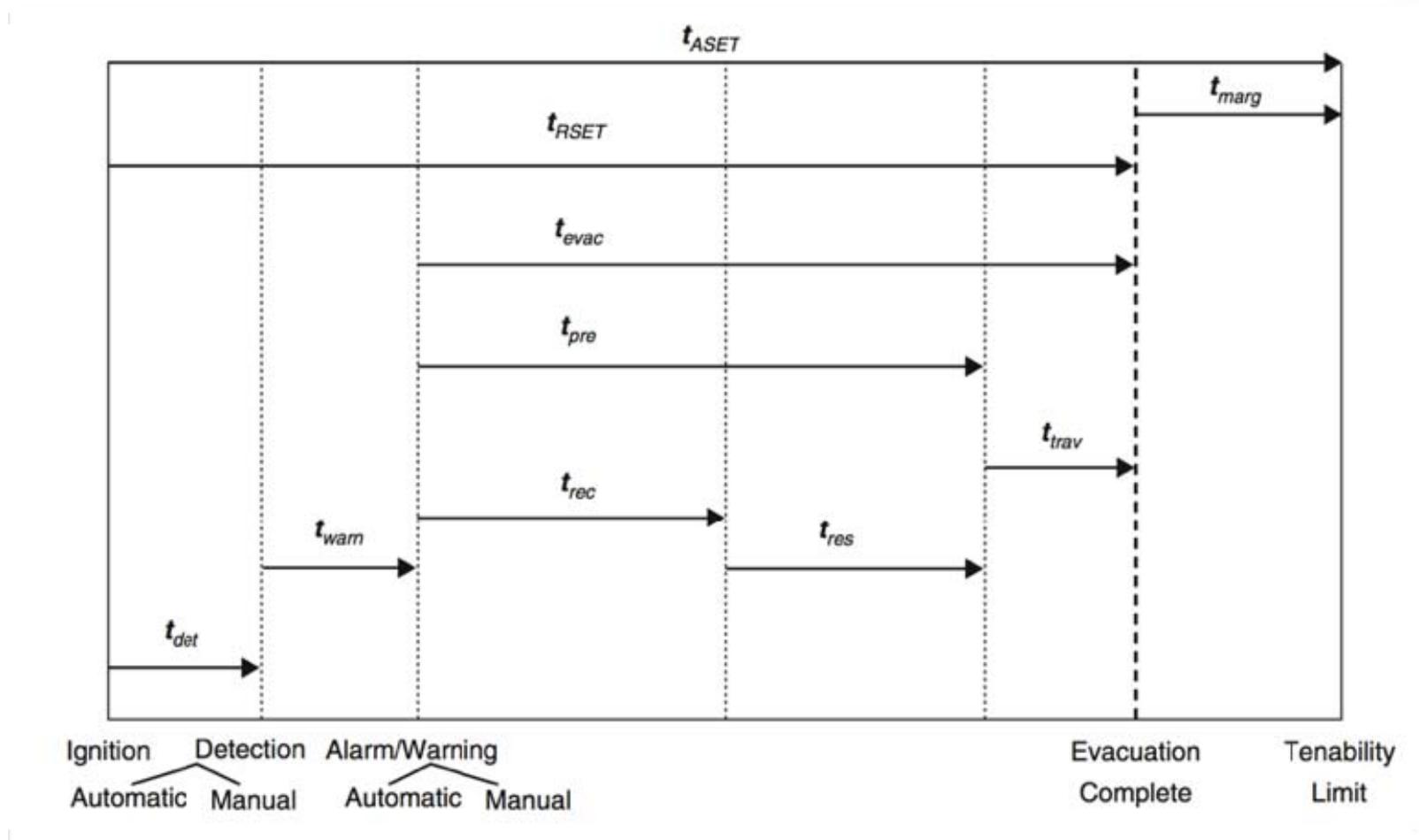
Quantifying Egress (SFPE HANDBOOK)



S.M.V. Gwynne and K.E. Boyce

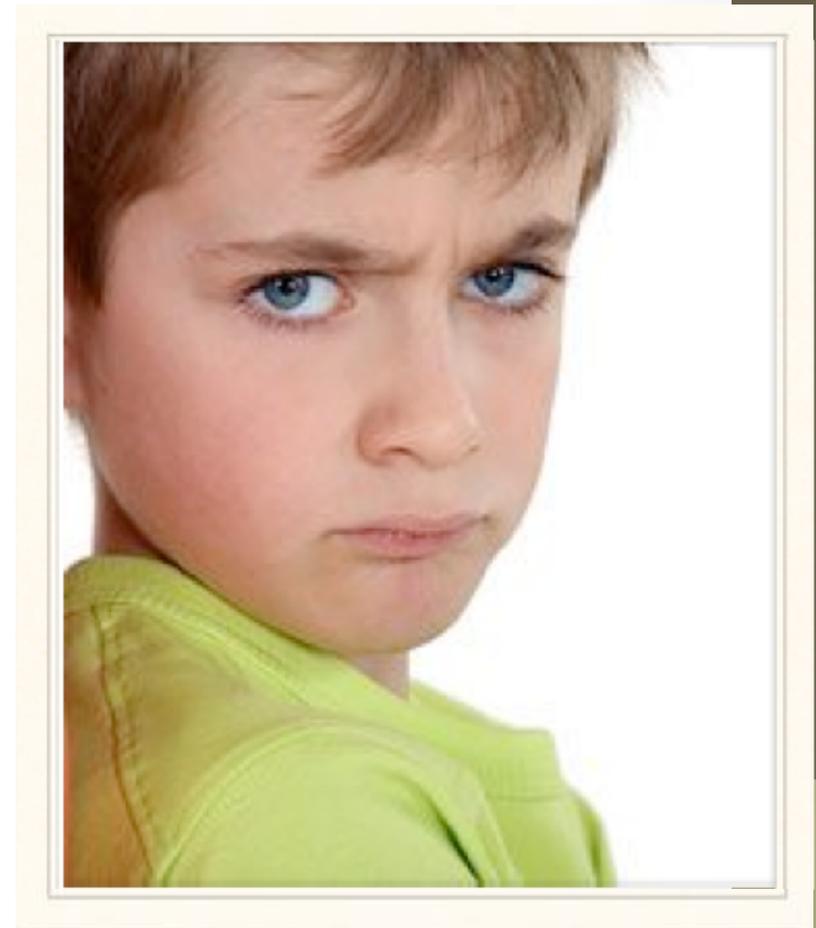
ENGINEERING TIMELINE

The Evacuation Stages Being Considered



4. HOW TO ASSESS THE SAFE EVACUATION OF CHILDREN

- Behaviour in Emergency Events
- Child development is in stages and is not consistent with adult norms
- Those infant years where the cognitive and physical capacity to behave and react to emergency and fires are not developed. This is from the NFPA study and development of their fire safety education programs, not even considered in the Australian National Quality Framework (NQF) programs
- Number of staff is in proportion to these development stages to assist in egress



STUDY OF CHILD BEHAVIOUR

Child Development Stages – Guide by Piaget and Learning Safety

Piaget's Stages of Cognitive Development and Teaching Implications

AGES AND STAGE

COGNITIVE DEVELOPMENT AND IMPLICATIONS FOR TEACHING

Birth to age 2:
**SENSORIMOTOR
STAGE**



During this stage, children learn about themselves and their environment through motor and reflex actions. Thought derives from sensation and movement. Children learn that they are separate from their environment and that aspects of the environment — their parents or favorite toys — continue to exist even though they may be outside the reach of the child's senses. Teaching for a child in this stage should be geared to the sensorimotor system: Modifying behavior by using the senses. A frown, a stern voice, a soothing tone — all serve as appropriate techniques.

From when the child starts to talk until about age 7:
**PREOPERATIONAL
STAGE**



In this stage, children apply their new knowledge of language and begin to use symbols to represent objects. Early in this stage, they also personify objects. They are now better able to think about things and events that aren't immediately present. Oriented to the present, children at this stage have difficulty conceptualizing time. This thinking is influenced by fantasy — the way they'd like things to be — and they assume that others see situations from the same viewpoint. They take in information and then change it to fit their own ideas. Teaching must take into account a child's vivid fantasies and undeveloped sense of time. Using neutral words, body outlines, and equipment they can touch gives children an active role in learning.

From about 1st grade to early adolescence:
**CONCRETE
STAGE**



During this stage, accommodation increases. Children develop an ability to think abstractly and to make rational judgments about concrete or observable phenomena, which in the past they needed to manipulate physically to understand. In teaching children in this stage, giving them the opportunity to ask questions and to explain things back to you allows them to mentally manipulate information.

Adolescence:
**FORMAL
OPERATIONS
STAGE**



This stage brings cognition to its final form. Adolescents no longer require concrete objects to make rational judgments. They are capable of hypothetical and deductive reasoning. Teaching for adolescents can be wide-ranging, because they are able to consider many possibilities from several perspectives.

Adapted from: honolulu.hawaii.edu/intranet/committees/FacDevCom/guidebk/teachtip/piaget.htm

FIRE SAFETY HAZARDS

- The nature of the problem is that children have to be locked in and their environment is one of stimulus and play. Clothing and exposure are issues
- Of design rooms are a mix of plastic toys, paper and art materials, small wooden and plastic furniture, carpets and soft padding.
- Flammable liquids are in cleaning areas, offices and for infants, beds, cots, pillows and blankets.
- Heating and cooling equipment, lighting and displays for fish, reptiles, TV's and video players.
- Secured locations, locked in and monitored by staff to prevent the “escape artist” , which is like dementia for aged care.
- Fire loads are considered to be of domestic proportions and offices for small people, so guidelines propose 600 MJ/m²

REF: THE NATIONAL BUILDING CODE OF FINLAND

FIRE EGRESS DATA

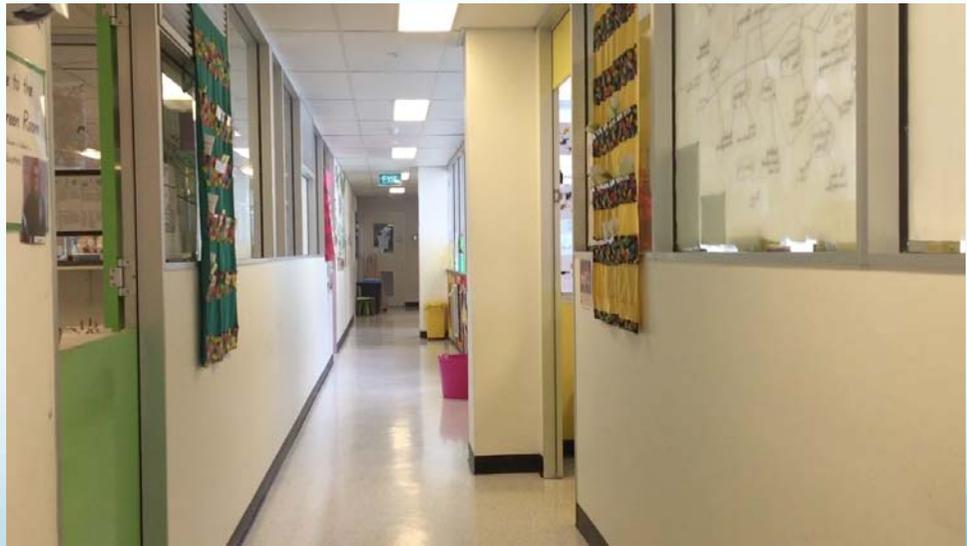
- Human child behaviour in fire is not adequately supported by the data available and this should be understood before interrogating the data-sets presented
- Data can be obtained using a variety of research methods and data collection techniques
- The reliability of the results, validity to the correctness of the study findings is subjective to location. Data from Japan will be less useful in Australia as the cultural and education processes are different
- Field investigations (drills, etc.). These may be announced or unannounced. Depending on the nature of the experiment, the population involved may have some forewarning of the event, may not be exposed to deteriorating environmental conditions, and/or may become aware that the event is not real. All of these may influence the external validity of the results produced.
- We present field test trials from local drills in Brisbane

FIRE EGRESS DATA - REVIEW

- Drill of local Child Care Facility:
- Assessed by Observation, Fixed Camera, 2 Roving Cameras and Participants
- Pre-movement times in this case are skewed to shorter than normal Std Deviations. These are dealt with on separate observations and staffing levels.
- Result Summary:
 - **Speed of Child Down a Stair 0.10 - 0.12 m/sec (Age group 12-24 months)**
 - **Flight 2.95m High with 17 stairs, 175mm rise**
 - **4 Staff on the 1 flight with 8 children maximum**
 - **Time for 1 child per flight was 25.8 sec (26 -29 sec)**
 - **Stair was not able to pass more occupants, blocked to others**
 - **Total First Floor evacuation time 2:25 seconds (18 <2yrs +6 adults down 1 stair)**
 - **Total Third Floor evacuation time 2:38 seconds (76 >2 + 8 adults down 1 ramp)**

FIRE EGRESS DATA - REVIEW

- Of critical importance here is whether the staff were aware that it was a drill/experiment rather than a real incident. Staff were aware in our data sample.
- Pre-movement times in this case are skewed to shorter than normal Stnd Deviations. Children were not at sleep which occurs in the afternoons.
- Children were not at random locations in the area, they were in gathered locations which meant there was high densities in corridors and at the top of stairs, which was observed.
- Use of Cots to remove from the Ground floor was crucial in the fast responses to outside and reaching the assembly areas. These were city streets and footpaths, uneven and bitumen.
- Time for Total Evacuation were recorded at the exit ramp or stair deemed a safe space. NCC deems that the exit point. Travel time to the assembly areas was + **2** minutes on average.
- In summer, these surfaces will reach **60C** and burn small feet in seconds. Clothing play a part. Russian Kindergarten (2 levels) tests vary from 60 seconds in Summer to 450 seconds in winter, needed to dress the children to stay outdoors.
- Factors that must be considered in the transport times from each element with and outside the building.



WHAT TO COMPARE

AN EVACUATION MODEL - 11 FLOOR FIRE STAIR



FIRE EGRESS DATA - REVIEW

- The importance of this review of egress data is the ability for a PEEP process and staff training to act reasonably well. Daisy chains with ropes is an effective method, holding hands
- The difficulty for mixed class **9b + 5 + 2** facilities is they have adult interaction in the stairwells and managing the numbers and head counts of the Children.
- In the World trade Centre attack, the Child Care facility there was evacuated by the staff. Each Teacher carried 2 children under 24 months and older children with a change link of holding hands
- In other emergencies, there are reports of child abductions during events, children missing. The fire stair in a **5 - 32** storey tower will be uncontrolled and unsecured for a child.
- Reaching the assembly areas are uncontrolled, as wandering and escaping children is a real issue as is placing them on a city street, cars, buses, trucks and people is uncontrolled.

5. DESIGN TOOLS

- Design Tools for the assessor and the fire safety engineer are needed, but we only have adult data
- NCC has a DtS arrangement that is for ambulant adult and young children in low densities in high rise evacuations.
- High rise Child Care facilities places a high density of disabled young persons into stairs with inadequate designs for their smaller size. Stairs will be blocked
- Potential to fall is higher, handrails are crucial, floor finishes and footwear slow down the pace and staff have to handle a child every step by holding hands and a maximum 2 children per adult <2 years old
- Any one facility can have 200 children, with 80 infants. That takes time to move down from 3 storey let alone 20 floors.
- So what tools are needed.



DESIGN GUIDES AND SYSTEMS

- **Fire Systems need to be appropriate to the space and height. DP4 will lever into EP2.2 and CP2**
- **There are solutions - Building Tools to be considered are:**
- **Lifts for Egress (ABCB Guide on Lifts - free)**
- **Guidelines for designing fire safety in very tall buildings (SFS - members free access)**
- **Fire Evacuation Equipment (US and UK based)**
- **Safe Haven Locations for Pre-stair movement**
- **Pressurisation and smoke control for the floor**
- **Add ramps (or drop chutes) instead of stairs**
- **Sprinklers and the use of Quick Response heads**
- **Early warning detection and staged evacuation**
- **Management procedures form the basis for success**



5. DESIGN, POLICIES, EDUCATION AND PROCEDURES

- **Solutions Exist now with simple changes to both the Planning Schemes, the Local Government and Department of Education procedures. A set plan to change legislation to accommodate “reasonable mans” test, and return QDC MP5.4**

Recommendations

- A. The chief executive in charge of the Acts, makes conditions on all approvals to multi-storey child care facilities to have them submit and respond to give proof of safety in fire. Part 22 and 33 of the Acts.**
- B. Have expert fire and building code advice in the assessment process added to the Education Departments application program.**
- C. A change to QDC MP2.2 or a new MP5.4 to include conditions for child day care and aged care day respite facilities for fire safety. Prescriptive measures in the QDC and NCC does not address egress for young children or temporary sleeping use. (Both Aged Care and Child Care)**
- D. Add into MP2.2 a definition for “evacuation impairment” to extend to both children under 6 years and the infirm in temporary day care facilities, as they must be recognised and added to legislation for their fire safety needs**

5. DESIGN, POLICIES, EDUCATION AND PROCEDURES

Recommendations

- E. Added conditions or procedures for operators in high rise locations (above 2 levels) to place child evacuation controls and transport apparatus to ensure carer ratios can evacuate occupants and staff are trained to use apparatus.**
- F. Amend the Local Town Planning City 2014 guide to cover the risk factors in the High Rise sectors and place condition for Child Care in those sectors. The factors are incorrect in the plan currently. Restriction on use and height instantly solves the issue for risk mitigation in the future.**
- G. Development of a Fire Safety in Child Care Guideline. Society of Fire Safety of Engineers Australia will assist in that process.**
- H. Awareness campaign and guidelines to owners and for new applications of expected fire safety education and fire evacuation guidelines.**
- I. Undertake mandatory witnessed evacuation drills and staff training registers as per the Aged Care style of record keeping.**
- J. Placement of occupancy categories and added fire safety provisions in the prescriptive aspects of the NCC and adoption of reformations by the ABCB for the upcoming NCC 2019.**
- K. Use of Personal Evacuation Emergency Plans for the Child Care Facilities Directly, and registered as part of the Approval for the Building permit and License.**

DESIGN GUIDES AND SYSTEMS

- **There management solutions - Procedures**
- **Staff Induction and training is paramount**
- **Guidelines to Emergency Evacuation Planning Guide for People with a Disability (NFPA)**
- **Cots and Trolleys and Skids that accommodate more children to ease staff/child ratios and stress and loads**
- **Assembly areas with back-up locations for safe external environment**
- **Sock/booty ages that staff grab with Fire Backpack kits - to assist the little feet to handle harsh surfaces**
- **Food and pacifier kits for infants**
- **Drills and team training, child lists in paper**
- **Assessment and audit with a fire engineer (1 /year)**



CONCLUSION - DO IT FOR THE KIDS

THANK YOU FOR YOUR ATTENDANCE

