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# The Future of Smart Buildings & Cities in the IoT Age



## Background

- The huge growth of the Internet of Things, (“IoT”), and Industry 4.0 to being the 7th largest industry sector on the planet is well documented with US\$6 trillion of capital investment being made from 2018 – 2020, and an annual market of US\$157Bn in 2016 increasing to US\$457Bn by 2020\*. Smart cities, (23%), Connected Industry, (17%), and Connected Buildings, (12%), lead the IoT market sector.
- Most industry sectors, including property are rapidly moving towards intelligent, connected devices to provide better control, monitoring and insights into building systems and asset conditions, including Fire & Life Safety systems
- Recent catastrophic fire events including Grenfell Tower, Notre Dame Cathedral, FR Tower in Dhaka, Torch Tower in Dubai, and near misses locally at Neo200 & Lacrosse Apartments in Melbourne mean that there is more need than ever fire & life safety technology innovation to deliver safer outcomes for occupants, fire brigades and asset owners.

*\*SOURCE: Forbes Magazine, December 2017.*

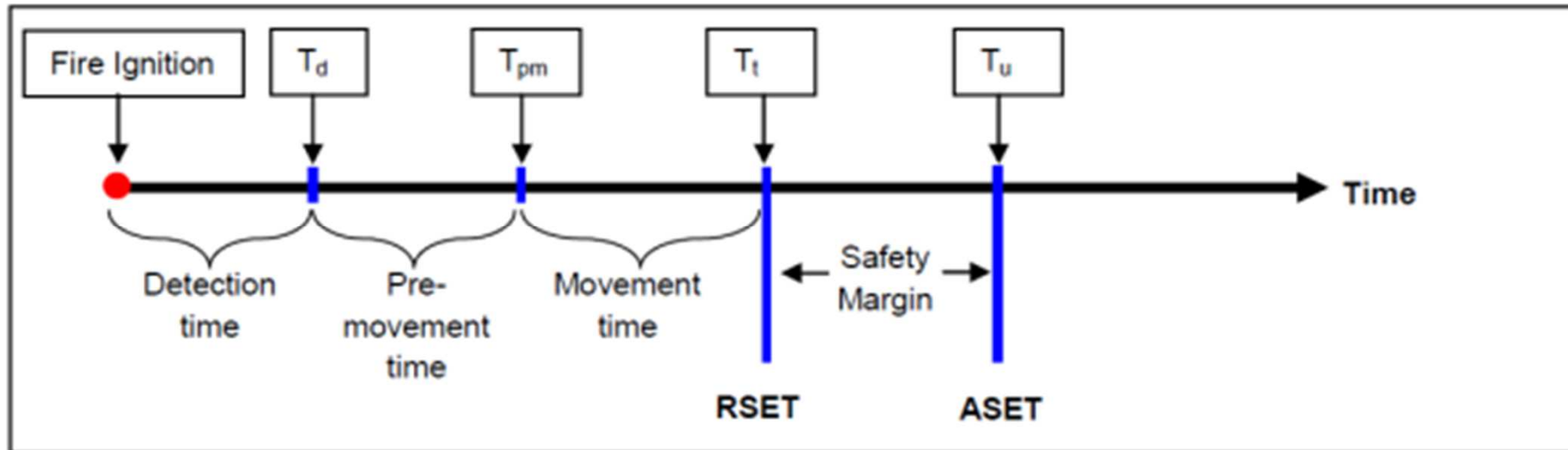




# Fire Safety Objectives

- Life Safety
  - Reduce detection time
  - Reduce pre-movement time, (the time it takes to investigate an alarm and determine whether it is genuine and therefore interventive action or evacuation is necessary)
  - Provide occupants with the opportunity to extinguish a fire at an early stage of development.
  - Reduce egress time for occupants
- Property Protection, (avoid spread to adjoining properties)
- Fire Brigade Intervention
  - Provide better information to fire brigades to enhance fire fighting and evacuation outcomes.
  - Reduce false alarms, (risk associated with fire crews being at a false alarm when a genuine event takes place)

# The Fire Safety Engineering Approach



- **RSET:** “Required Safe Evacuation Time”  
Max. evacuation time permitted in the fire safety design solution  
Occupant Cue + Occupant pre-movement + Occupant travel time
- **ASET:** “Available Safe Evacuation Time”  
Max. evacuation time before untenable conditions, (self evacuation not possible)



# Fire Safety Objectives

## Other

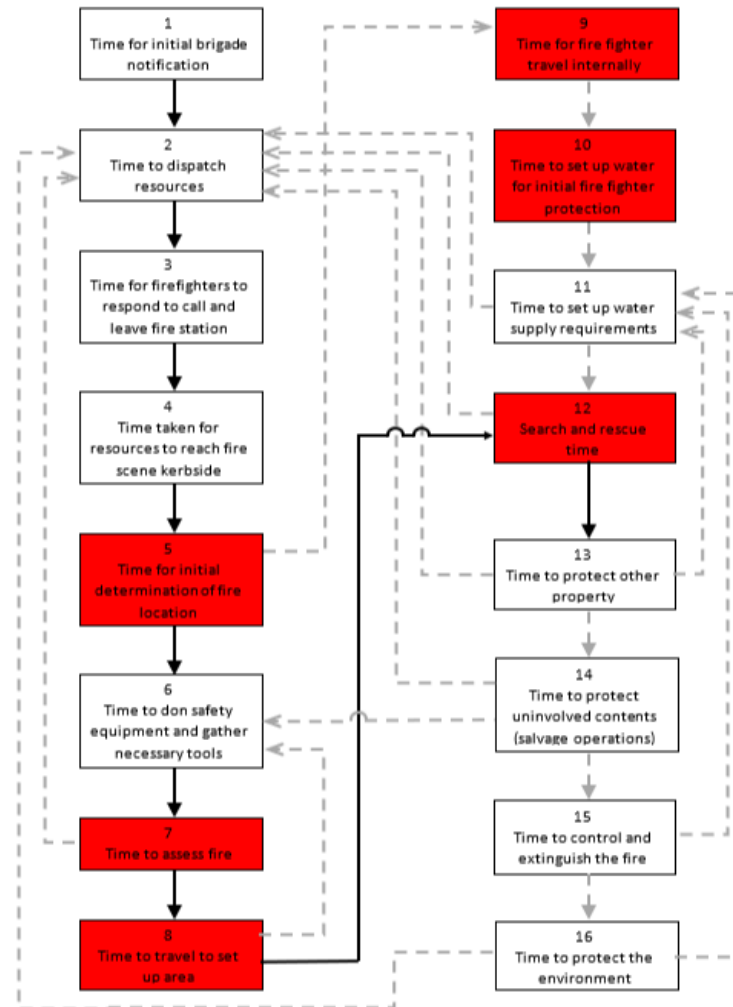
- Business continuity
- Asset protection
- Environmental protection
- Minimise inconvenience of fire safety compliance for occupants
  - Reduce false alarms. NSW Fire Brigade reports 97% of fire brigade call-outs annually are false alarms\*
  - Reduce occupant disruption, (reduce amount of time on site for tradespeople)
- Compliance cost transparency
- **Compliance transparency**
- Executive risk management/mitigation
- NDIS Compliance

*\*SOURCE: Mark Whybro, Fire NSW , “Research and education into modern fire problems”.*



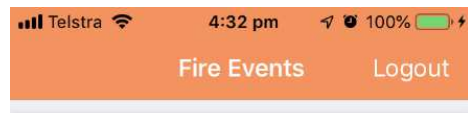
# Opportunities Summary

## Fire Brigade Intervention Model



# Reduce Detection & Pre-movement Times, (fire panel interfaced App)

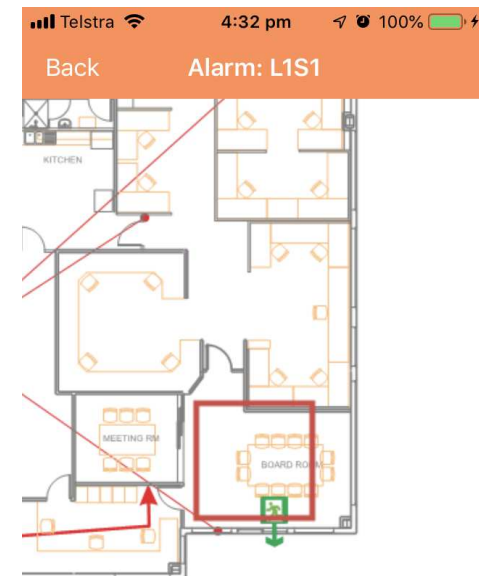
## App Event Screen



No current event

2019-01-08 15:56:59	Detector ID: L1S2 - Test Site - 33 R...
2019-01-08 15:56:00	Detector ID: L1S1 - Test Site - 33 R...
2019-01-08 15:55:29	Detector ID: L1S1 - Test Site - 33 R...
2019-01-08 15:54:48	Detector ID: L1S1 - Test Site - 33 R...
L1S1 Meeting Room	

## App Location Screen



ide Office





# Enhanced Way Guidance

Broadband Directional Sound



# Enhanced Egress Decision-making

More Information

# SFPE EUROPE



## INTELLIGENT ACTIVE DYNAMIC SIGNAGE SYSTEM: BRINGING THE HUMBLE EMERGENCY EXIT SIGN INTO THE 21ST CENTURY

*By Edwin R. Galea, Hui Xie, and Peter Lawrence*



# Enhanced Egress Decision-making

*Professor Edwin Galea, BSc, Dip.Ed, PhD, CMath, FIMA, CEng, FIFireE  
CAA Professor of Mathematical Modelling, Director Fire Safety Engineering Group,  
University of Greenwich*

*A new concept in emergency signage, which I call the 'Active Dynamic Signage System (ADSS)', extends the idea of smart buildings to emergency wayfinding, with a new generation of advanced emergency exit signs. Traditional emergency signs are not always noticed in an emergency and cannot adapt to the circumstances of an incident or a changing threat environment, even if they are directing people into potential danger.*

This technology can reduce egress times by up to 94% and enhance decision-making accuracy 4 fold\*

*\*SOURCE: SFPE Europe, Q1 2016, Issue No. 3, "Intelligent Active Dynamic Signage System: Bringing the Humble Emergency Exit Sign into the 21<sup>st</sup> Century"*



# Enhanced Egress Decision-making

Dynamic Signage, (Positive Reinforcement)



# Enhanced Egress Decision-making

Dynamic Signage, (Negative Reinforcement)



## Benefits of Dynamic Signage

- Perception increases 103% from 38% to 77%, overcoming “learned irrelevance”
- 90% of people understood red cross irrespective of age, language or cultural background
- 66% chose viable rather than nearest exit versus 1% in control conditions
- Decision time reduces from 2.6 to 1.8 seconds per decision



# Enhanced Evacuation Response

## Occupant Location Detection

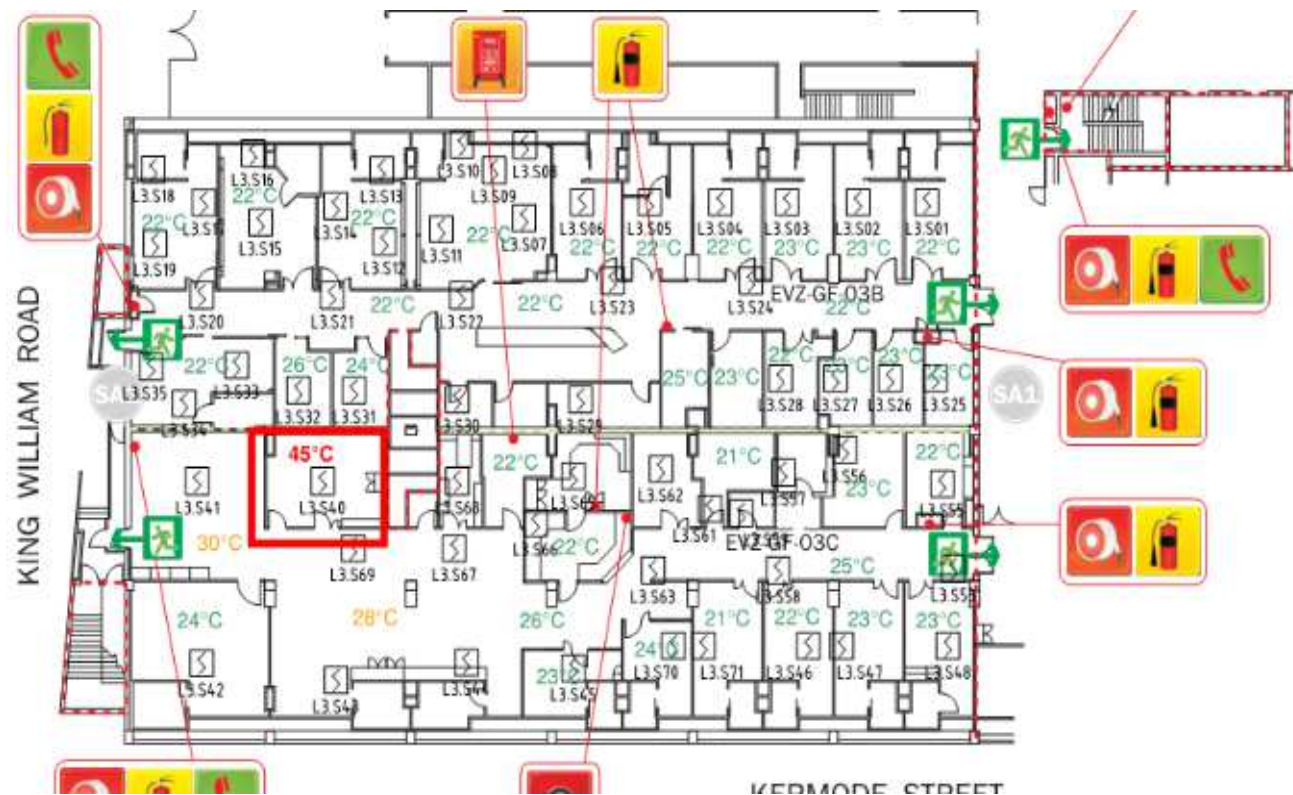


# Enhanced Fire Response

Dynamic Fire Location & Condition Information

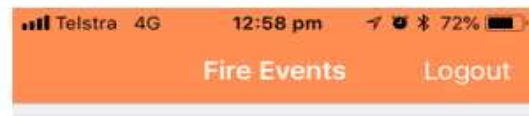
Fire Fighting Equipment Information

App Screen of responding Fire Crew



# Other Benefits

## Cost & Works Transparency; Executive Risk Mitigation



No current event

2018-08-3 1 11:55:12	<b>L3S34</b> Detector ID: - Test site for WCH
2018-08-3 1 11:54:00	<b>L3S34</b> Detector ID: - Test site for WCH
2018-08-3 1 11:29:18	<b>test flight map</b> Detector ID: L3S34 - Test site for...
2018-08-3 1 11:25:05	<b>L1S1 Test</b> Detector ID: - Test site for WCH
	<b>test flight map</b>



Event logs stored off-site in a web portal, and real time system status dashboards mean that Facility Managers can finally independently verify the condition of their fire safety assets, allowing costs to be independently verified, immediate actions to be taken in circumstances of non-compliance, thereby mitigating executive risk.

# Summary

The Internet of Things and Industry 4.0 presents a significant opportunity to enhance the interaction between buildings and cities to provide greater safety and operability for citizens.

At the same time technological innovation finally provides an opportunity to drive accountability over testing, maintenance and compliance regimes that have traditionally been imprecise and relied upon manual, (and often written), reporting.

This transparency provides accountability in relation to the cost of fire and life safety compliance for facility managers and building owners.

Most significantly, the outcome of the above is a giant leap towards the comprehensive, independently verifiable mitigation of risk for occupants, asset managers, building owners and their insurers.

A key outcome of enhances fire & life safety systems with be the increased market appeal, value and yield of assets with such innovations in place.

