



Science. Community. Arson 😊.

Stellenbosch University – Division for Social Impact 2018
Presented by: Dr Richard Walls – Fire Engineering Research Unit

Overview of presentation

- Informal settlement fires
- Research being undertaken
- Partners
- Opportunities...



Fire Engineering Research Unit



The closest academics can get to Mythbusters

What happens in a fire...

1. A typical South Africa informal settlement before a fire.



3. Two days after the fire. Relief construction materials were handed out to people who had lost their homes.

2. The same area after a fire



How do we know if “solutions” work?

- Limited data exists regarding:
 - Testing of solutions
 - Understanding technical details surrounding the current problem (temperatures experienced, smoke products produced, speed of spread, behaviour of construction materials, people movement during disasters, etc.)



Research Being Undertaken



Research Group Objectives

- Understand fire behaviour in shacks.
- Produce data that can be used for developing solutions.
- Investigate which detectors are most suitable for informal settlements.
- Develop a “standard shack fire” test.
- Understand human response during fires
- Develop models to predict fire spread through areas to highlight potential risks and look at which solutions are most suitable.
- Provide guidelines for improving fire safety.
- Potentially provide guidelines for forensic investigations after shack fires have occurred.

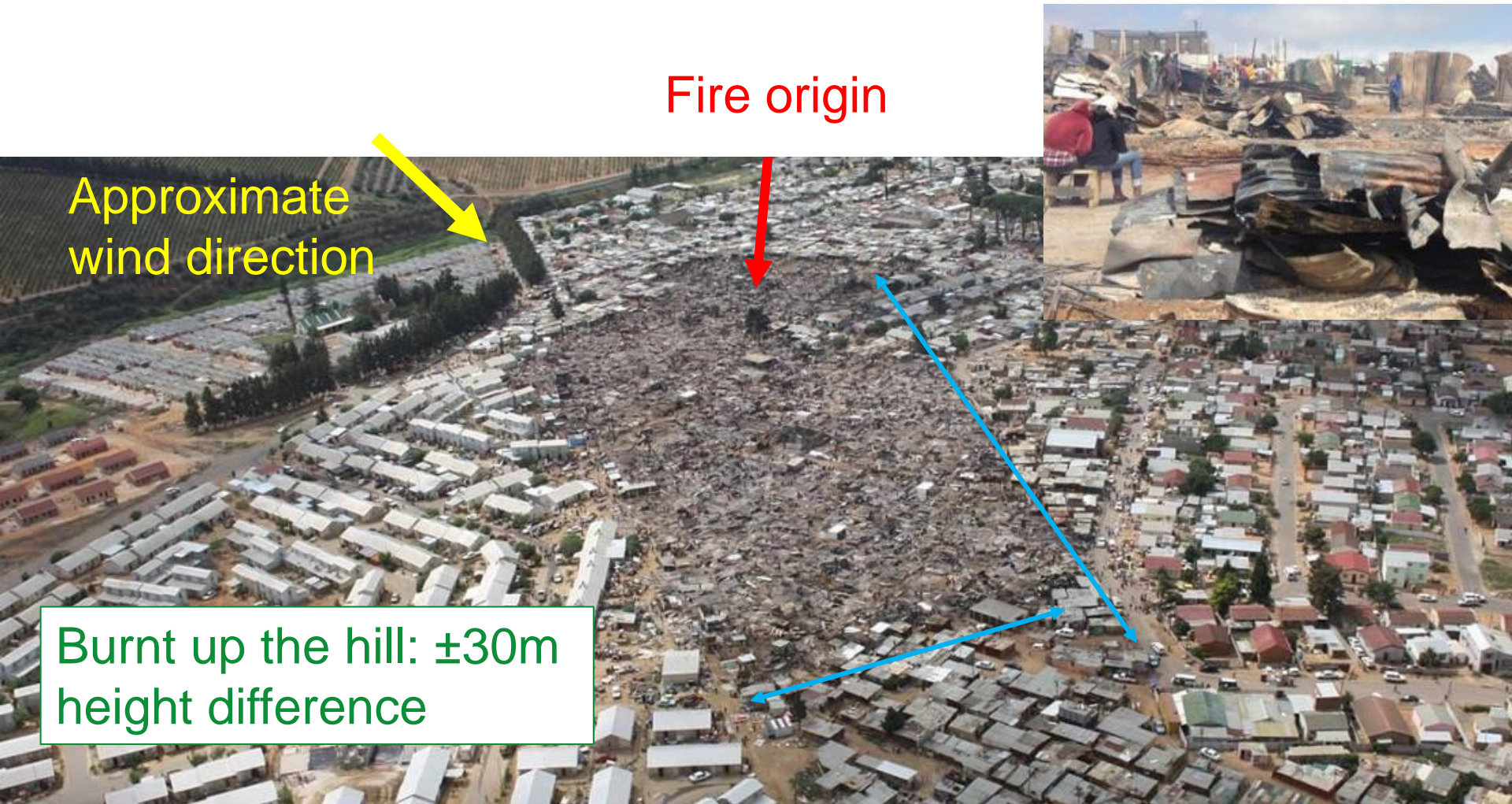


Research Group Objectives

- Train the next generation of fire engineers.
- Work with government officials, fire brigades, municipalities, NGOs, etc. to find solutions.
- Local and international partnerships to assist with development.



Kayamandi – 4500 people left homeless



$\pm 120 \times 450\text{m}$





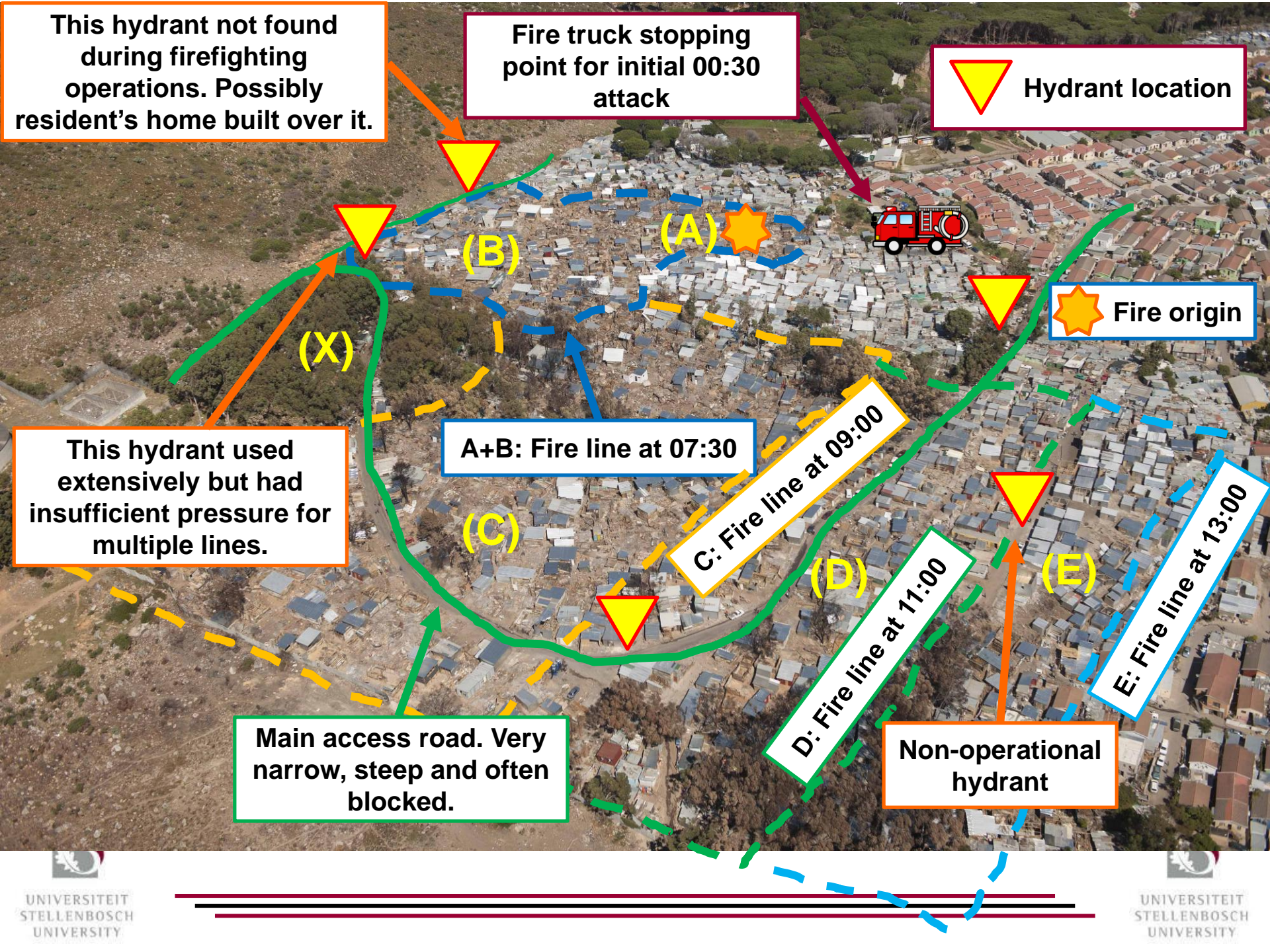
© Sullivan Photography

<https://www.facebook.com/SullivanPhotographyZA/>



© Sullivan Photography

<https://www.facebook.com/SullivanPhotographyZA/>



This hydrant not found during firefighting operations. Possibly resident's home built over it.

Fire truck stopping point for initial 00:30 attack

Hydrant location

Fire origin

This hydrant used extensively but had insufficient pressure for multiple lines.

A+B: Fire line at 07:30

C: Fire line at 09:00

D: Fire line at 11:00

E: Fire line at 13:00

Main access road. Very narrow, steep and often blocked.

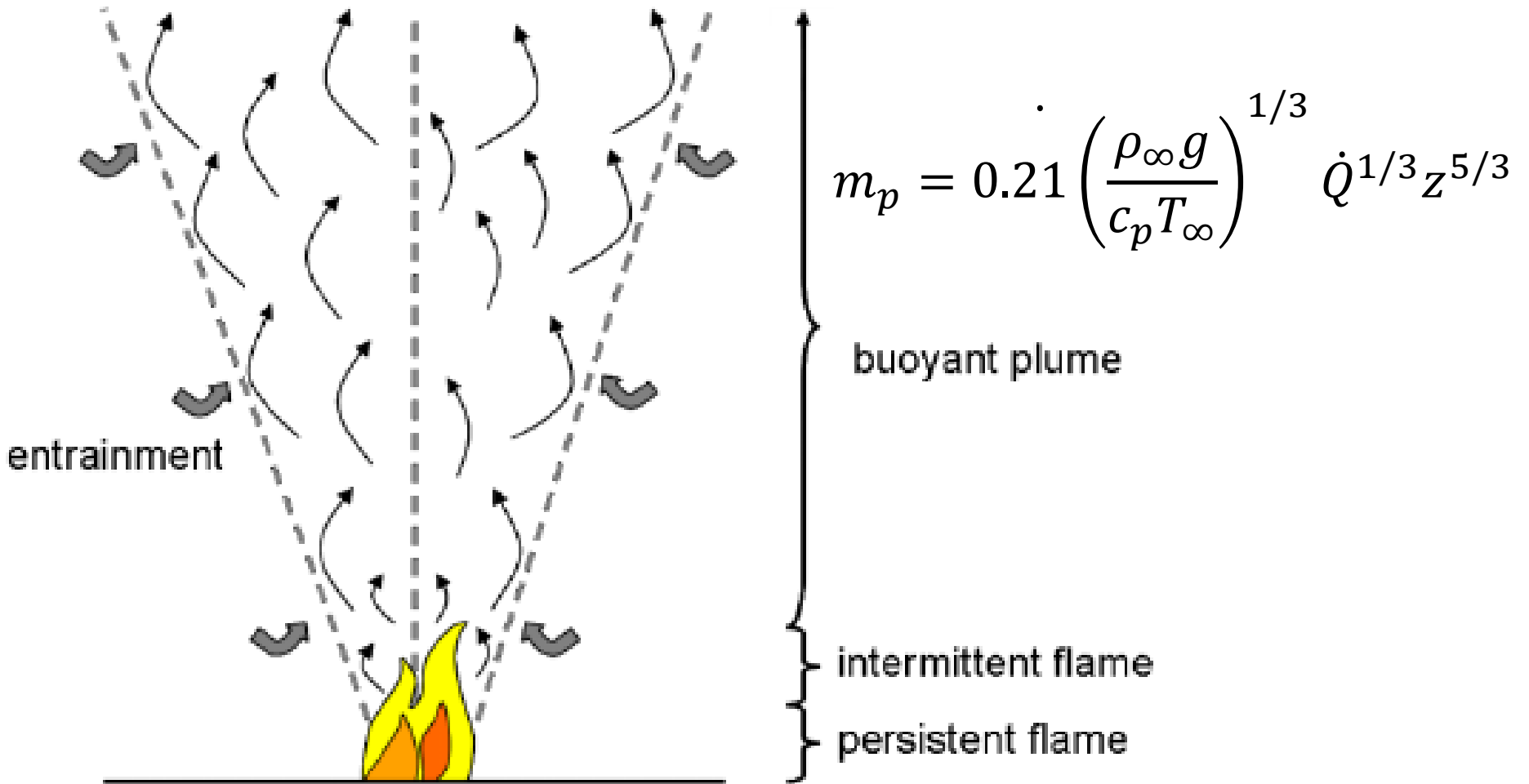
Non-operational hydrant

The map shows an aerial view of a residential area with a fire incident. The fire origin is marked with a yellow star in zone A. The fire spread into five distinct zones, each color-coded and labeled with a letter. Zone A is the initial fire origin. Zone B is the area immediately surrounding the origin. Zone C is the area to the east of zone B. Zone D is the area to the north of zone C. Zone E is the area to the north of zone D. The map also shows the location of Phalo Ave and the OR Tambo R. The wind direction is indicated by a blue arrow pointing from the southeast towards the northwest. The initial wind direction is indicated by an orange arrow pointing from the southeast towards the northwest.

Name:	Time:
Area A	23:30-01:00
Area B	01:00-07:30
Area C	07:30-09:00
Area D	09:00-11:00
Area E	11:00-13:00
TOTAL:	

Trees (with +/-200 houses below) protected by firefighting efforts, aerial support and wind direction

Fire origin







Only 2-4°C temperature
increase at roof



UNIVERSITEIT
STELLENBOSCH
UNIVERSITY

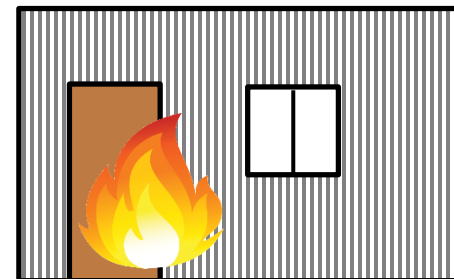
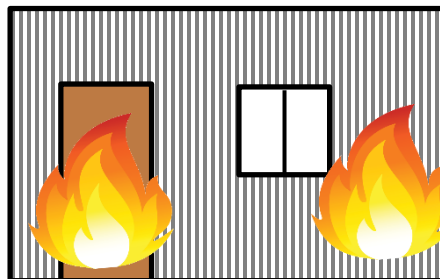
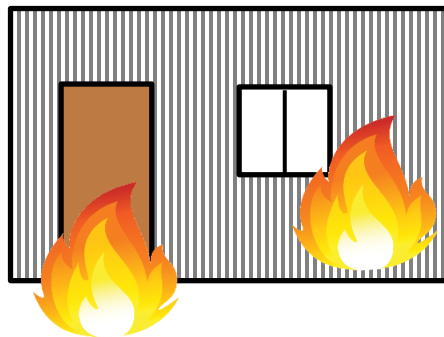
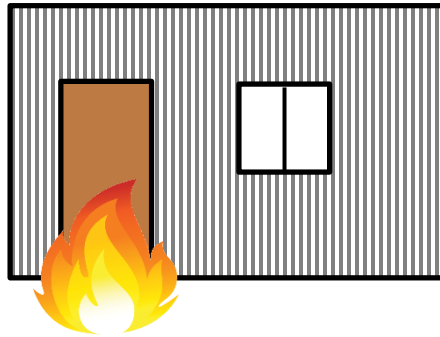


57

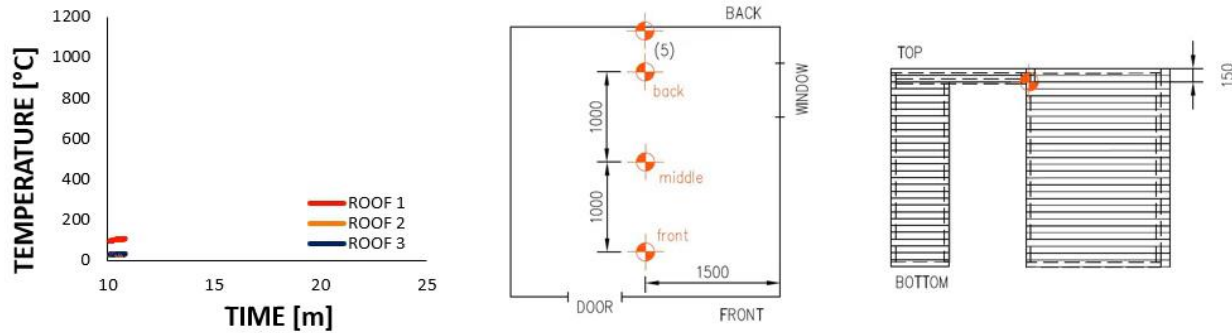




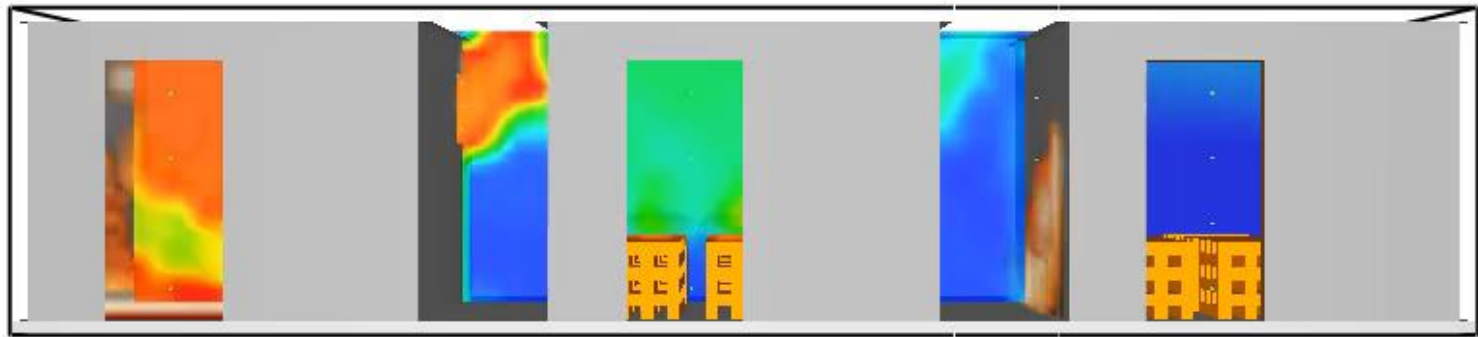
Development of Standard Shack Fire Test



RESULTS: MULTI-ISD ROOF TEMPERATURES

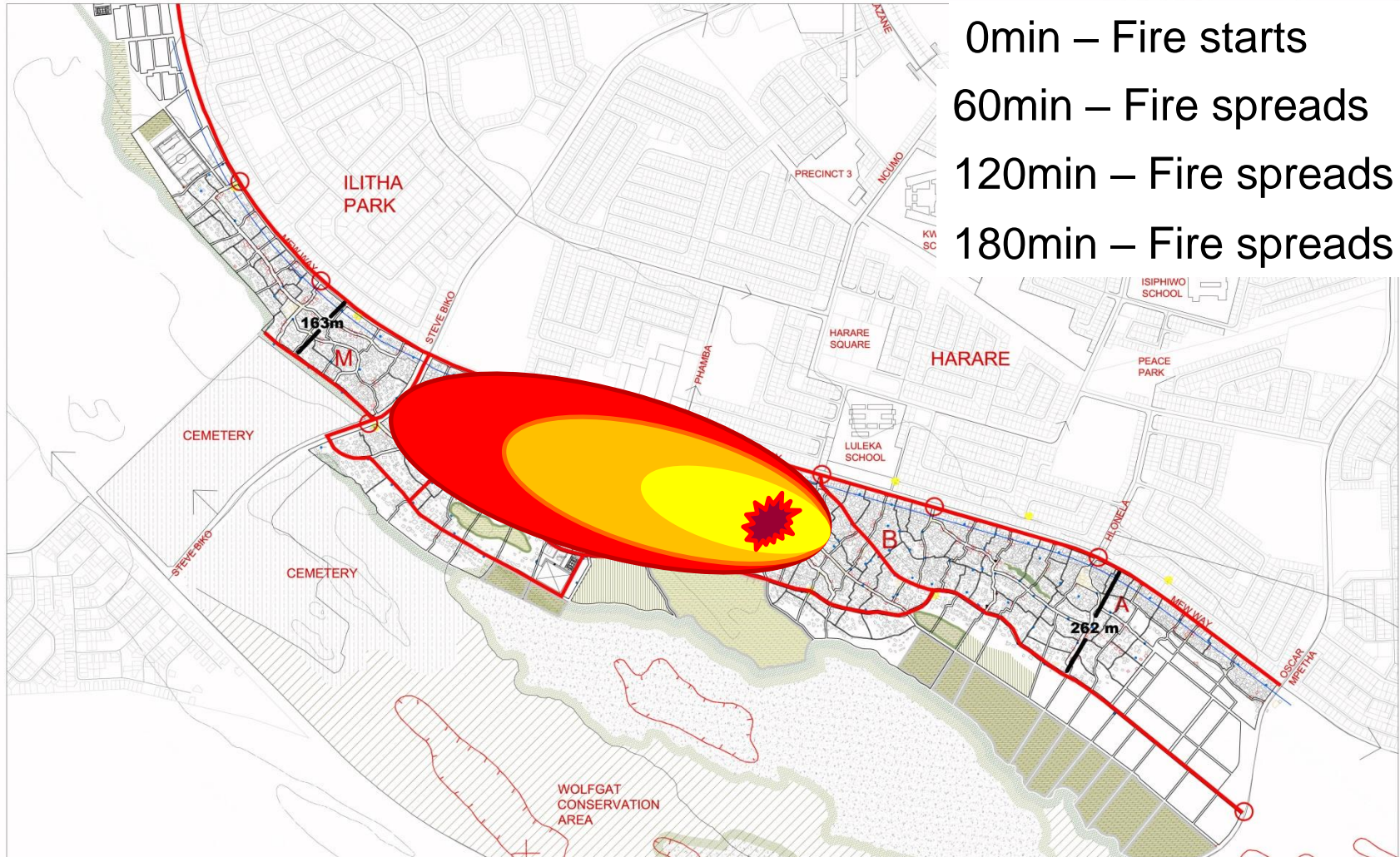


FLASHOVER



(Cicione, 2018)

Fire Spread Modelling?



0min – Fire starts
60min – Fire spreads
120min – Fire spreads
180min – Fire spreads

IRIS-Fire

- Improving the Resilience of Informal Settlements to Fire (IRIS-Fire). SU has teamed up with the University of Edinburgh for this work.
- R4.4m awarded to SU.
- Postdoc employed and extensive research equipment being purchased.



IRIS-Fire

- Research topics:
 - Community surveys
 - Full-scale burn tests on up to 50-70 shacks
 - Extensive fire modelling and testing
 - Develop guidelines for improving safety



Smoke Alarm Testing

- Smoke and fire alarms tested in 2016
- Most effective technology identified rolled out by WC Disaster Management.
- 1400 smoke alarms installed in Wallacedene, sponsored by Santam (implementation by RADAR). Lives saved already.
- Further testing to happen soon (Dept. of Electrical Engineering assisting).

Projects & Partners

- **IRIS-Fire:** University of Edinburgh, Breede Valley Fire Station & WCDMFRS
- **Smoke alarm development:** WCDMFRS & Oklahoma State University
- **Intervention testing:** WCDMFRS, Breede Valley Fire Station, CoCT
- **Knysna fire investigation:** Santam & WCDMFRS (RADAR & CSIR & Vulcan Wildfire Management)
- **Full-scale steel building testing:** SAISC

- **Bursaries:** AECOM
- Funding in the pipeline...

Media / Community Response



Mr Eksteen presenting to the Premier of the Western Cape, Helen Zille and Minister Anton Bredell

1 400 Smoke Alarms in Wallacedene



Media / Community Response

- Multiple interviews on radio Cape Talk with Kieno Kammies.



Smoke detectors save life

Wallacedene residents give thanks

CAPE ARGUS
26 JULY 2017, P.3

Bronwyn Davids

THE smoke detectors installed in Wallacedene TRA informal settlement are doing their job and have saved one life already.

Community leader Thembelane Mzola, who was trained by Western Cape Government Disaster Risk Management Fire and Rescue and University of Stellenbosch University Engineering Department specialists to install and maintain the photoelectric smoke detectors, said the number of fires had been reduced this winter.

Mzola said there had been 20 fires in the settlement last winter and one young boy was badly burnt when plastic melted on to his skin.

There was only one fire this winter. Neighbours heard the alarm and were able to break down their friend's door and drag him from his burning bed. They were then able to put out the fire.

"Some people complained at first but people don't know until they see what is happening: that the detectors save people's lives and keeps their houses from being burnt," said Mzola.

He said the community members who were trained to install and maintain the detectors and are paid a small stipend by the Western Cape government, inspect the detectors regularly with the university specialists, who are engaged in ongoing research.

Rodney Eksteen, assistant director at the Provincial Disaster Management Centre, said: "We believe that photoelectric smoke detection technology engineered into a self-contained device with a silence feature and long-life battery with a 10-year lifespan will alert occupants of a fire and provide the necessary time to escape, three minutes."

"About 70% of all fire deaths in the Western Cape occur during sleeping hours."

Eksteen said the devices were installed in bedrooms, away from cooking areas



LIFESAVER: A photoelectric smoke alarm with long-life lithium battery.

To comment on this story email capetalk@capeargus.co.za or send a SMS to 027 3345 6555 (R1)
Provide your physical address and phone number (not for publication).

which would activate the alarm.

Already 5 000 smoke detectors had been installed in informal settlements and other vulnerable facilities in the Western Cape, he said.

Over 1 200 devices had been installed at Wallacedene and with the assistance of the private sector and the university, they would be rolled out to other vulnerable communities, in spite of budgetary constraints.

Local Government, Environmental Affairs and Development Planning MEC Anton Bredell said: "For too long too little has been done to proactively tackle the scourge of fires in our informal communities and many lives and lots of property has been destroyed. The goal of this project is to install smoke alarms in our vulnerable communities that will wake people up before it's too late."

Local fire services a world leader in fire research

Angelo Julies

The Breede Valley Fire Department (BVFD) recently hosted yet another fire test at the local station facilities to promote research regarding the issue of fires in informal settlements.

On 4 July the BVFD were joined by researchers from the Oklahoma State University, Stellenbosch University (SU) and officials of the Breede Valley municipal mayoral committee during the testing of smoke detectors.

"The BVFD, Western Cape Government Disaster Management & Fire Brigade Services and SU Engineering Faculty have been involved in a partnership since 2016 to do research regarding the issue of fires and fire deaths in informal settlements," said, Neels de Klerk, station commander: fire prevention.

According to him the research aims at understanding fire load, fire



The Breede Valley Fire Department is said to be a world leader in fire prevention research.

spread and construction models for future tests. "It also aims to identify the most appropriate smoke alarm installation methods and specifications that would be suitable for conditions in informal houses."

Niell Mercuur, BVM speaker, in his welcoming address, said

"these fire deaths are a major cause of concern for the administration of this municipality" and highlighted the achievements to date.

"Tests like these provide the fire service fraternity with the evidence of what can work, as opposed to making assumptions and misusing

public funds on projects that are not properly researched and backed by the academic fraternity."

Ed Kearthly from Oklahoma State University congratulated the municipality, fire services and their partners for their innovative approach in solving fire-related deaths in their

communities. Dr. Richard Walls praised the BVFD and said: "After presenting my initial research paper at a conference in Sweden a couple of weeks ago, some of the best fire engineering people in the world are now looking at South Africa as the leaders of this type of research."

"The BVFD has installed more than 1 500 smoke alarms in informal houses over the last 18 months as part of the research project. Numerous reports of instances where the smoke alarm activated and prevented possible destruction were reported," De Klerk added.

The Fire Department urges the community to install smoke alarms in formal and informal houses. Any organisation or business that wishes to assist by donating smoke alarms for informal areas or non-profit organisations who cannot afford a smoke alarm, can contact the fire department on 023 348 9060 during office hours.

Publications

- In 2018 the following papers will be submitted / have already been submitted:
 - Journal papers: 6-9
 - Conference papers: 3



Opportunities / where to next...

- Many exciting opportunities. World-first research is being conducted which can impact poor communities.
- Desperate need for technical solid but socially suitable solutions to be developed.
- Experimental facilities being developed to further the investigations.
- Companies need fire engineering staff so may be willing to support bursaries.
- Funding being sought to establish an MEng in fire engineering.



Questions?

