CSTB
le futur en construction

Timber Fire resistance Simulation of fire behaviour

Paul Lardet – 2023-06-05

Current main research topics on timber and fire

Fire reaction

MASS LOSS RATE CARACTERIZATION, FLAMING CONTRIBUTION
IMPACT ON THERMAL CONDITIONS DURING FIRE
EXTINGUISHMENT CRITERIA
SMOULDERING COMBUSTION

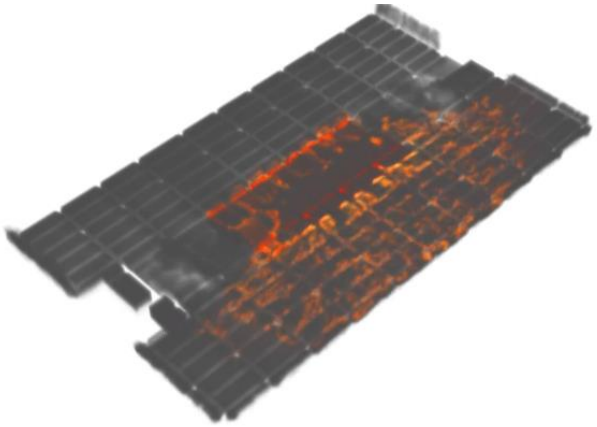
Fire Resistance

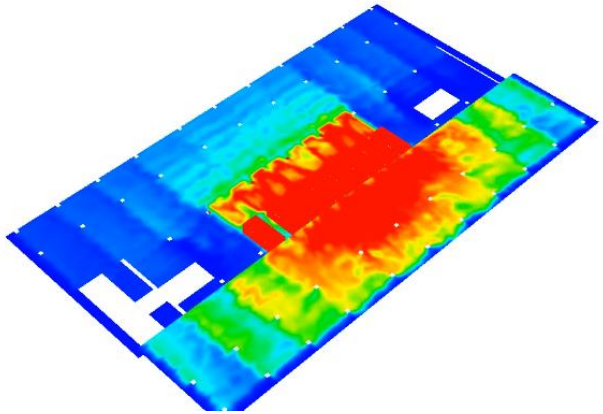
BEHAVIOUR UNDER REAL FIRE CONDITIONS VS. ISO834
INFLUENCE OF MOISTURE TRANSPORT
COOLING AND LONG TERM BEHAVIOUR
JOINTS BEHAVIOUR

Numerical simulation

MASS LOSS RATE PREDICTION
THERMAL AND MOISTURE FIELDS PREDICTION
MECHANICAL BEHAVIOUR

Recent timber and fire research history





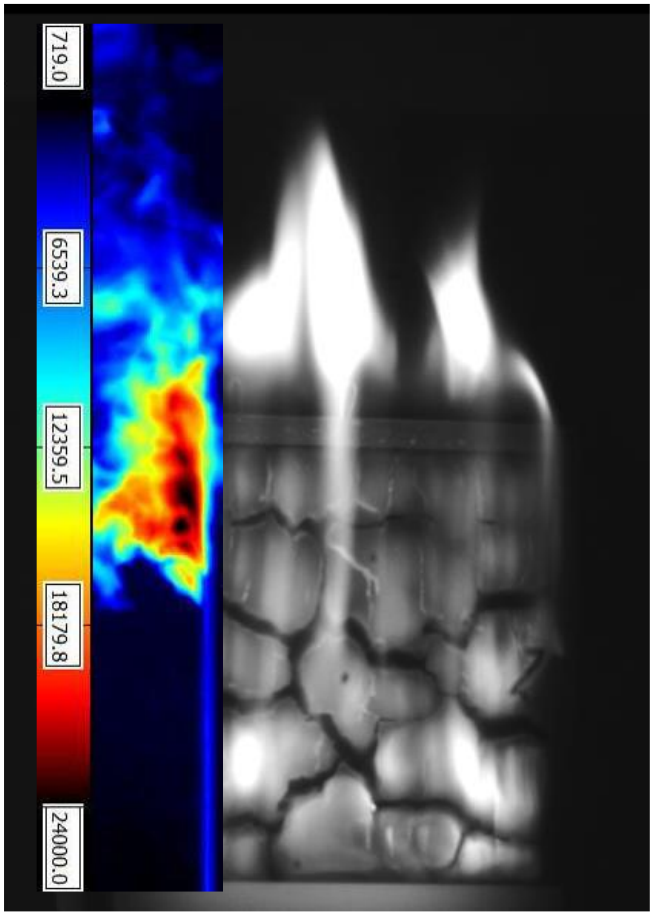
2016 – 2019 : timber/concrete car park fire resistance

WELL VENTILATED CAR PARK, TIMBER FRAME AND CONCRETE FLOORS

CAR FIRE CHARACTERIZATION TEST
TIMBER FIRE REACTION CARACTERIZATION TESTS
ENGINEERING MODEL OF TIMBER REACTION TO FIRE
CFD NUMERICAL SIMULATION, INCLUDING TIMBER CONTRIBUTION TO FIRE
REAL SCALE TEST W/ 7 CARS
CFD + MECHANICAL SIMULATION OF REAL CAR PARK

LARDET, PAUL, ET AL. "AN ENGINEERING MODEL FOR IGNITION AND EXTINCTION OF WOOD FLAMES USING BENCH-SCALE DATA." JOURNAL OF PHYSICS: CONFERENCE SERIES. VOL. 1107. NO. 3. IOP PUBLISHING, 2018.

Recent timber and fire research history : Fire Reaction



Limits : timber mass loss rate to be more precisely quantified

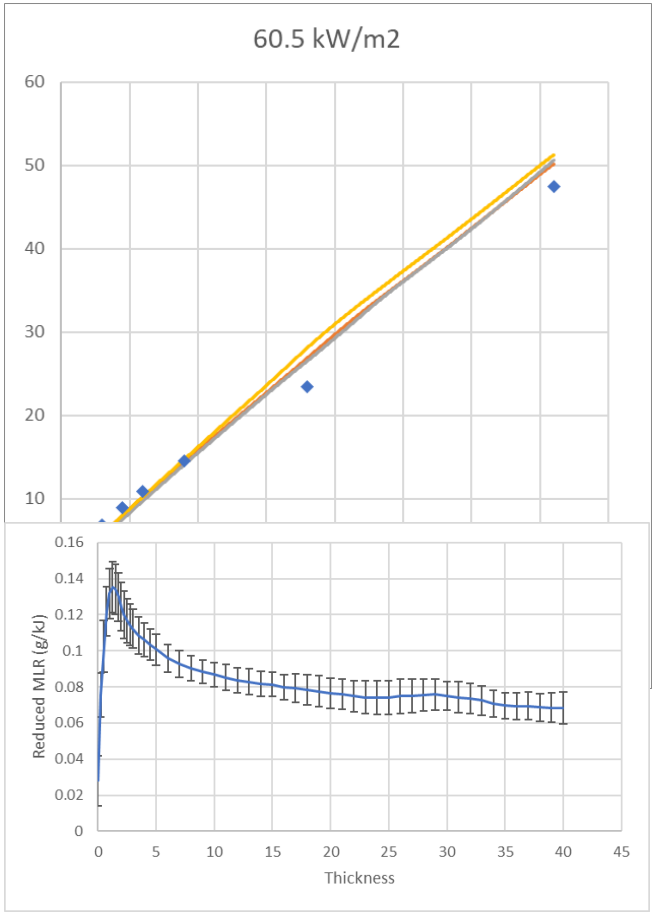
2 consecutive PhDs : 2017-2023 (Lucas Terrei and Hassan Flitty)

Topics :

TIMBER DEGRADATION / FLAMING / EXTINGUISHMENT
THERMAL CHARACTERIZATION
TEMPERATURE MEASUREMENTS IN WOOD

6+ Publications

Recent timber and fire research history : Fire Reaction simulation



Data from PhDs to be analyzed :

New mass loss rate model

Need for a simple and fast model to be used in FSE studies

Arhenius-based models too complicated and slow to use

Heat-flux based models too simple and severe to use

→ New model including char layer impact on mass loss rate

Currently under validation

Recent timber and fire research history : Thermal conditions during fire

Limits : difficulties to predict flaming extinguishment

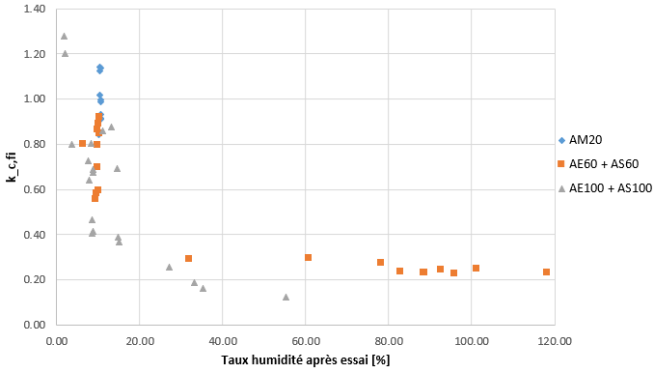
Depends on a lot of parameters

2021-2022 : Middle scale test series

INFLUENCE OF TIMBER WALL AMOUNT
INFLUENCE OF VENTILATION AND OPENINGS
INFLUENCE OF GEOMETRICAL CONFIGURATION

Data under investigations

Recent timber and fire research history : Fire Resistance



Limits : mechanical characteristics of timber not well known

EUROCODE 5 DATA (NF-EN-1995-1-2)
WEAKNESS AT MODERATE TEMPERATURES

Small scale timber mechanical tests : 2020

PhD started in fall 2021 (Hussein Daher)

Topics :

MOISTURE/TEMPERATURE INTERACTIONS
COOLING PHASE

Future work and needs - timber and fire

Mass loss rate prediction

- Need for large scale validation tests, w/ detailed heat flux and mass loss rate measurements

Temperature / moisture interactions :

- Characterization and predictive modelling
- Influence on mechanical behaviour, predictive modelling

Parameters influencing smouldering combustion after fire

Standard elements and joints behaviour under real fires

Fire protection of timber walls and joints under real fires