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impacts dynamics of fluviatile hazards on buildings

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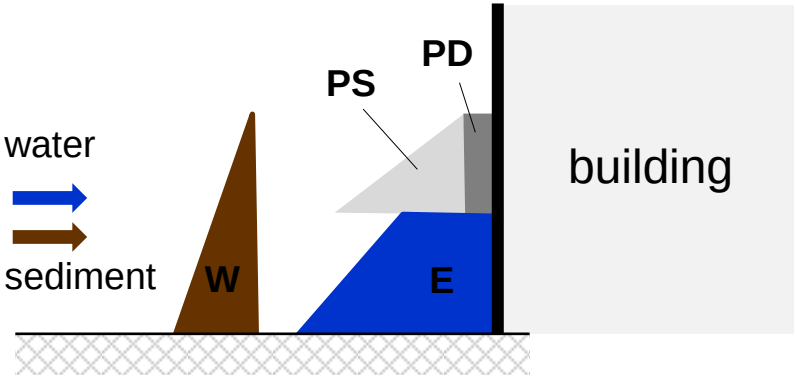
Schnannerbach torrent, 08/2005 (source: FF Schnann)

Schallerbach torrent, 02/2017 (Source: Bezirksblätter)

process model ⟷ impact model



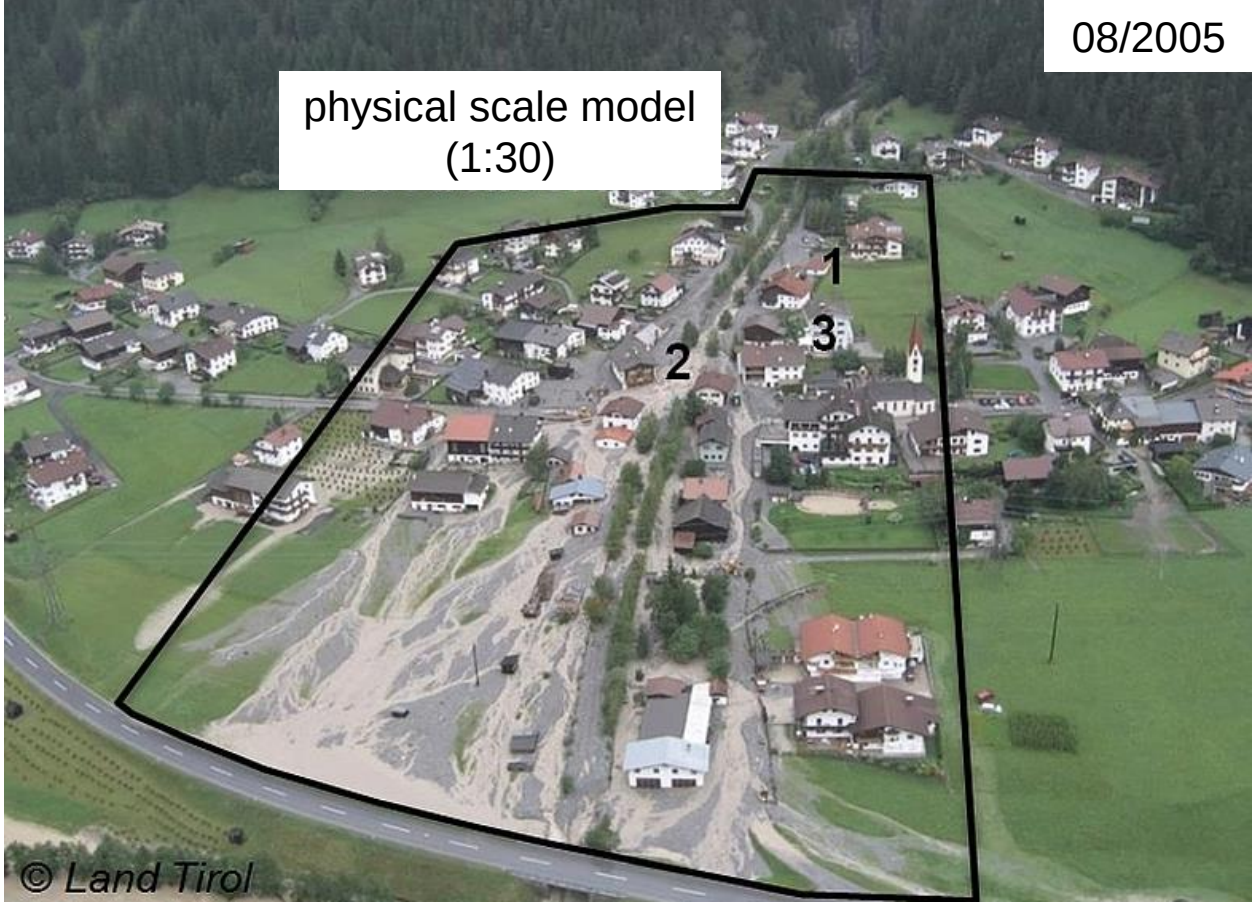
W	water (hydrostatic)
E	deposition (active earth pressure)
PS	process (static)
PD	process (dynamic)

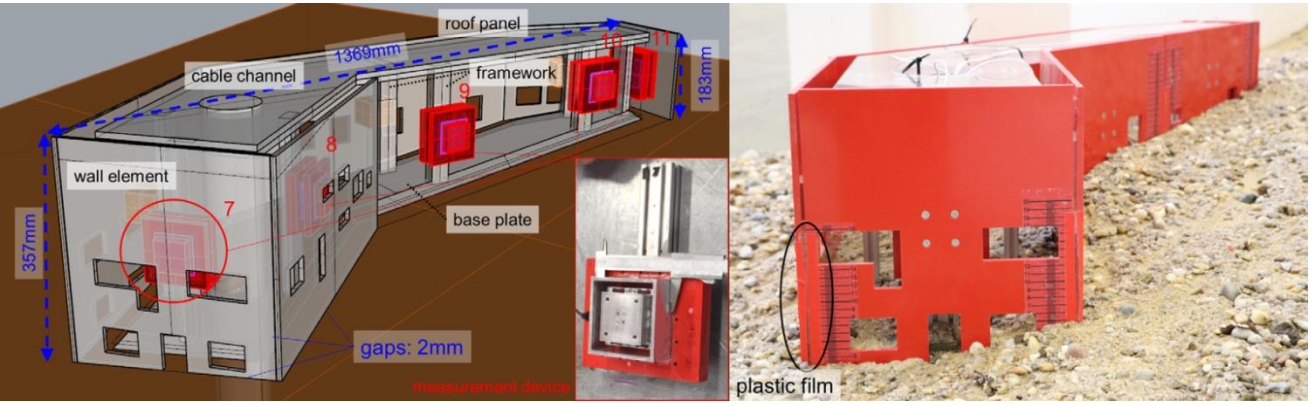
case study
Schnannerbach torrent

- catchment area 6,3 km²
- torrent channel 13 %

- design event
  ~ 30 m³/s water
  ~ 35.000 m³ bed-load

- regressive sedimentation in torrent channel



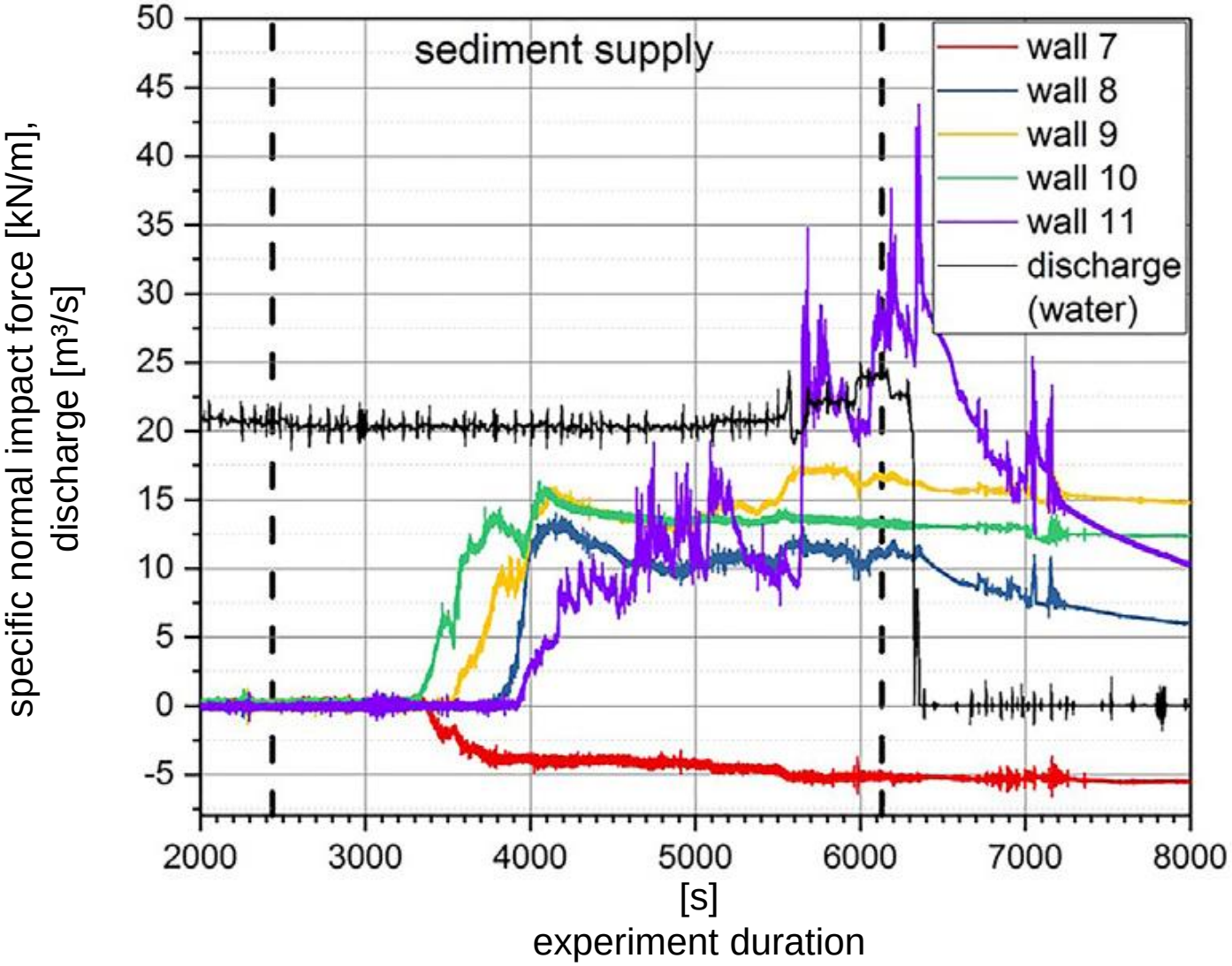


building reconstruction

- three-axial pressure sensores
- material intrusion

reference:
Sturm M., Gems B., Keller F., Mazzorana B., Fuchs S., Papathoma-Köhle M., Aufleger M. (2018) Understanding impact dynamics on buildings caused by fluviatile sediment transport. Geomorphology 321: 45-59. https://doi.org/10.1016/j.geomorph.2018.08.016

fluviatile bed load transport – impact dynamics



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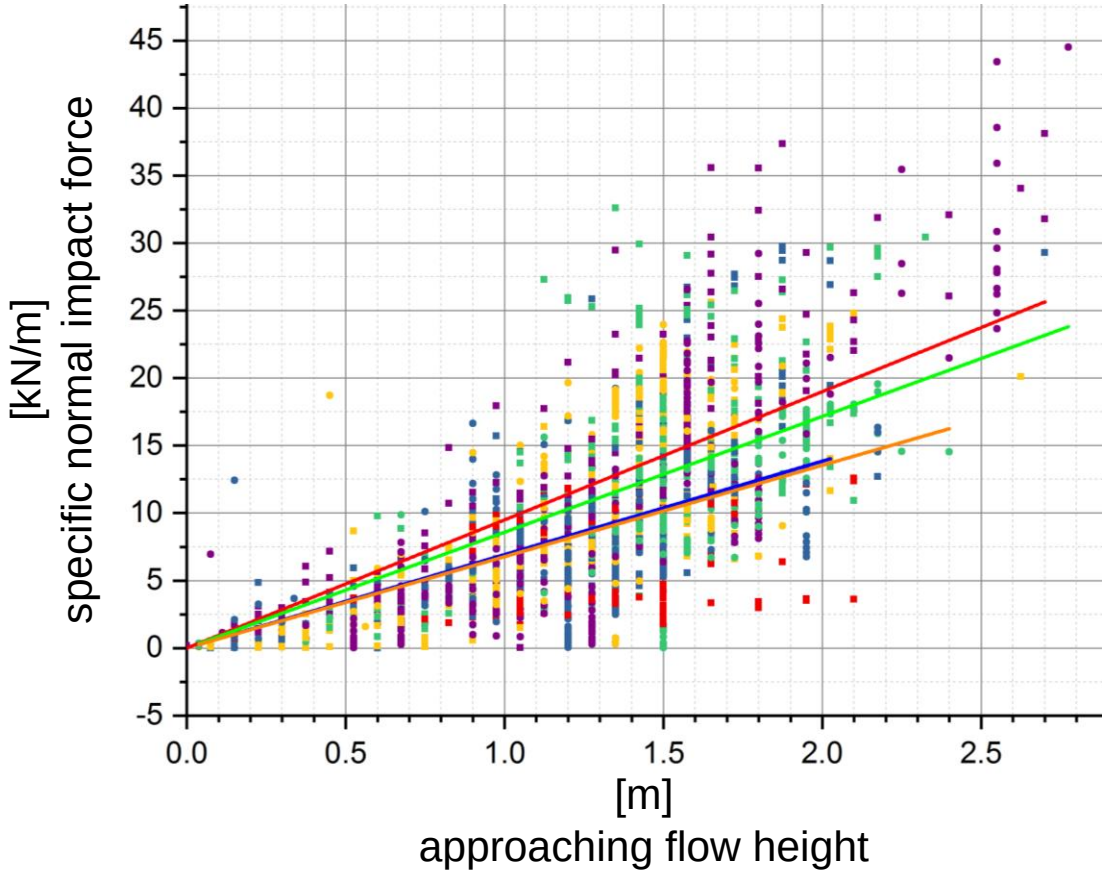
Sturm M., Gems B., Keller F., Mazzorana B., Fuchs S., Papathoma-Köhle M., Aufleger M. (2018) Understanding impact dynamics on buildings caused by fluviatile sediment transport. Geomorphology 321: 45-59. https://doi.org/10.1016/j.geomorph.2018.08.016

ratio of specific normal forces and approaching flow heights



regression

all buildings, no openings
all buildings, openings

single building, no openings
single building, openings

reference:
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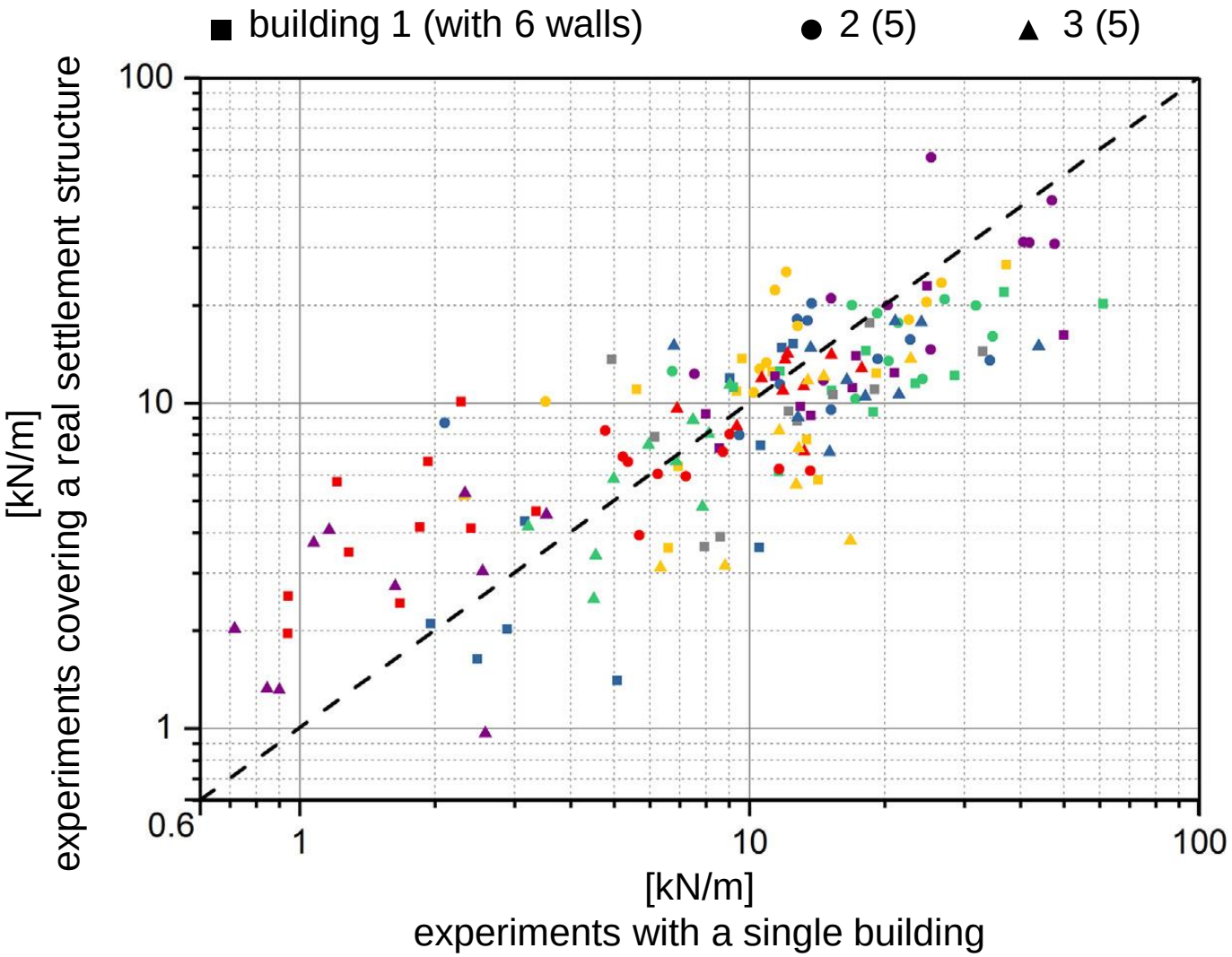
specific normal impact forces



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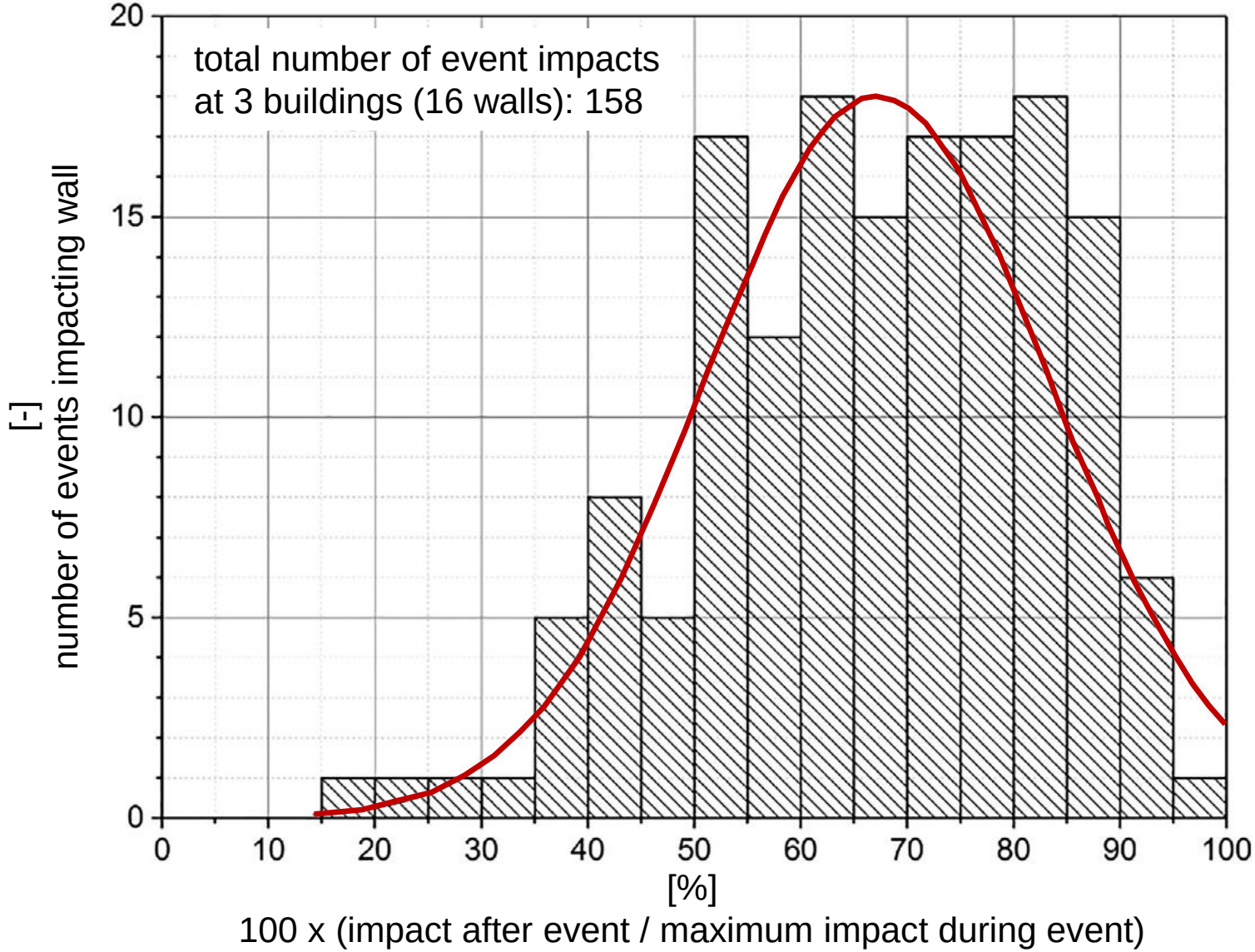
specific normal impact forces



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summary

- **clear-water conditions**

  maximum impacts ~ 15 kN/m
  clear relation approaching flow height – normal impact force

- **bed-load transport (fluviatile, no debris flow)**

  maximum impacts ~ 60 kN/m
  highly dynamic impact patterns (spatially and temporarily)

  settlement structure (number and locations of buildings) highly relevant

- rough estimation of potential impacts on buildings ➡ **simplified analytical approaches**

  more detailed studies ➡ **complex models** (experiment, numeric)

reference:
Sturm M., Gems B., Keller F., Mazzorana B., Fuchs S., Papathoma-Köhle M., Aufleger M. (2018) Experimental analyses of impact forces on buildings exposed to fluvial hazards. Journal of Hydrology 565: 1-13. https://doi.org/10.1016/j.jhydrol.2018.07.070
Sturm M., Gems B., Keller F., Mazzorana B., Fuchs S., Papathoma-Köhle M., Aufleger M. (2018) Understanding impact dynamics on buildings caused by fluviatile sediment transport. Geomorphology 321: 45-59. https://doi.org/10.1016/j.geomorph.2018.08.016