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Comparison of studies from Denmark, Spain and Brazil

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## Evacuation of school children

Comparison of studies from Denmark, Spain and Brazil

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Many countries have implemented performance based fire codes, where instead of following the prescriptive requirements the safety level of a building is evaluated by holding the required safe egress time (RSET) for the occupants in the building up against the available safe egress time (ASET). In order to make a design that enables all persons in a building equal and safe egress, mixed populations need to be described. However, studies on young, able bodied people have been used in experiments for retrieving input data for models. A large part of the actual population comprehending old and young aged people as well as people with impairments is badly described in present literature, forcing designers to use data to represent other parts of the population than it is documented for. Some handbooks and design guides mention special measures regarding children. However, the documentation is little and incoherent. There exists neither an evacuation theory including movement parameters that specially applies for children nor a guideline stating when it is appropriate or realistic to apply adult's values regarding evacuation, on children and youth. All in all literature provides very limited data on children's movement parameters and evacuation behavior.

In recent years the fire safety society has been catching up and new evacuation data on various subgroups has been produced<sup>1,2,3,4</sup>. The data collection will hopefully continue so that the whole of the population can be represented when it comes to fire safety. Starting in 2009 the Technical University of Denmark has contributed to the data collection regarding evacuation of children through the KESØ project<sup>5,6</sup>. The focus has mainly been on pre-school aged children, that are children aged 0-6 years, and that research is still ongoing. However, in year 2010 data was collected from full scale fire drills in elementary schools in Denmark<sup>7</sup> for children aged 6-15. The drills were partly unannounced as the teachers knew the day of the drill and in most of the schools the drill had been explained to the youngest students, since this was their first. The films were among others analyzed for travel speed and evacuation behavior, while moving down stairs. At least two more studies<sup>8,9</sup> on children have been carried out in recent time including school evacuations, in Spain and Brazil, presenting evacuation parameters and new data on children.

Cultural differences have been found to make a difference in travel speed as a function of density when comparing results from Germany and India<sup>10</sup>. Furthermore an evacuation drill involving two groups of university students in Australia and Sweden also showed a cultural effect on the evacuation behavior. A different degree of seriousness, as well as group behavior could be seen, where the fire alarm was taken more serious in Australia than in the Swedish drill<sup>11</sup>.

The goal of the present work is to compare the results of the three studies that all provide some numerical data regarding travel speed. However observations have been made on different areas. The Danish study looked at handholding during the evacuation<sup>7</sup>, the Spanish observed if the children placed one or both legs on each step<sup>8</sup> and the Brazilian studied how the speed of the leading child in each group influenced the total movement speed<sup>9</sup>.

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