Results of CESAR

Climate is going to change! Both extreme and gradual climate and weather changes can have major consequences for the functioning of cities and transport systems and travel behaviour of individuals. In CESAR (‘Climate and Environmental change and Sustainable Accessibility of the Randstad‘), several research groups studied these effects of climate change. What are the main findings?

Important for transport are the local weather conditions (‘microclimate’).Temperature differences depend on weather, but also the design of the built environment and the presence of water. Temperatures in a street are a combination of sunlight and shadow and the retention of thermal radiation from buildings. In case of high buildings and narrow streets, little thermal radiation can escape which leads to temperature increase. On the other hand decreased solar radiation has a reducing effect on temperature. The final effect depends on the season: in summer higher buildings and narrow streets have a reducing effect on temperature; in winter an increasing effect. The temperatures in a city are also dependent on the presence of water. In daytime well-mixed water remains generally cooler than the air and as a consequence lowers the air temperature; in the evening and night when water temperature will be higher than air temperature water has a warming effect on the environment. This keeps the temperature in the evening in cities with lots of water warmer than in cities without water.

Urban microclimates work through daily mobility. In 2050, winters are warmer and wetter than today and will possibly lead to higher bike shares compared to especially the car; heat gains in summer will lead to a decrease in bicycle use. As the only weather condition, temperature has a non-linear effect on bicycle use: till a daily maximum air temperature of 25 °C temperature rise leads to an increase in bicycle use; above this temperature cycling actually declines. These effects appear relatively small in dense central areas but higher in more remote, sparsely built-up areas.

Finally, it appears that weather causes significant emotional experiences. High precipitation, strong winds and heavily overcast, but also heat cause negative emotional experiences while being mobile. It also appears that pedestrians and cyclists, in particular, experience less thermal comfort than the highly protected car driver.

Knowledge about climate impacts on urban microclimate and travel behaviour should be integrated into policy processes. The study on ‘Planning Support Systems’ (PSS) shows that 'quick wins' for policy lie not so much in sophisticated measurement models, but especially in sorting out the boundary conditions, like having a good moderator for the group process, a clear agenda for interactive workshops, sufficient preparation time and attention to the interface and visual output of instruments. In addition, scientists must make a pre-selection of findings that are really important in a PSS and introduce these properly. Finally, disciplinary knowledge and skills should be considered. Traffic engineers and environmental experts are far more accustomed to work with quantitative models than urban developers who largely work intuitively and creatively. The crux is to find a shared language for all disciplines. Digital card tables could provide this.

CESAR shows that climate proof transport cannot be without a good dialogue between scientific and policy disciplines. Meteorologists and urban planners will focus in particular on the supply of vegetation, water, building heights and density to develop suitable urban microclimates. What suitable is depends highly on studies of human geographers on the perception, constraints, opportunities and desirable behavioural choices of users of cities and transport systems. Finally, policymakers should weigh the interests of users against other collective interests, such as of the urban economy and the environment.