Worldwide, we are increasingly being confronted with extreme weather events. Because of climate change also the weather in the Netherlands is expected to show more extremes in rainfall, sea level rise and storms. This affects the operation of the Port of Rotterdam. Besides the port facilities itself, also the connecting transport infrastructure (road, rail, shipping, pipelines) is important to directly ensure the continuous operation of the freight logistics of the port. Indirectly the whole system is depending on other Critical Infrastructure (CI), for instance the power supply and communication networks. If these networks fail by extreme weather events, the port operation can be disrupted due to the so-called cascading effects, one failure leading to another failure.

In 2014 the EU project INTACT was launched to help critical infrastructure to become more resilient and responsive in advance to the different extreme weather events across Europe, thereby reducing its vulnerability. The ultimate objective is to create a set of guidelines and best practises to aid policy makers, decision makers and other stakeholders. The INTACT project incorporates five case studies, each based in a different European country in order to attain different regional settings and extreme weather conditions. One of these cases is the Port of Rotterdam and the transport connections to the hinterland. The R&D focus in this case is on long-term planning of adaptation strategies by an integral risk assessment of the system, including cascading effects.

The main stakeholders (owners and users) of the Port of Rotterdam case participated for the first time together in a workshop to discuss vulnerability of critical infrastructure and interdependencies. Other studies carried out previously are used as reference, such as

> Figure 1 Transport logistics near the Port of Rotterdam
the results of Blue spots studies which investigated the vulnerability of the road and railway network to flooding. While many owners already made this kind of assessments for their infrastructure, the analyses of interdependencies and cascading effects was new to them. Also the involvement of infrastructure users (for example freight transport organisations) led to a different perspective.

The Circle tool is used to support the risk assessment discussion and to visualise cascading effects. Circle is an interactive touch table application which combines expert knowledge with the prediction of interdepending effects of the different critical infrastructure networks. The biggest effects of extreme weather events the stakeholders encounter are the impacts of disruptions on the ports’ market position, safety and cost. For example a discontinuation of essential functions such as power supply can lead to dangerous situations on bridges and in tunnels and to unavailability of highways. A repeating discontinuity of performance of essential functions can lead to loss of income, claims and have a negative influence on the competitive position of the Dutch port.