GRSP Informal Working Group
Frontal Impact
Overview for Selecting Reference Collisions

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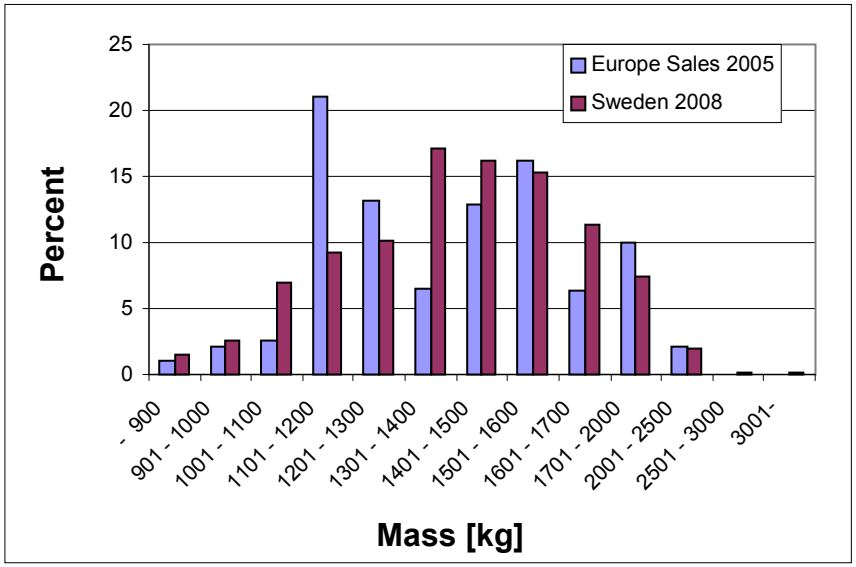
Background

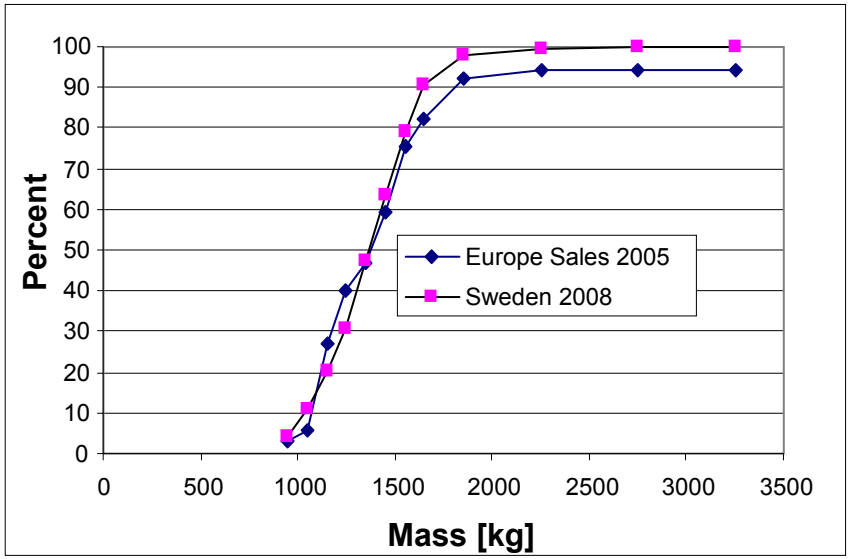
- The Accident data provided to the working group has indicated that the casualty risk is related to the mass of the vehicles in the car-car collisions
- A reference or baseline requirement for frontal protection has not been identified
- The following slides provide some information and proposals for selecting a reference collision

Fleet Summary

» The new car sales from Europe 2005 was compared to the Swedish registrations in 2008



Mass Distribution

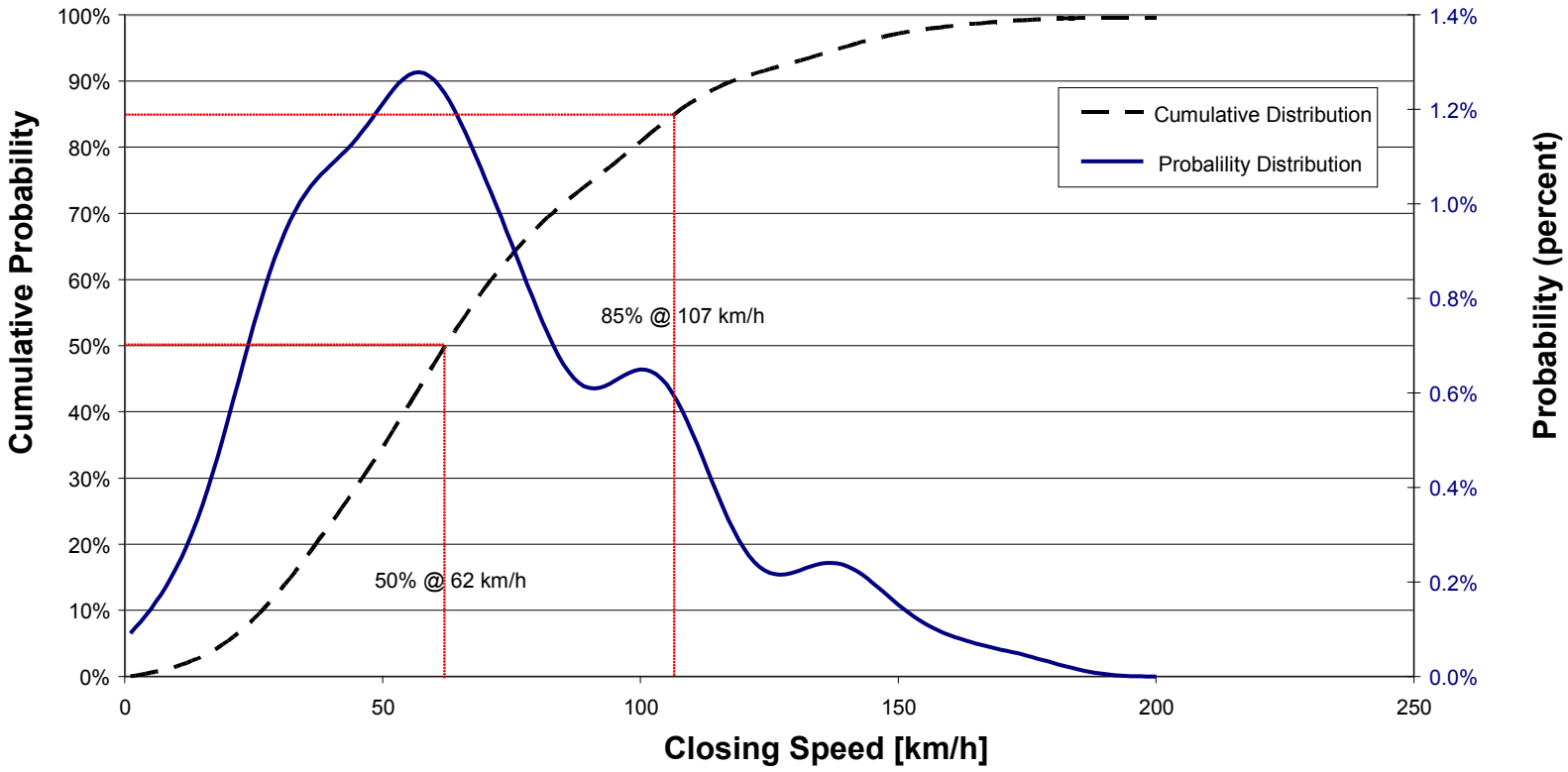


Cumulative Distribution

Source: IMPROVER Project, SIKA Sveriges officiella statistik

Accident Speed Information

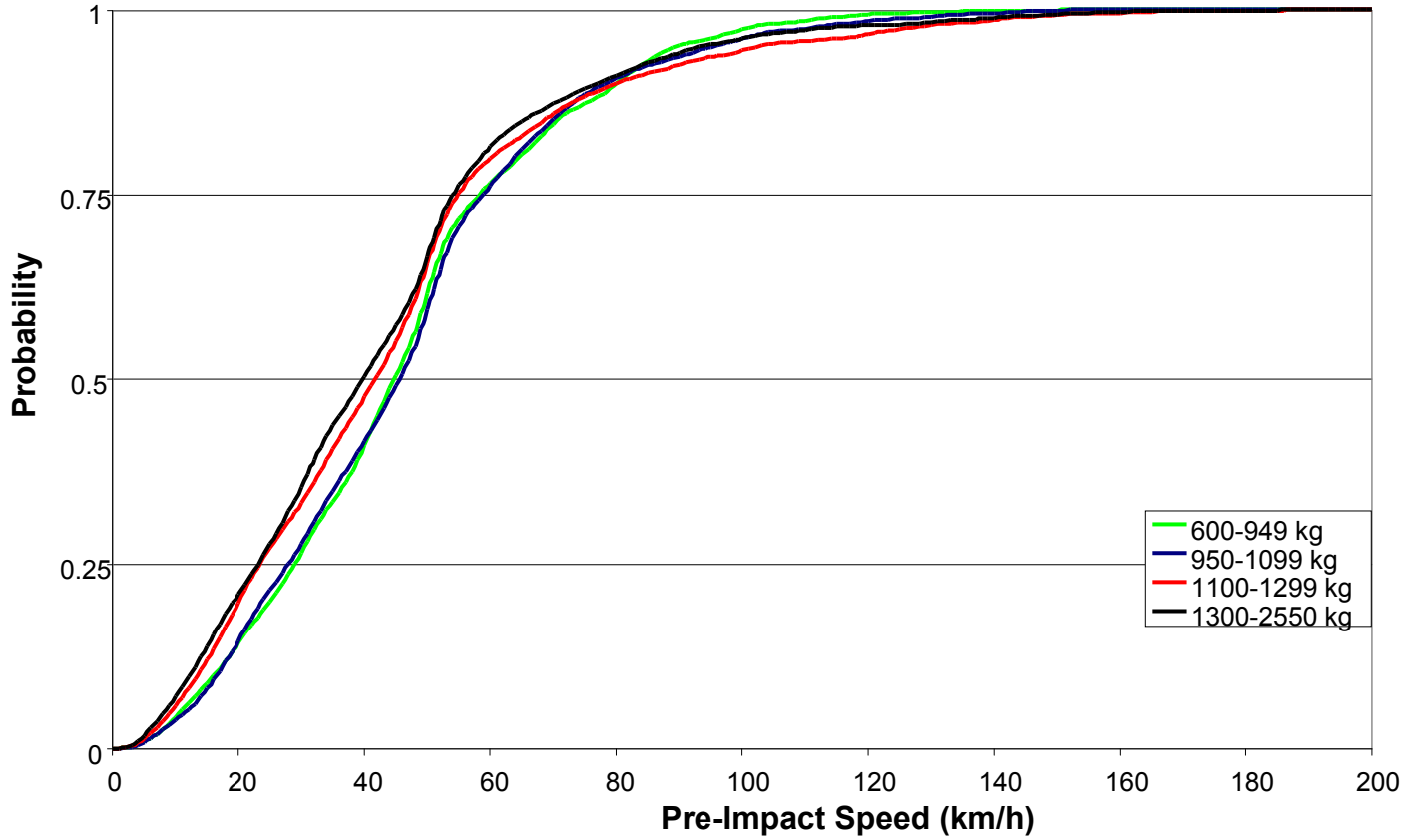
» The GIDAS database has reconstructed values of collision speeds



Source – IMPROVER Project (Bast)

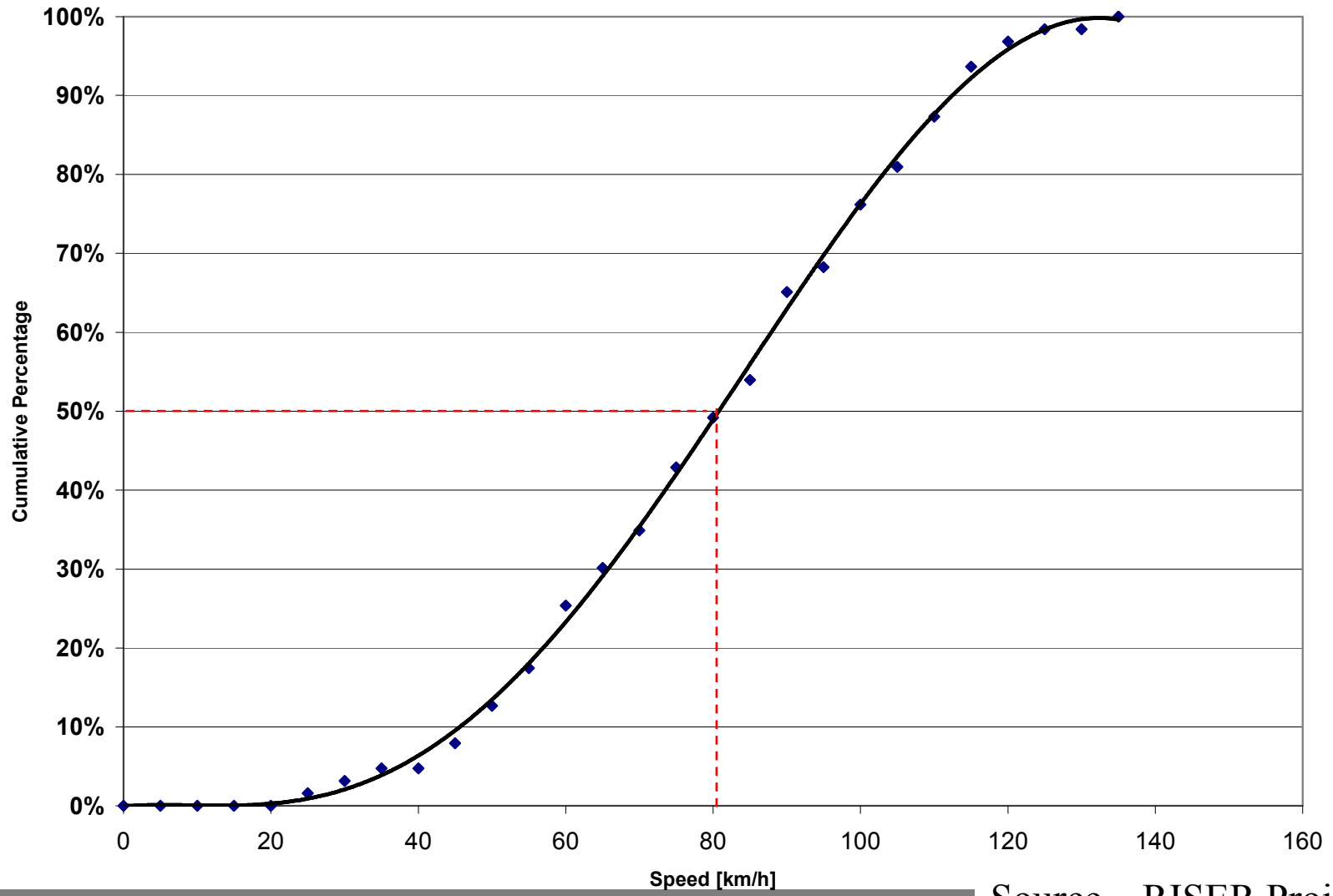
Individual Impact Speeds

» From GIDAS (2000-2007) the impact speed distributions for each car in a car-car impact



Source: BASt

Reconstructed Single Vehicle Accidents
Speeds Leaving the Road
(Not Impact Speed)



Source – RISER Project

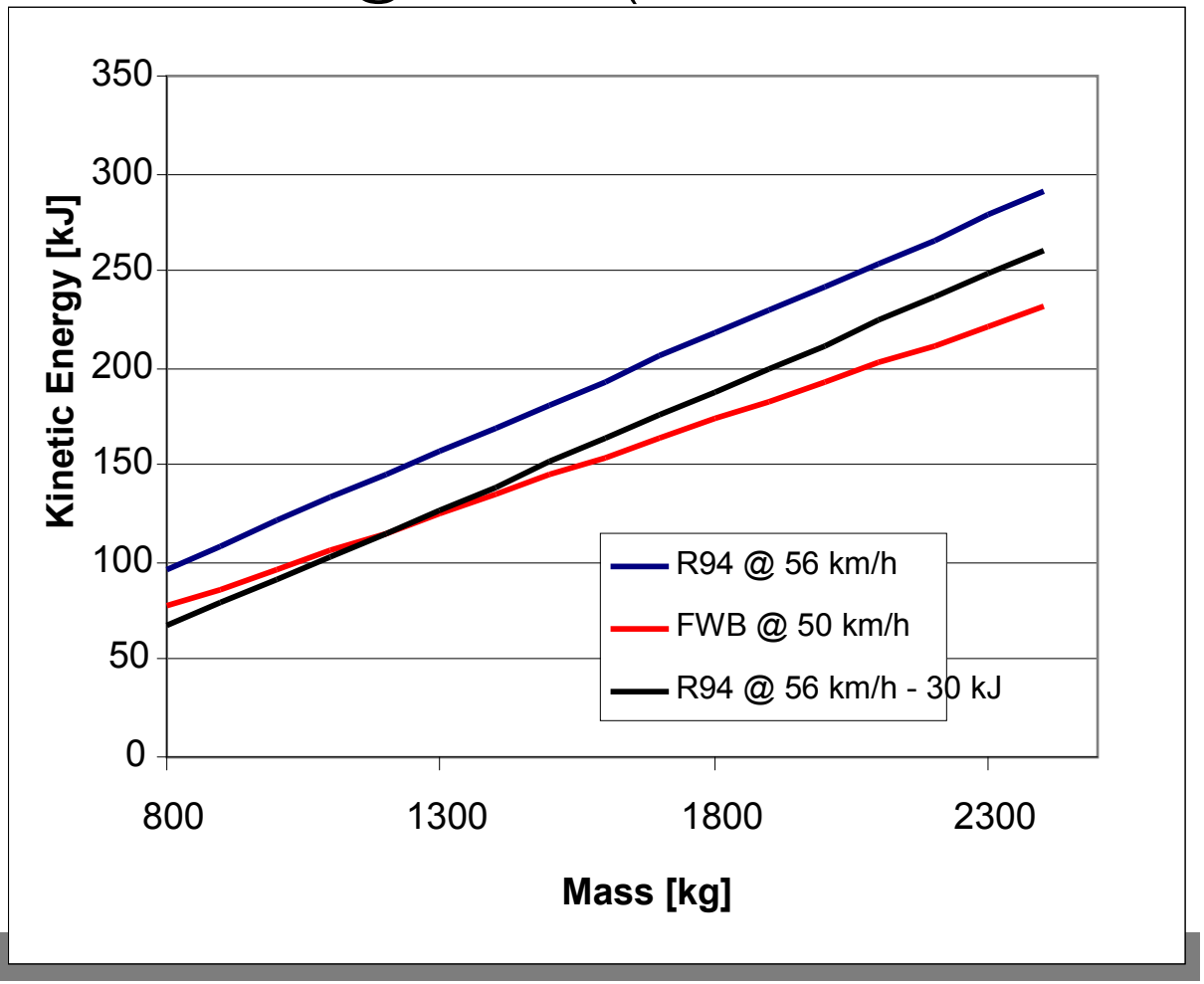
Reference Collision Options

- A baseline for frontal impact regulations can be based on:
  - 1) fixed percentile of accident conditions (speed, mass, energy, injuries)
  - 2) most common accident conditions (speed, mass, energy, injuries)
- Current R94 is based on a reference crash of 50 km/h and 50% offset represented by a 56 km/h impact with the EEVC barrier (Assumes mass ratio 1:1)

Current Reference Conditions

- Pre-impact energy
  - R94 @ 56 km/h
  - Car-Car approximated as FWB @ 50 km/h (Reference condition)

Car is expected to absorb in R94 the kinetic energy minus the energy in the barrier – 30 kJ barrier deformation energy (as an example)



Review Likely Accident Conditions

- Preliminary Approach
  - Using the fleet mass and speed distributions to identify joint distribution of speed and vehicle mass
  - Assume that the impact speed is independent of vehicle mass
- Agreement on type of criteria for self protection levels
- More complete analysis is needed to finalize values for regulation

Joint Probability

» The probability of a collision of a given vehicle (mass given by European Sales in 2005) for a given speed (using GIDAS vehicle impact speeds

$$P_{\langle imp \,|\, V+M \rangle} = P_{\langle imp \,|\, V \rangle} P_{M}$$

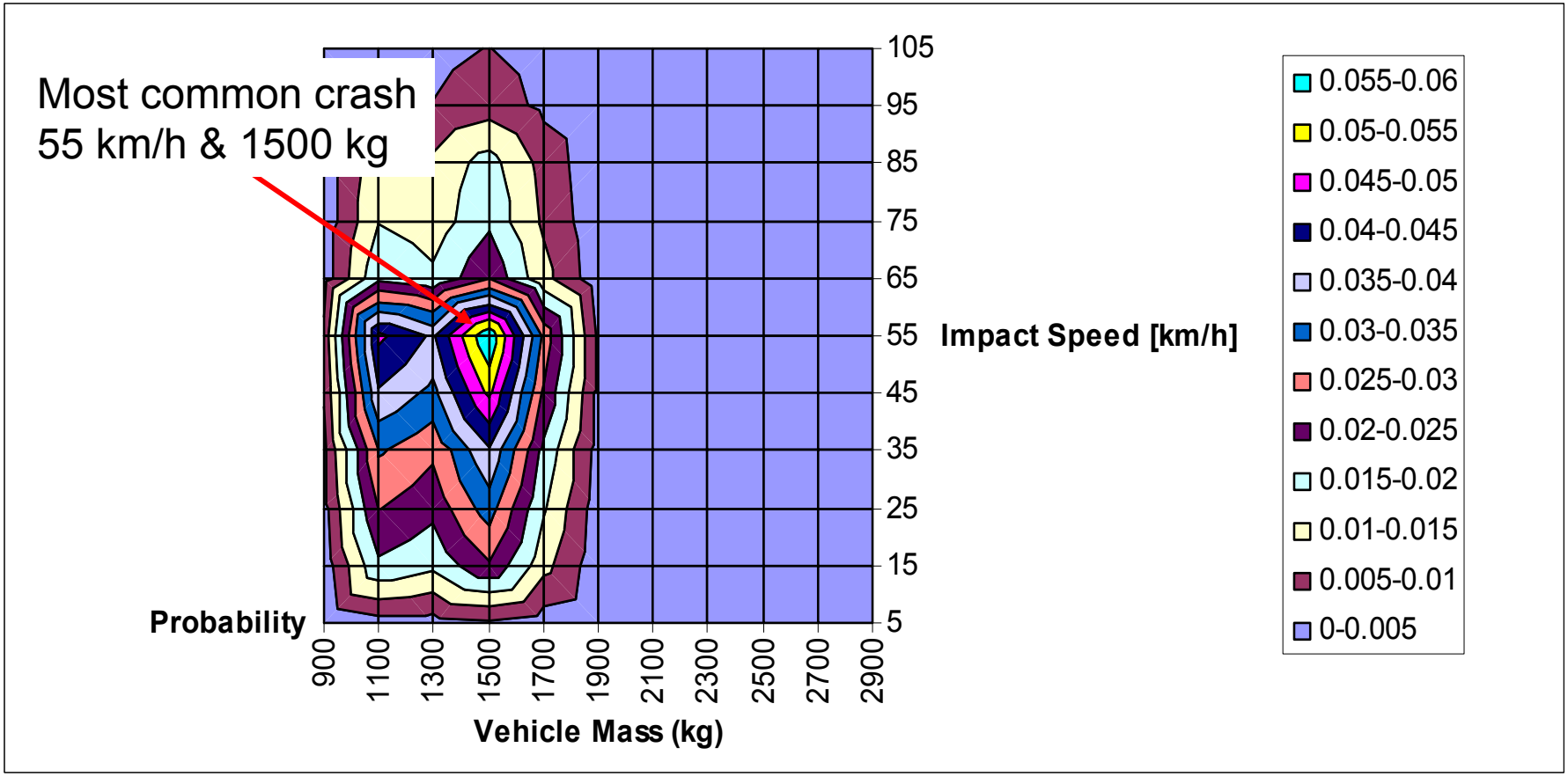
Conditional probability of An impact of vehicle mass M at velocity V

Probability of impact speed V

Probability of vehicle mass M

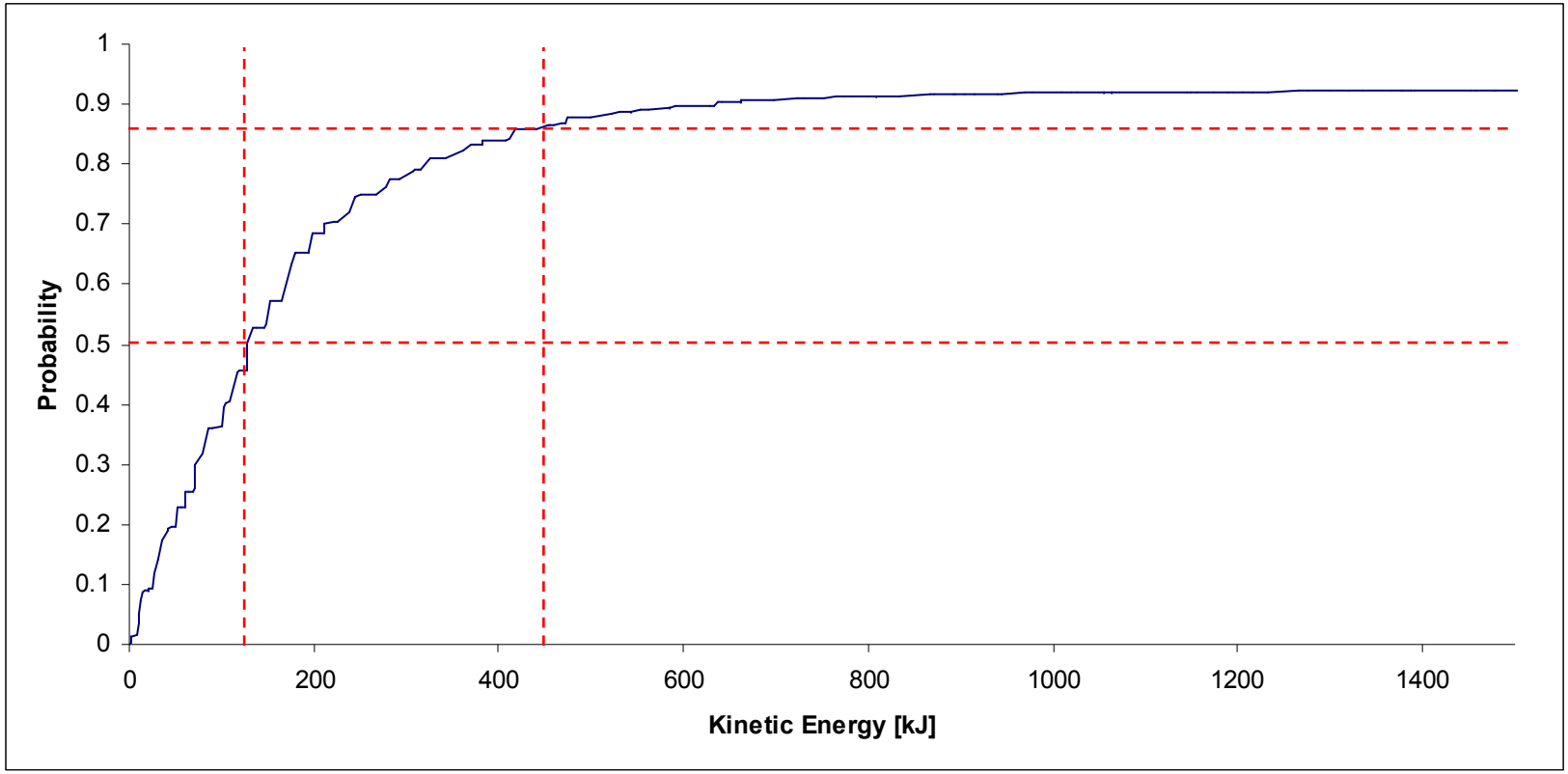
Joint Probability

$$P_{\langle imp \,|\, V+M \rangle} = P_{\langle imp \,|\, V \rangle} P_{M}$$



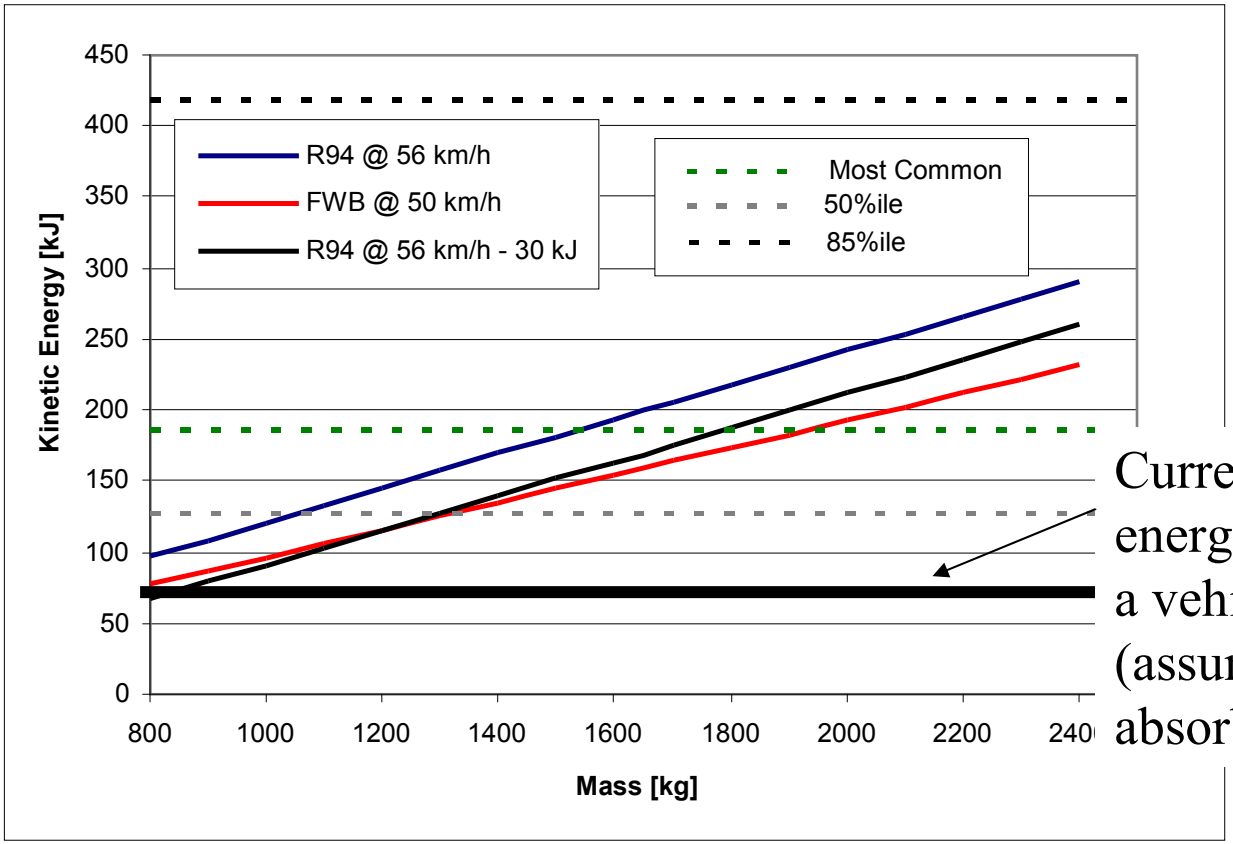
Cumulative Distribution of Impact Energy

» Kinetic Energy for one vehicle from Joint Probability distribution



Summary of Crash Energies

» Examples from preliminary analysis



Current minimum test energy absorbed by a vehicle in R94 (assuming 30 kJ absorbed by barrier)

Next Steps

- A criteria for selecting a reference collision is needed for further discussions ofan update for R94
  - Most common impact? 50%ile for energy?
- The Informal Group for Frontal Impact needs to define the target for self protection
- An investigation of PENDANT frontal collisions is ongoing in Sweden to review distributions of overlap, delta V, AIS, etc.