

ES-2re Side Impact

The ES-2re Side Impact Dummy represents a 50th percentile adult male, without lower arms. Masses and inertia of dummy parts are based on known anthropomorphic data. The total mass of the dummy (including rib displacement transducers, force transducers in the abdomen, pubic symphysis force transducer, and suit) is 72.4 ± 1.20 kg.

Dummy Features

Head & Neck

The head is based on a 6-axis Hybrid III 50th percentile head comprised of an aluminum skull covered by a pliable vinyl skin. The changes with respect to the Hybrid III head are in the head-upper neck load cell interface and the mass. The mass of the combined head and upper neck load cell is tuned. At the head-neck interface, a 6-axis Upper neck load cell is mounted on the skull base. The interior of the skull is a cavity in which accelerometers can be located. Access is provided by removal of a skullcap at the back of the head.

Shoulder

The shoulder box mainly consists of an aluminum spacer block and two PTFE coated aluminum plates on the top and bottom of the spacer block. The shoulder box is attached to the top face of the spine box, which is inclined 5 degrees backwards.

Thorax/Abdomen

The ES-2re dummy incorporates a rear rib extension bracket on the impact side of each rib that together with a rear rib extension guide provides more realistic interaction with vehicle seatbacks. Roller bearing guidance of rib extension were added in the backplate. A new backplate load cell was introduced. The central part of the abdomen section is a metal drum positioned around the lumbar spine and rigidly attached to the T12 - load cell (or its structural replacement) at the bottom side of the thorax. The drum is covered by foam. At both sides of the foam covering, a curved slab of leadpellet- filled foam is integrated to obtain the required inertial mass and viscoelastic performance. The foam allows a penetration of 40 mm before 'bottoming out'.

Arms

The ES-2re arm consists of a plastic skeleton covered by flesh-simulating foam and a plastic skin. The upper part of the arm is made of a high energy absorbing solid foam, while the lower part is constructed of soft foam. The arm is attached to the end of the shoulder clavicle.

Pelvis

The pelvis contains two iliac wings that are made of plastic resin. The two iliac wings are linked together at the pubic symphysis by a force transducer or a transducer replacement. At the rear of the pelvis, the iliac wings are attached to each side of the sacrum block.

Legs

The legs consist of a metal skeleton covered by flesh-simulating polyurethane covering. The joints at hip, knee and ankle allow realistic motion of the leg parts. The legs are of the standard Hybrid II design, except for the femur bone and the thigh flesh. These parts are modified to obtain a more humanlike mass distribution over the rigid bone structure and the soft flesh simulation. The flesh part is increased in mass and the femur bone is decreased in mass. The mass shift is approx. 2.75 kg. This modification is introduced to achieve a more humanlike knee-to-knee interaction performance.

Simulation Models

Humanetics offers highly detailed and fully validated Finite Element (FE) Models of its dummies in the codes LS-DYNA, PAM-CRASH, ABAQUS and RADIOSS, along with FE modeling consultancy services.



Technical Specifications

Weight Specification

Body Segment	Mass (Kg)	Tol. (+/-)
Head Assembly	4.0	0.20
Neck Assembly	1.0	0.05
Thorax Assembly	22.4	1.00
Arm, Left or Right	1.3	0.10
Abdomen	5.0	0.25
Pelvis Assembly	12.0	0.60
Leg, Left or Right	12.7	0.60
Total Weight	72.4	1.20

Instrumentation

Location	Description	Channels
Head	3 Uni-axial Accelerometers	Ax, Ay, Az
Neck	6-Axis Upper Neck Load Cell 6-Axis Lower Neck Load Cell	Fx, Fy, Fz, Mx, My, Mz Fx, Fy, Fz, Mx, My, Mz
Shoulder	3-Axis Load Cell	Fx, Fy, Fz
Thorax	2-Axis Angle Indicator 4-Axis Torso Back Plate LC Tri-axial Accel or 3 Uni-axial at T1 shoulder 3 Uni-axial Accels at T12 Uni-axial Accels on each Rib 3 Linear Potentiometers, 1 each Rib	θ_x, θ_y Fx, Fy, My, Mz Ax, Ay, Az Ax, Ay, Az Ay Dy
Abdomen	4-Axis T12 Load Cell 3 Uni-axial Load Cells	Fx, Fy, Mx, My Fy
Pelvis	2-Axis Angle Indicator 3-Axis Lumbar Spine Load Cell Uni-axial Pubic Symphysis Load Cell Tri-axial Accel or 3 Uni-axial Sacrum	θ_x, θ_y Fy, Fz, Mx Fy Ax, Ay, Az
Legs	6-Axis Femur Load Cell	Fx, Fy, Fz, Mx, My, Mz

Dimensions

Measurement	Dim (mm)	Tol. (+/-)
Total Sitting Height	909	9
Seat to Shoulder Joint	565	7
Seat to Lower Face of Thoracic Spine Box	351	5
Seat to Hip Joint	100	3
Sole to Seat, Sitting	442	9
Head Width	155	3
Shoulder/Arm Width	470	9
Thorax Width	327	5
Abdomen Width	280	7
Pelvis Lap Width	366	7
Head Depth	201	5
Thorax Depth	267	5
Abdomen Depth	199	5
Pelvis Depth	240	5
Back of Buttocks to Hip Joint	155	5
Back of Buttocks to Front Knee	606	9