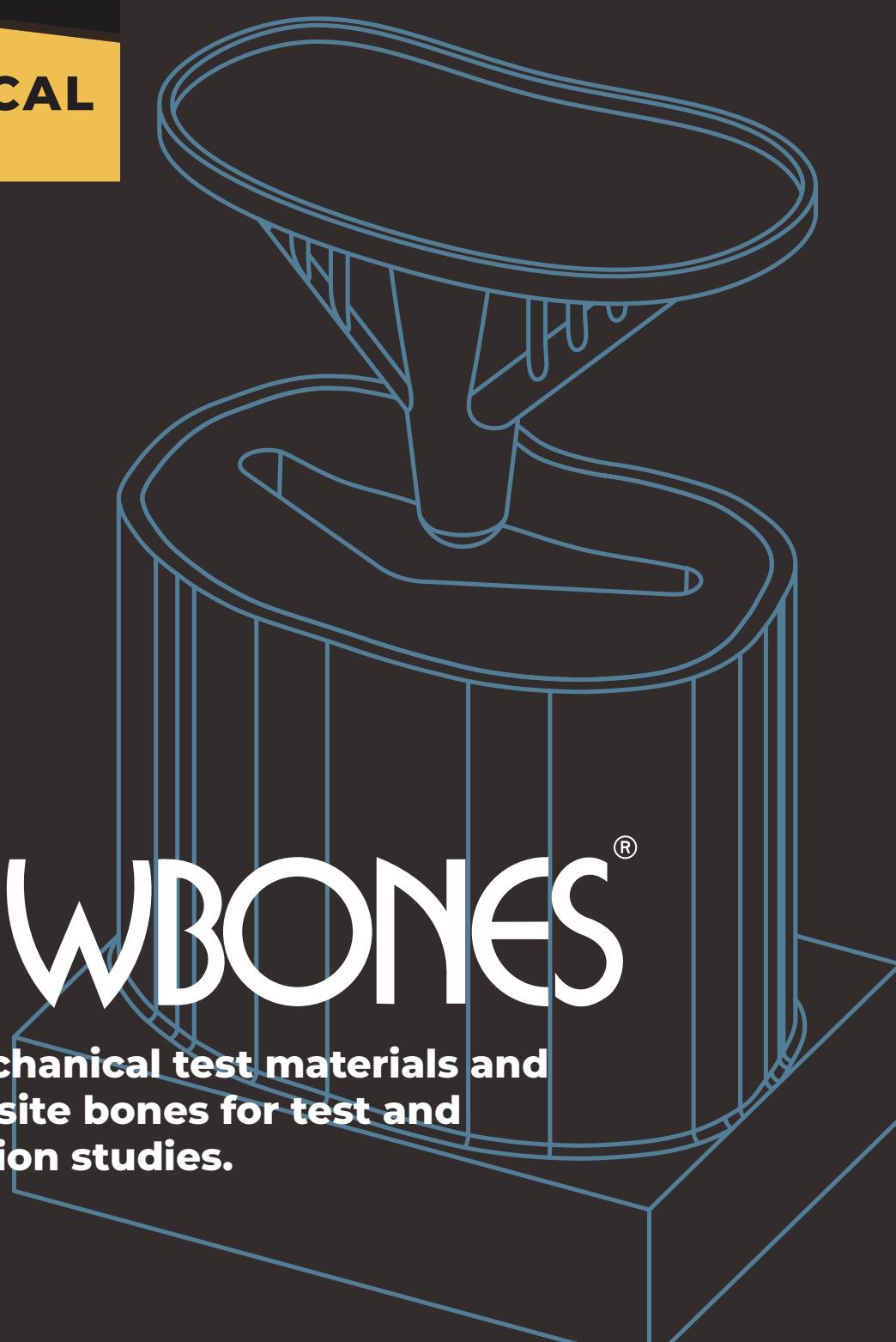




TEST MATERIALS AND COMPOSITE BONES

BIOMECHANICAL Products Catalog



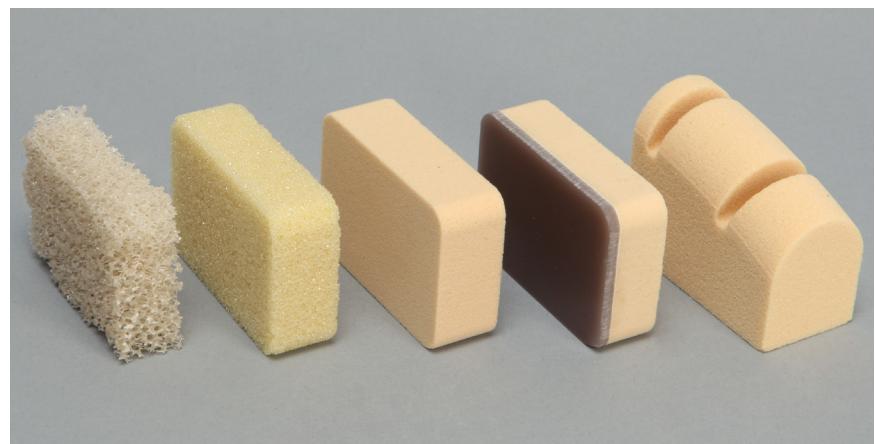
SAWBONES®

**Biomechanical test materials and
composite bones for test and
validation studies.**



BIOMECHANICAL TEST MATERIALS

Biomechanical test materials are used as an alternative to cadaver bone for testing orthopaedic implants, instruments and instrumentation. Our biomechanical test materials offer uniform and consistent physical properties that considerably reduce variability and eliminate special handling requirements encountered with cadaver bone. These materials are most commonly used for comparative and developmental testing of bone screws, staples and fusion devices.



Rigid polyurethane foam blocks are transverse isotropic due to the direction of rise during manufacturing. Properties listed are parallel to the direction of rise which is maintained parallel to block thickness or cylinder length unless otherwise indicated. If required to test perpendicular to rise, you may see a reduction in modulus (25%) and strength (5%) for rigid foams with a density of 20 PCF and lower. To reduce variability in results we recommend measuring the density of individual test specimens to use as a co-variate in data analysis.

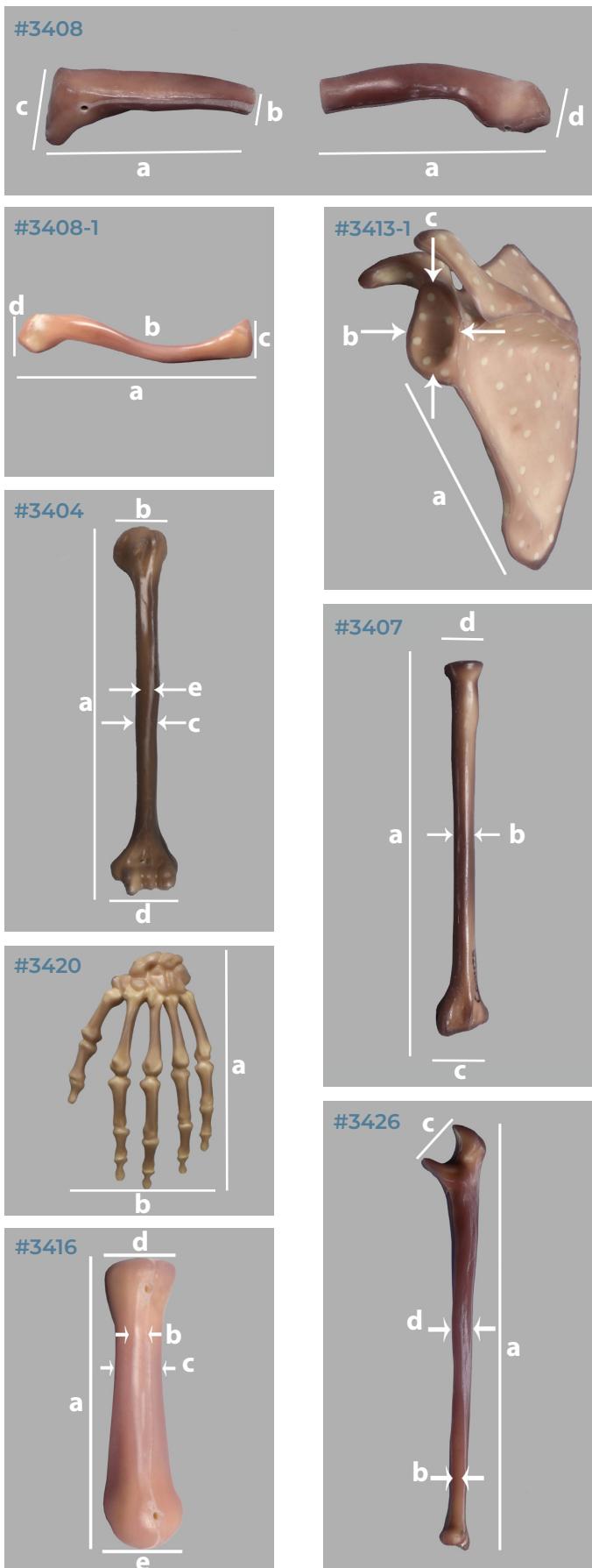
COMPOSITE BONE

Composite bones are designed to simulate structural and material properties of cadaveric bone without the challenges of high variability and special handling requirements. Over 250 peer reviewed articles have used composite bones for comparative and developmental testing of orthopaedic devices and instrumentation. These bones may be reamed and broached to prepare for implant fixation. Standard 4th generation composite bones have a cortical shell made of short fiber filled epoxy and a cancellous core made of 17 PCF solid rigid polyurethane foam. The midshaft of long bones have a hollow intramedullary canal.

Cancellous foam is available in solid rigid polyurethane 8 to 20 PCF or cellular rigid polyurethane foam 12.5 to 20 PCF.



SIMULATED CORTICAL BONE (SHORT FIBER FILLED EPOXY)					
DENSITY (g/cc)	LONGITUDINAL TENSILE Strength (MPa)	Modulus (GPa)	COMPRESSIVE Strength (MPa) Modulus (GPa)		
1.64	106	16.0	157	16.7	
DENSITY (g/cc)	TRANSVERSE TENSILE Strength (MPa)			Note: Material property data based on ASTM D-638 and D-695.	
1.64	93	10.0			
SIMULATED CANCELLOUS BONE (RIGID POLYURETHANE FOAM)					
	Density (g/cc)	COMPRESSIVE Strength (MPa) Modulus (MPa)		Note: Material property data based on ASTM D-1621.	
Solid	0.27	6.0	155		



MANDIBLE

#3444 — Large, edentulous mandible with teeth indentation. 17 PCF solid foam cancellous core.

SHOULDER

#3408 — Large, left clavicle manufactured in medial and lateral sections without canal.

Dimensions: a) distal) 95 mm; a proximal) 80 mm; b) 15 mm; c) 28 mm; d) 29 mm

#3408-1 — Large, left clavicle without canal.

Dimensions: a) 175 mm; b) 15 mm; c) 28 mm; d) 29 mm

#3413 — Large, left scapula.

Dimensions: a) 155 mm; b) 28 mm; c) 45 mm

#3413-1 — Large, left scapula with 10 PCF solid foam cancellous core.

Dimensions: a) 155 mm; b) 28 mm; c) 45 mm

#3413-2 — Large, left scapula with 12 PCF solid foam cancellous core.

Dimensions: a) 155 mm; b) 28 mm; c) 45 mm

ARM

#3404 — Large, left humerus.

Dimensions: a) 365 mm; b) 55 mm; c) 23 mm; d) 64 mm; e) 9 mm - canal tapers to 5.5 mm, 80 mm from the distal end.

#3404-4 — Large, left humerus with 10 PCF solid foam cancellous core.

Dimensions: a) 365 mm; b) 55 mm; c) 23 mm; d) 64 mm; e) 9 mm - canal tapers to 5.5 mm, 80 mm from the distal end.

#3407 — Large, left radius.

Dimensions: a) 250 mm; b) 16 mm; c) 35 mm; d) 27 mm; 5 mm canal.

#3407-5 — Large, left radius with 10 PCF solid foam cancellous core.

Dimensions: a) 250 mm; b) 16 mm; c) 35 mm; d) 27 mm; 5 mm canal.

#3426 — Large, left ulna.

Dimensions: a) 270 mm; b) 4.7 mm canal; c) 30 mm; d) 16 mm.

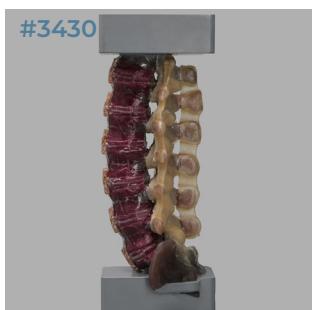
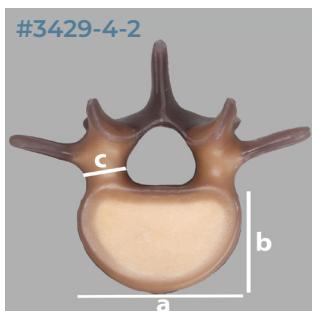
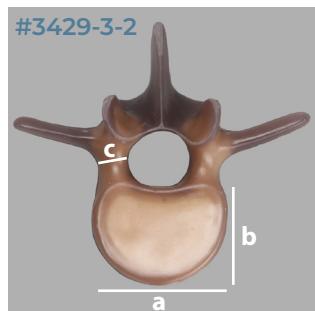
HAND

#3420 — Large, left hand with fused bones.

Dimensions: a) 200 mm; b) 112 mm

#3416 — Large, left third metacarpal.

Dimensions: a) 70 mm; b) 3.2 mm canal; c) 7.8 mm; d) 13.6 mm; e) 16.6 mm



*unpotted versions available as well

SINGLE LEVEL

#3429-1 — Individual L1 solid cortical, no cancellous foam.

#3429-2 — Individual L2 solid cortical, no cancellous foam.

#3429-3 — Individual L3 solid cortical, no cancellous foam.

#3429-3-2 — Individual composite L3 vertebrae with 10 PCF (0.16 g/cc) density solid foam cancellous core. Dimensions: a) 48 mm; b) 35 mm; c) 11 mm; Pedicle height 16 mm.

#3429-3-4 — Individual composite L3 vertebrae with 5 PCF (0.08 g/cc) density solid foam cancellous core. Dimensions: a) 48 mm; b) 35 mm; c) 11 mm; Pedicle height 16 mm.

#3429-3-5 — Individual composite L3 with 20 pcf (0.32g/cc) density solid foam cancellous core. Dimensions: a) 48 mm; b) 35 mm; c) 11 mm; Pedicle height 16 mm.

#3429-4 — Individual L4 solid cortical, no cancellous foam.

#3429-4-2 — Individual composite L4 vertebrae with 10 PCF (0.16 g/cc) density solid foam cancellous core. Dimensions: a) 52 mm; b) 36 mm; c) 14 mm; Pedicle height 16 mm.

#3429-5 — Individual L5 solid cortical, no cancellous foam.

#3429-12 — Individual T12 solid cortical, no cancellous foam.

MULTIPLE LEVELS

RANGE OF MOTION TEST MODEL

All models include transverse spinous process, supraspinous and intraspinous ligaments, anterior and posterior longitudinal ligaments, facet capsule and ligamentum flavum. Intervertebral discs include a nucleus, annulus and annular fiber.

#3430 — Potted T12 to sacrum without cancellous inner material.

#3430-1 — T12 to sacrum solid cortical, no cancellous foam, not potted.

#3430-25 — Potted L2 to L5 solid cortical, no cancellous foam.*

#3430-34 — Potted L3 to L4 solid cortical, no cancellous foam.*

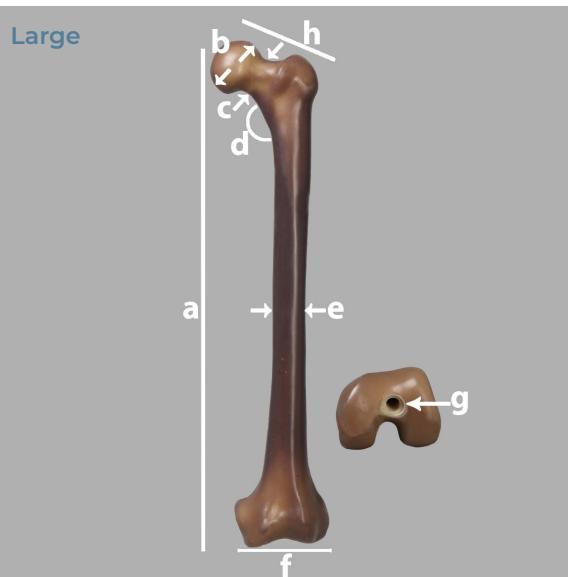
#3430-34-2 — Potted L3 to L4 with 10 PCF solid foam cancellous core.*

#3430-34-6 — L3 to L4 solid cortical with 10 PCF solid foam cancellous core. No potted end blocks.

SACRUM

#3405-2 — Sacrum with cancellous, matches #3405 and #3409 hemi-pelvis.

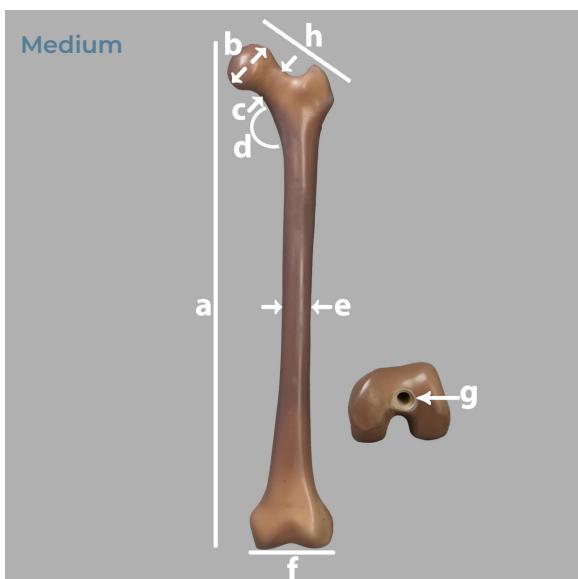
#3429-6 — Sacrum without cancellous inner material, matches with #3430 and #3430-1 spine.



LARGE

Dimensions: a) 485 mm; b) 52 mm; c) 37 mm; d) 120°; e) 32 mm;
 f) 93 mm; g) 16 mm canal standard; h) 106 mm
 Also available with 10 or 12.8 mm canal.

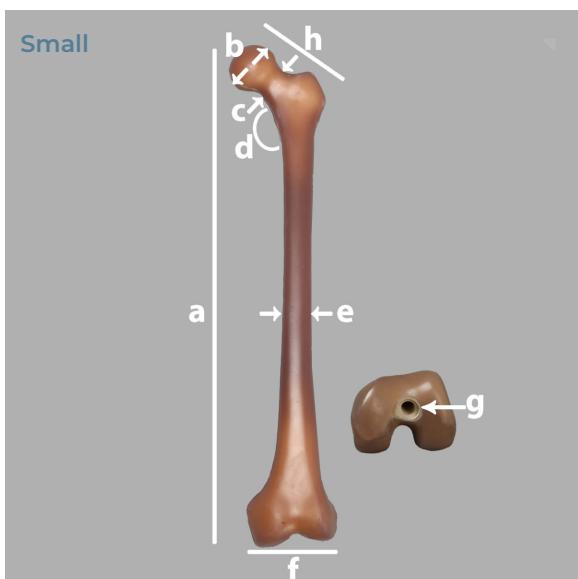
- #3406-11 — 8 PCF solid foam cancellous core.
- #3406-5 — 10 PCF solid foam cancellous core.
- #3406-13 — 12 PCF solid foam cancellous core.
- #3406-17 — 15 PCF solid foam cancellous core.
- ★ #3406 — 17 PCF solid foam cancellous core.
- #3406-12 — 20 PCF solid foam cancellous core.
- #3406-7 — 12.5 PCF cellular foam cancellous core.
- #3406-18 — 15 PCF cellular foam cancellous core.
- #3406-4 — 20 PCF cellular foam cancellous core.



MEDIUM

Dimensions: a) 455 mm; b) 45 mm; c) 31 mm; d) 135°; e) 27 mm;
 f) 72 mm; g) 13 mm canal standard; h) 102 mm; i) 26 mm
 Also available with 10 or 12 mm canal.

- #3403-117 — 8 PCF solid foam cancellous core.
- #3403-106 — 10 PCF solid foam cancellous core.
- #3403-109 — 12 PCF solid foam cancellous core.
- #3403-107 — 15 PCF solid foam cancellous core.
- #3403-128 — 15 PCF solid foam cancellous core, 10 mm canal.
- ★ #3403 — 17 PCF solid foam cancellous core.
- #3403-108 — 20 PCF solid foam cancellous core.
- #3403-103 — 12.5 PCF cellular foam cancellous core.

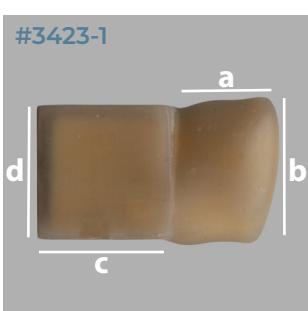
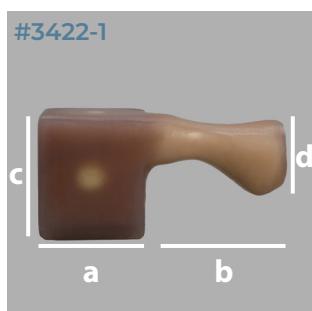
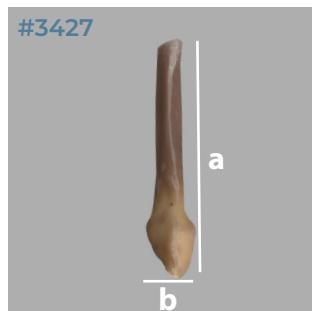
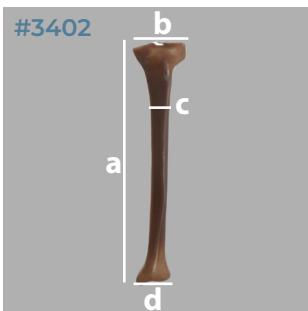
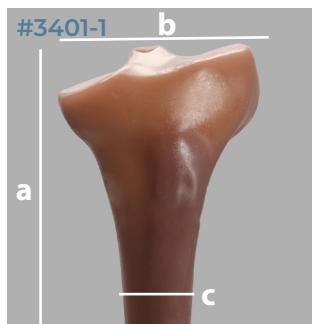
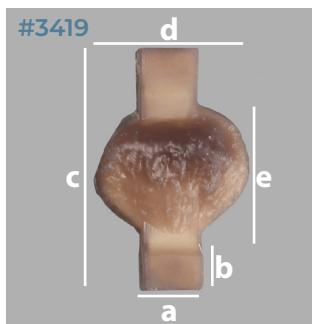
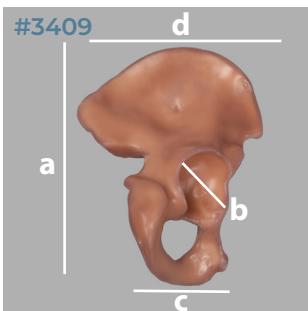


SMALL

Dimensions: a) 375 mm; b) 37 mm; c) 25 mm; d) 130°; e) 20 mm;
 f) 55 mm; g) 9.5 mm canal; h) 82 mm; i) 49 mm

- ★ #3414 — 17 PCF solid foam cancellous core.

★ Standard Density



HIP

#3405 — Large, left hemi-pelvis. Dimensions: a) 235 mm; b) 55 mm; c) 140 mm; d) 175 mm

#3409 — Large, right hemi-pelvis. Dimensions: a) 235 mm; b) 55 mm; c) 140 mm; d) 175 mm

#3415 — Full pelvis with fused pubis symphysis and sacroiliac joints.

#3415-1 — Full pelvis with fused pubis symphysis and right sacroiliac joint.

LEG

#3419 — Large, left patella. Dimensions: a) 19 mm; b) 11 mm; c) 78 mm; d) 47 mm; e) 50 mm

#3401 — Medium, left tibia with 9 mm canal. Dimensions: a) 375 mm; b) 74 mm; c) 22 mm; d) 50 mm

#3401-1 — Medium, left tibia with 10° of varus deformity and 9 mm canal. Dimensions: a) 375 mm; b) 74 mm; c) 22 mm; d) 52 mm

#3402 — Large, left tibia with 10 mm canal. Dimensions: a) 405 mm; b) 84 mm; c) 28 mm; d) 58 mm

#3410 — Small, left tibia with 10 mm canal. Dimensions: a) 324 mm; b) 65 mm; c) 18 mm; d) 41 mm

#3427 — Distal portion of large, left fibula with 3.2 mm canal. Dimensions: a) 110 mm; b) 27.5 mm

#3427-1 — Medium, left fibula with 2.5 mm canal. No cancellous core. Dimensions: a) 384 mm; b) 19 mm

FOOT

#3422 — Large, left, first metatarsal with proximal vise block and 4.7 mm canal. Dimensions: a) 94 mm; b) 15.4 mm; c) 29.5 mm; d) 30.5 mm; e) 22.5 mm

#3422-1 — Large, left, first, proximal phalanx with 4.7 mm canal. Dimensions: a) 30.5 mm; b) 39 mm; c) 30 mm; d) 18 mm

#3423-1 — Medial cuneiform with proximal vise block. Dimensions: a) 94 mm; b) 15.4 mm; c) 29.5 mm; d) 30.5 mm

#3423 — First metatarsal with distal vise block. Dimensions: 3 cm x 3 cm x 2 cm deep.

SOLID RIGID POLYURETHANE FOAM

Solid rigid polyurethane foam is used as an alternative test medium for human cancellous bone. It does not replicate the structure of human bone, however, it does provide consistent properties in the range of human cancellous bone. This closed cell polyurethane foam is most commonly used for testing screw pullout, insertion and stripping torque.

The ASTM F-1839-08 "Standard Specification for Rigid Polyurethane Foam for Use as a Standard Material for Testing Orthopaedic Devices and Instruments" states "The uniformity and consistent properties of rigid polyurethane foam make it an ideal material for comparative testing of bone screws and other medical devices and instruments".

DENSITY		COMPRESSIVE		TENSILE		SHEAR	
(PCF)	(g/cc)	Strength MPa	Modulus MPa	Strength MPa	Modulus MPa	Strength MPa	Modulus MPa
ASTM D1622		ASTM D1621		ASTM D638		ASTM C273	
5*	0.08	0.07	0.60	16	1.0	32	0.59
8	0.13	0.11	1.5	38	1.3	56	1.2
10*	0.16	0.14	2.2	58	2.1	86	1.6
12*	0.19	0.16	3.2	81	2.5	112	2.1
15*	0.24	0.20	4.9	123	3.7	173	2.8
20*	0.32	0.27	8.4	210	5.6	284	4.3
25*	0.40	0.34	12.9	317	8.8	399	5.9
30*	0.48	0.41	18	445	12	592	7.6
35*	0.56	0.47	24.4	592	15.6	713	9.4
40*	0.64	0.54	31	759	19	1000	11
50*	0.80	0.68	48	1148	27	1469	16
							178

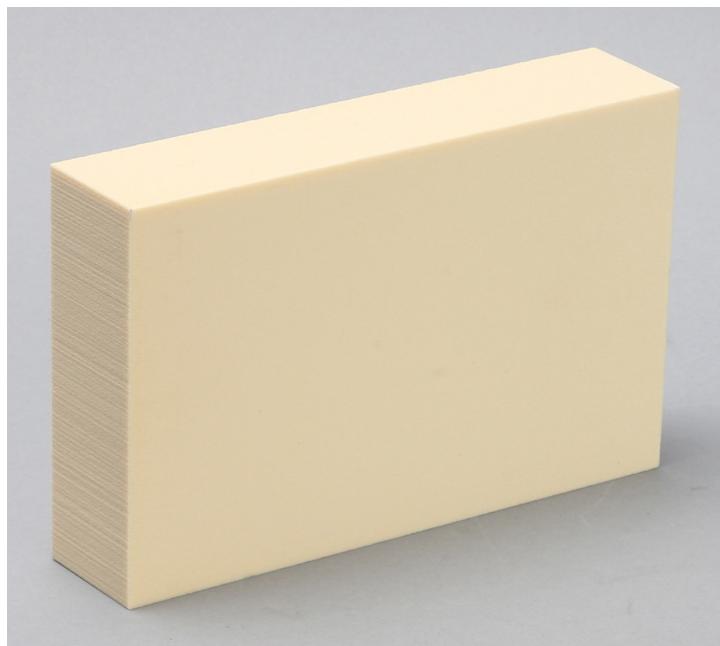
*Foam meets ASTM F1839-08.

- BLOCK SIZE:**
13 cm x 18 cm x 4 cm
#1522-23 — 5 PCF
#1522-536 — 8 PCF
#1522-01 — 10 PCF
#1522-48 — 12 PCF
#1522-02 — 15 PCF
#1522-03 — 20 PCF
#1522-660 — 25 PCF
#1522-04 — 30 PCF
#1522-1349 — 35 PCF
#1522-05 — 40 PCF
#1522-27 — 50 PCF

SOLID FOAM BLOCK TOLERANCES:

Foam density	+/- 10%
Block dimensions	+/-2mm

Our foam is available in a range of sizes and densities, from 0.08 to 0.80 grams per cubic centimeter (5 to 50 pounds per cubic foot).



CELLULAR RIGID POLYURETHANE FOAM

This closed cell polyurethane foam has a cell size that is closer to human cancellous bone and is most commonly used for testing subsidence, press-fit devices and cement augmentation.



BLOCK SIZE: 13 cm x 18 cm x 4 cm

#1522-09 — 7.5 PCF

#1522-10 — 10 PCF

#1522-11 — 12.5 PCF

#1522-1300 — 15 PCF

#1522-12 — 20 PCF

DENSITY		CELL		COMPRESSIVE	COMPRESSIVE	
(PCF)	(g/cc)	Volume Fraction	Size (mm)	Count cells/cm	Strength (MPa)	Modulus (MPa)
7.5	0.12	0.10	0.5-2.5	3-5	1.4	12.4
10	0.16	0.14	0.5-2.0	5-7	2.3	23.0
12.5	0.20	0.17	0.5-1.5	6-8	3.9	47.5
15	0.24	0.20	0.5-1.0	7-9	4.1	68.4
20*	0.32*	0.27	0.5-1.0	8-12	5.4	137.0

*Contains e-glass fibers.

OPEN CELL RIGID FOAM

This open cell foam is a composite made of urethanes, epoxies and structural fillers. It is most commonly used in specific applications that require an open-cell structure, cement augmentation and dynamic loading.



Cell count may vary 3-8 cells/cm.

20 and 30 pcf blocks contain both open and closed cell walls.

BLOCK SIZE: 13 cm x 18 cm x 4 cm

#1522-505 — 5.5 PCF #1522-524 — 15 PCF

#1522-507 — 7.5 PCF #1522-526-1 — 20 PCF

#1522-523 — 10 PCF #1522-525 — 30 PCF

DENSITY		COMPRESSIVE	COMPRESSIVE	
(PCF)	(g/cc)	Volume Fraction	Strength (MPa)	Modulus (MPa)
5.5	0.09	0.08	0.11	6.2
7.5	0.12	0.11	0.28	18.6
10	0.16	0.14	0.53	35.0
15	0.24	0.15	0.67	53.0
20	0.32	0.21	1.3	105.0
30	0.48	0.31	3.2	270.0

FOAM BLOCK TOLERANCES:

Foam density	+/- 10%
Block dimensions	+/-2mm

SOLID RIGID POLYURETHANE FOAM SHEETS

This closed cell polyurethane foam is most commonly used for testing screw pullout, insertion and stripping torque.



FOAM SHEET TOLERANCES:

Density	+/-10%
Length and Width	+/-2mm
Thickness	+/-0.3mm

SHEET SIZE:
13 cm x 18 cm x 1 mm

#1522-50 — 20 PCF

#1522-102 — 30 PCF

#1522-103 — 40 PCF

SHEET SIZE:
13 cm x 18 cm x 1.5 mm

#1522-28 — 50 PCF

SHEET SIZE:
13 cm x 18 cm x 2 mm

#1522-19 — 10 PCF

#1522-15 — 15 PCF

#1522-18 — 20 PCF

#1522-20 — 30 PCF

#1522-16 — 40 PCF

#1522-24 — 50 PCF

SHEET SIZE:
13 cm x 18 cm x 3 mm

#1522-13 — 15 PCF

#1522-14 — 20 PCF

#1522-06 — 30 PCF

#1522-07 — 40 PCF

#1522-08 — 50 PCF

COMPOSITE SHEETS

This epoxy is filled with short glass fibers and is used to simulate cortical bone for structural testing of fixation devices and total joint replacements.



SHEET SIZE:
13 cm x 18 cm x

#3401-07 — 1 mm

#3401-01 — 2 mm

#3401-02 — 3 mm

#3401-03 — 4 mm

#3401-04 — 6 mm

#3401-05 — 8 mm

#3401-06 — 10 mm

EPOXY SHEET TOLERANCES:

Density	+/-2.5%
Length and Width	+/-2mm
Thickness	+/-0.3mm
1mm and 2mm are +/-0.2mm (3401-07, 3401-01)	



CUSTOM LAMINATED FOAM BLOCKS

Laminated test blocks are manufactured to your specifications using any combination of solid rigid polyurethane foam, cellular rigid polyurethane foam, open cell rigid foam and short fiber filled epoxy sheets.

Blocks are laminated with sheet(s) of solid rigid polyurethane foam or short fiber filled epoxy selected to simulate unicortical or bicortical bone. Standard laminated test blocks are 12 cm x 17 cm with a thickness based on your specified combination of block and sheet sizes. All blocks and sheets are laminated together with 0.64g/cc (40PCF) solid rigid polyurethane foam.

Please see the property tables to make your selection of materials that will best simulate a bone model for your biomechanical test or product demonstration.



CUSTOM MACHINED FOAM

We have a full CNC machining center available to create your custom rigid foam part that may be used in biomechanical tests or product demonstration. We have solid rigid polyurethane foam available in sizes up to 61 cm x 61 cm x 10 cm thick.



To request a quote please email a dimensioned drawing, sketch or 3D CAD model to:

Sawbones Corporate Headquarters
Servicing North America, South America, Asia and Australia

10221 SW 188th Street, PO Box 409
Vashon, Washington 98070, USA

E-mail: info@sawbones.com
Tel: (206) 463-5551
Fax: (206) 463-2526

Sawbones Europe AB
Servicing Europe, Middle East and Africa

Krossverksgatan 3, 216 16 Malmö
Sweden

E-mail: info@sawbones.se
Tel: +46 40 650 70 00

COMPOSITE CYLINDERS

These hollow cylinders are made with short fiber epoxy, see property table on page 1. They can be filled with solid, cellular or open cell foam upon request for an additional charge. Customized cylinders can be made upon request.



#3403-10	27 mm	7 mm
#3403-36	27 mm	solid
#3403-30	30 mm	1.4 mm
#3403-18	30 mm	2.5 mm
#3403-16	30 mm	3.1 mm
#3403-15	30 mm	4.3 mm
#3403-29	30 mm	7 mm
#3403-1	35 mm	1 mm
#3403-4	35 mm	2.5 mm
#3403-5	35 mm	3.5 mm
#3403-2	35 mm	4 mm
#3403-20	35 mm	11 mm
#3403-19	40 mm	2 mm
#3403-6	40 mm	3 mm
#3403-8	40 mm	5 mm
#3403-7	40 mm	6 mm
#3403-26	40 mm	15 mm

COMPOSITE CYLINDER TOLERANCES:

Density	+/-2.5%
Length	+/-2mm
Wall Thickness	+/-0.2mm for 2mm and less, otherwise +/-0.3mm

OVERALL LENGTH 250 MM

PART	OUTSIDE DIAMETER	WALL THICKNESS
#3403-23	20 mm	7.5 mm
#3403-31	40 mm	8.9 mm

OVERALL LENGTH 500 MM

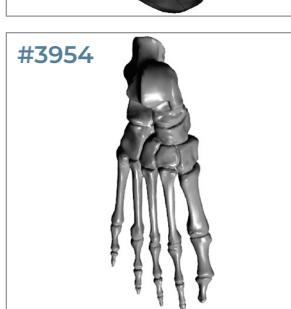
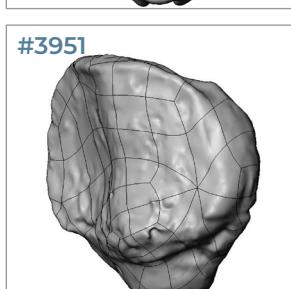
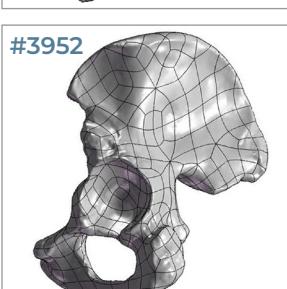
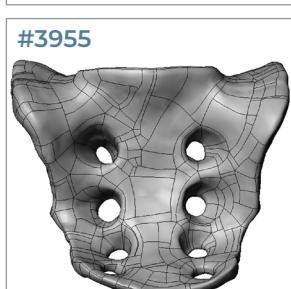
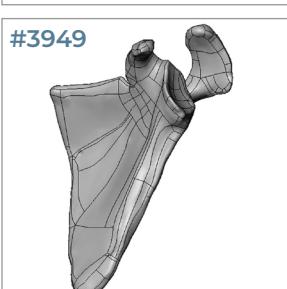
PART	OUTSIDE DIAMETER	WALL THICKNESS
#3403-25	20 mm	1 mm
#3403-27	20 mm	1.5mm
#3403-41	20 mm	2 mm
#3403-42	20 mm	3 mm
#3403-34	20 mm	3.6 mm
#3403-21	20 mm	5.25 mm
#3403-35	20 mm	6.6 mm
#3403-33	20 mm	solid
#3403-28	27 mm	1 mm
#3403-9	27 mm	2 mm

OVERALL LENGTH 150 MM

PART	OUTSIDE DIAMETER	WALL THICKNESS
#3403-11	10 mm	solid
#3403-17	10 mm	2 mm
#3403-24	10 mm	2.5 mm

OVERALL LENGTH 110 MM

PART	OUTSIDE DIAMETER	WALL THICKNESS
#3403-03	74 mm	3 mm



PLASTIC / FOAM BONES

Cortical geometry only.

File formats: Step, Parasolid, SolidPart, IGES

Upper extremity

#3920 — Large, left clavicle. Reference part #1020.

#3949 — Large left scapula. Reference part #1021.

#3921 — Large, left humerus. Reference part #1028.

#3917 — Large, left ulna. Reference part #1017.

#3918 — Large, left radius. Reference part #1018.

#3919 — Large, left hand/wrist. Reference part #1022.

#3916 — Large, left hand. Reference part #1016.

Spine

#3955 — Large sacrum. Reference part #1298.

Lower extremity

#3952 — Large, left hemi pelvis. Reference part #1294.

#3953 — Large, right hemi pelvis. Reference part #1296.

#3904 — Medium, left femur. Reference part #1121.

#3929 — Large, left femur. Reference part #1130.

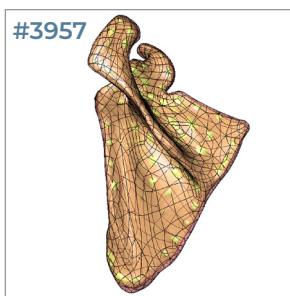
#3951 — Large, left patella. Reference part #1128.

#3915 — Large, left tibia. Reference part #1126.

#3926 — Medium, left tibia. Reference part #1117.

#3950 — Large, left fibula. Reference part #1127.

#3954 — Large, left foot. Reference part #1131.



COMPOSITE BONES

Cortical and cancellous geometry.

File formats: Step, Parasolid, SolidPart, IGES

Upper extremity

#3957 — Large, left scapula. Reference part #3413.

#3907 — Large, left humerus. Reference part #3404.

#3969 — Large, left ulna. Reference part #3426.

#3988 — Large, left radius. Reference part #3407.

Spine

#3963 — T12. Cortex only. Reference part #3429-12.

#3961 — L1. Cortex only. Reference part #3429-1.

#3959 — L2. Cortex only. Reference part #3429-2.

#3960 — L3. Cortex only. Reference part #3429-3.

#3902 — L4. Cortex only. Reference part #3429-4.

#3962 — Sacrum. Cortex only. Reference part #3429-6.

Lower extremity

#3924 — Large, right hemi pelvis. Cortex only. Reference part #3409.

#3965 — Large, left hemi pelvis. Reference part #3405.

#3908 — Medium, left femur. Reference part #3403.

#3909 — Large, left femur. Reference part #3406.

#3972 — Small, left femur. Reference part #3414.

#3973 — Medium, left tibia. Reference part #3401.

#3975 — Large, left tibia. Reference part #3402.

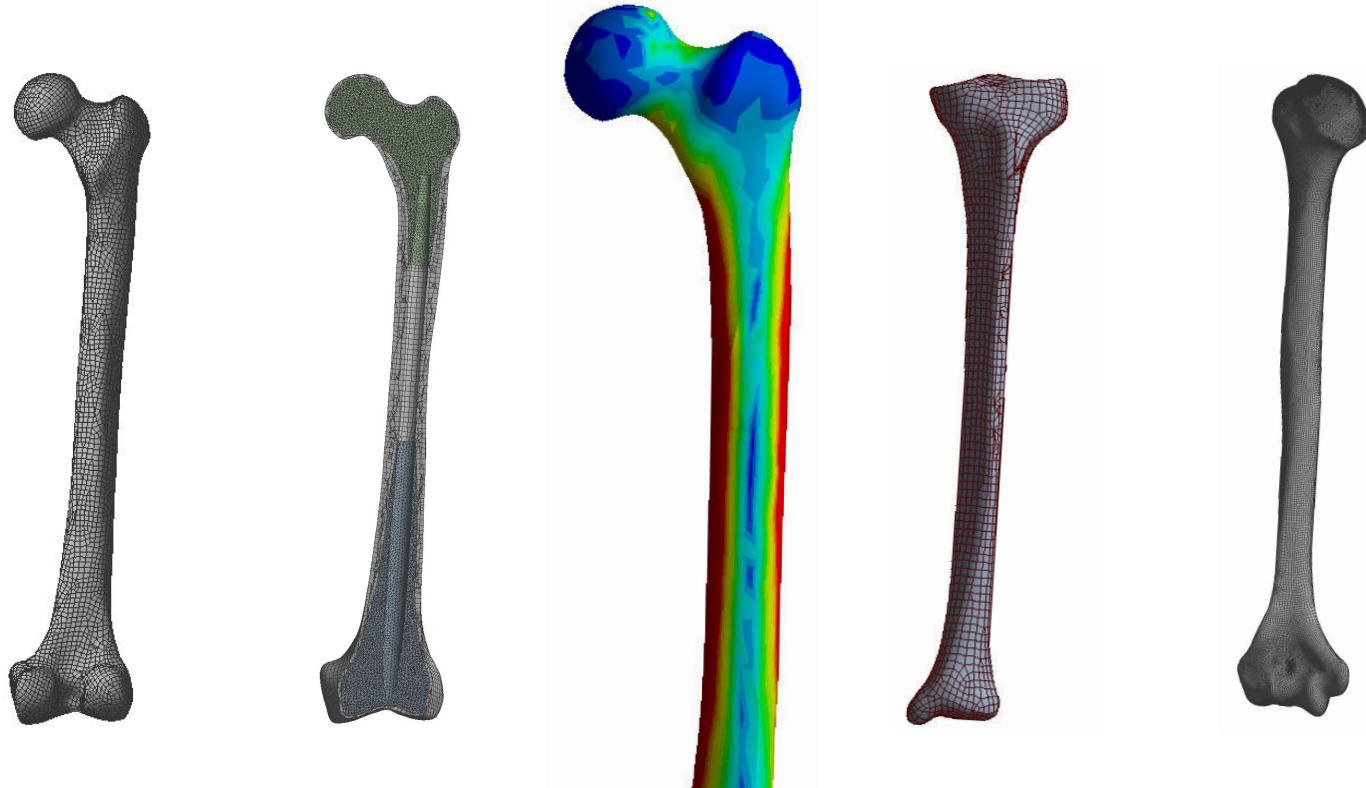
#3976 — Small, left tibia. Reference part #3410.

#3912 — Large, left, first metatarsal. Reference part #3422.

FE MODELS (FINITE ELEMENT)

Sawbones as 3D digital files with coded material properties available for purchase. These files are used for computer simulated experimentation (finite element analysis). The anatomy and material properties of these files are based on the composite bone production line. FE models are most commonly used to optimize, compare and test orthopaedic devices and surgical instruments.

File formats available are Abaqus, APDL, and Nastran. Also available are mesh only files without material properties.



Femur

#3908-10 — Medium model of #3403

#3909-10 — Large model of #3406

#3900-118-10 — Medium model of #3503

Tibia

#3973-10 — Medium model of #3401

#3975-10 — Large model of #3402

Humerus

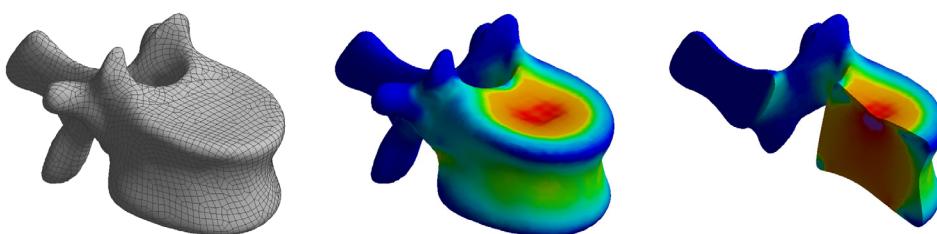
#3907-10 — Large model of #3404

Biomechanical Spine

#3930-10 — T12-sacrum model of #3430

#3930-25-10 — L2-L5 model of #3430-25

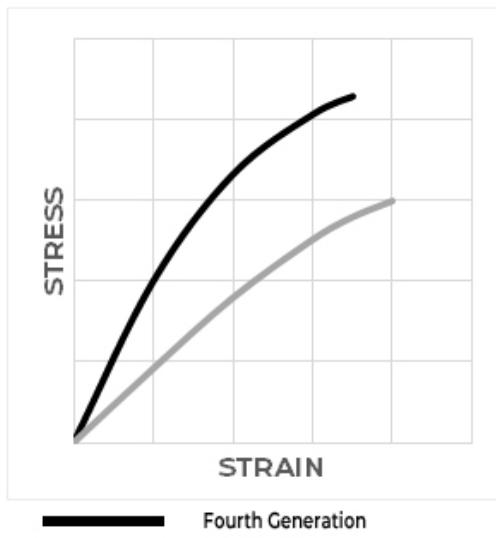
#3930-34-10 — L3-L4 model of #3430-34



OSTEOPOROTIC COMPOSITE BONE

Sawbones has designed a new formulation of composite bone to simulate osteoporosis. The bones have a thin cortical shell with reduced mechanical properties and a 10 PCF solid rigid polyurethane foam cancellous core.

The femur has been bench tested in comparison to osteoporotic cadaver bones with t-scores less than -2.5. Test parameters included anterior-posterior, lateral, torsional and axial bending rigidities, axial failure loads and cortical screw pullout forces.



#3503-3 — Same properties as above but with a 10 mm hollow canal.
#3900-118-10 — FE model of the #3503 osteoporotic composite femur.

COMPOSITE BONES

Composite bones are designed to simulate structural and material properties of cadaveric bone without the challenges of high variability and special handling requirements.



#3437 — Large, left Calcaneus



#3438 — Large, left Talus



#3444 — Large Mandible

SAWBONES CUSTOMER COMMITMENT AND PRODUCT GUARANTEE

At Sawbones, we are committed to providing the highest level of service and product quality. If you are less than completely satisfied with the performance of our products for any reason, we will gladly honor a full refund or replacement.

Contact us anytime with suggestions on how we can improve our products or service.

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Please provide the part number, description, and quantity for each item requested.

Indicate precise shipping instructions, if different than the billing address, and purchase order number when applicable.

Credit cards and bank transfers accepted. Please call customer service.

SAWBONES CORPORATE HEADQUARTERS

Servicing North America, South America, Asia and Australia

10221 SW 188th Street, PO Box 409
Vashon, Washington 98070, USA

E-mail: info@sawbones.com
Tel: (206) 463-5551
Fax: (206) 463-2526

SAWBONES EUROPE AB

Servicing Europe, Middle East and Africa

Krossverksgatan 3,
216 16 Malmö, Sweden

E-mail: info@sawbones.se
Tel: +46 (0)40 650 70 00

SAWBONES®

www.sawbones.com

