

## Suggestions for equipment to support delivery of units in the 9209 Level 4 and 5 qualifications for Civil Engineering

### Comment

Equipment is required for three distinct purposes.

- The first involves the development of the scientific, technical and mathematical knowledge and understanding that both underpins and comprises many of the units. This is the case for 'Hydraulics in Civil Engineering' and 'Structural Mechanics'. The units are written so that, where expensive equipment that might not be used on a regular basis is required, it would be sufficient for the centre to use secondary sources of data.
- The second is to support testing procedures. This is the case for 'Geotechnics and Soil Mechanics', 'Concrete Design' and 'Materials for Civil Engineering'. The units are written so that, where expensive equipment that might not be used on a regular basis is required, it would be sufficient for the centre to use secondary sources of data.
- The third, and most important, relates to the equipment needed to develop essential practical skills. This is the case for 'Site Surveying', 'Advanced Surveying Technology' and the graphical communication learning outcomes in 'Civil Engineering Drafting and Communications'. Such equipment can be purchased or hired as and when required, but the students **must** have access to the equipment in order to develop the required skills.

Unit	Level	Equipment	Comments
422	4	None	
439	4	None	
440	4	Essential for learning and assessment purposes.  Useful for teaching and learning purposes.	<ul style="list-style-type: none"> <li>• Chains, tapes, steel bands, ranging poles, EDM (Electronic Distance Measurement), automatic levels, tilting levels, staffs, rotating laser, theodolites, optical plumbing instruments, construction laser, auto-plumb bob, pegs, profiles, site squares</li> <li>• Sonic measuring devices, water level, pipe alignment laser, total stations, data loggers, GPS (Global Positioning Systems), digital terrain loggers, magnetic compasses</li> </ul>

441	4	Beams, rules, hanging weights, pulleys, string. Proprietary rigs for testing shear force and bending moments. Proprietary equipment for testing frames.	For demonstrating or determining: <ul style="list-style-type: none"> <li>• Principle of moments and beam reactions</li> <li>• Bending moments</li> <li>• Shear-force values</li> <li>• Deflection of beams</li> <li>• Forces acting in frames</li> </ul>
442	4	Soil-testing equipment.	For demonstrating: <ul style="list-style-type: none"> <li>• Direct and hydraulic shear testing</li> <li>• Unconfined compression testing</li> <li>• Triaxial testing</li> <li>• Liquid limits</li> <li>• Permeability testing (constant-head and falling-head permeameters)</li> <li>• Compaction and consolidation (one dimensional) testing</li> <li>• Cbr testing</li> <li>• Density and specific gravity</li> <li>• Other (augers, extruders, pycnometers, hydrometers, 200 mm and 300 mm sieves)</li> </ul>
443	4	For testing aggregates, fresh concrete, hardened concrete, metals, timber and plastics.	For demonstrating and testing: <ul style="list-style-type: none"> <li>• Aggregates (silt test, organic impurities test, bulking, sieve analysis)</li> <li>• The workability of fresh concrete (slump cones, compacting factor apparatus)</li> <li>• The compressive strength of concrete (cube moulds, compression testing machine)</li> <li>• The tensile strength of metals, timber and plastics</li> <li>• The moisture movement of timber and bricks</li> </ul>
444	4	Hydraulic bench and associated equipment. Manometers, Bourdon gauges, piezometers, Pitot tubes.	For determining: <ul style="list-style-type: none"> <li>• Hydrostatic forces and pressure</li> <li>• Velocity of flow, volume flow rates, energy losses (requires a hydraulic bench with orifice plate, venturimeter and pipe friction apparatus)</li> </ul>
445	4	None	
446	4	Essential for manual drafting facilities and equipment.  Essential for CAD (Computer Assisted Design).	<ul style="list-style-type: none"> <li>• Parallel action drawing boards or free-standing boards. Drawing equipment to include pencils, pens, compasses, adjustable set square, eraser, scale rule, dividers, protractors, French curves, stencils.</li> <li>• Each station to include computer, monitor and scanner. Printing facilities must be provided, either to individual stations or networked to all stations. Software must be renewed regularly to maintain currency and keep up with the industry.</li> </ul>
447	4	None	
504	5	None	
520	5	None	

521	5	None	
522	5	None	
523	5	Essential for learning and assessment purposes.  Useful for teaching and learning purposes.	<ul style="list-style-type: none"> <li>Chains, tapes, steel bands, ranging poles, EDM (Electronic Distance Measurement), automatic levels, tilting levels, staffs, rotating laser, theodolites, optical plumbing instruments, construction laser, autoplumb bob, pegs, profiles, site squares.</li> <li>Sonic measuring devices, water level, pipe alignment laser, total stations, data loggers, GPS (Global Positioning Systems), digital terrain loggers, magnetic compasses.</li> </ul>
524	5	None	
525	5	None	
526	5	None	
527	5	None	
528	5	For determining setting times, aggregate properties, workability, compressive strength (some overlap with 443).	<ul style="list-style-type: none"> <li>Setting times of cement (Vicat apparatus)</li> <li>Testing aggregates (silt test, organic impurities test, bulking, sieve analysis)</li> <li>Workability of fresh concrete (slump cones, compacting factor apparatus)</li> <li>Compressive strength of concrete (cube moulds, compression testing machine), concrete mixer.</li> </ul>
529	5	None	