



Australian Government

Assessment Requirements for AHCARB804 Analyse tree structure and biomechanics

Release: 1

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Modification History

Release	Comments
Release 1	This version released with AHC Agriculture, Horticulture and Conservation and Land Management Training Package Version 5.0.

Performance Evidence

An individual demonstrating competency must satisfy all of the elements and performance criteria in this unit.

There must be evidence that the individual has analysed the structure and biodynamics of a minimum of five different trees, including performed the following:

- five static load tests, and
- five dynamic load analyses.

There must also be evidence that the individual has:

- determined existing physical loads affecting trees
- identified areas of high stress on trees and the factors that affect these areas of high stress
- assessed root plate environment for damage
- assessed history and effect of tree pruning operations on tree roots and stems
- determined presence and extent of tree defects
- assessed strength and material properties of tree structural components
- determined wind environment of tree
- determined surface area of structure exposed to wind
- determined crown surface area exposed to wind
- assessed aerodynamic drag factor of tree crown
- estimated primary loads occurring in seasonal climatic events
- determined wind-load of prevailing storms
- determined load associated with saturated foliage
- determined static load on trees for structural integrity testing as an estimate of a wind equivalent load
- calibrated static load testing instruments
- conducted static tests that must include:
 - loads to the tree
 - measures the trunk strength
 - assesses root plate anchorage

- monitored loads and forces using electronic equipment
- monitored trees to ensure loads are kept within safe limits to prevent damage
- maintained records of all data from static tests
- compared data against benchmarks from stable tree populations and prepared a report on structural integrity testing
- investigated tree biomechanics using dynamic methods of analysis
- reviewed complex models of tree dynamics analysis
- calculated mass of branches to determine degree of open-grown form of tree
- calculated vector of force on the tree
- determined tree dynamic response under defined wind loads
- investigated level of contribution of material properties in tree dynamics
- investigated the dynamic effect of branches on frequency and damping
- determined the level of contribution of form and morphology in tree dynamics
- reviewed suitability of invasive and non-invasive methods of testing
- evaluated and determined likelihood of structural failure
- confirmed level of anchoring potential of root system and stability of tree
- prepared a structural integrity report and provided to client.

Knowledge Evidence

An individual must be able to demonstrate the knowledge required to perform the tasks outlined in the elements and performance criteria of this unit. This includes knowledge of:

- tree dynamics and impact of tree form and morphology
- tree stability and physical loads affecting trees, particularly in high stress environments
- root plate environment, including:
 - depth and consistency of soil
 - spatial limitations
 - site excavations and potential damage
- arboricultural activity and impact on tree structure and stability, including:
 - pruning operations to branches and roots
- presence and impact of defects on tree structure, including:
 - extent of decay and damage of trunk and root system
 - assessment of strength and material properties of structural wood
- biomechanical impact of wind on tree structure, including:
 - seasonal wind patterns, and tree exposure
 - surface area and tree structure
 - aerodynamic drag factor of tree crown in relation to trunk diameter and extent of hollowness
 - estimation of primary loads occurring in seasonal climatic events
 - severe wind-load due to storms and extreme weather conditions
 - load associated with rain and snow saturated foliage

- additional drag associated with saturated foliage
- open-grown form of tree
- testing principles for static load, including:
 - use and purpose of a static load on trees during structural integrity testing as an estimate of a wind equivalent load
 - calibrating static load testing instruments
 - limits of structural safety during a static testing
 - measurement of trunk strength
 - invasive and non-invasive methods of testing trees
- assessment of root plate anchorage in the ground
- methods and reasons for monitoring loads and forces on trees, including:
 - electronic monitoring
 - monitoring of tree to ensure loads are kept within safe limits
- value and purpose of benchmarks obtained from stable tree populations
- tree biomechanics studies using dynamic methods of analysis, including:
 - simple models of tree dynamics
 - complex models and finite element analyses
 - multimodal approaches representing dynamics of branches on trees
- calculations required for structural and biomechanical assessments of trees, including:
 - mass of branches
 - vector of force on trees
 - tree dynamic response
 - wind velocity and direction
 - statistical analysis and interpretation of test results
- dynamic effect of branch movement on tree stability and failure rate, including:
 - oscillation frequency
 - energy dissipation and damping effect of canopy structure
 - likelihood of structural failure
 - level of anchoring potential of root system
 - stability of tree
- records and reporting procedures for analysis of structural integrity testing.

Assessment Conditions

Assessment of the skills in this unit of competency must take place under the following conditions:

- physical conditions:
 - an arboriculture work site that has the trees stipulated in the performance evidence
- resources, equipment and materials:
 - computer with word processing software

- wind environment statistics
- static load test equipment
- models of tree dynamics
- specifications:
 - test equipment manuals, standard procedures and quality standards for performing load tests
 - sample reports for the diagnostic test methods listed in the performance criteria.

Assessors of this unit must satisfy the requirements for assessors in applicable vocational education and training legislation, frameworks and/or standards. In particular, assessors must have:

- arboriculture vocational competencies at least to the level being assessed
- current arboriculture industry skills directly relevant to the unit of competency being assessed.

Links

Companion Volumes, including Implementation Guides, are available at VETNet: -
<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=c6399549-9c62-4a5e-bf1a-524b2322cf72>