



Australian Government

AHCARB701 Analyse tree biomechanics

Release: 1

AHCARB701 Analyse tree biomechanics

Modification History

Release	TP Version	Comment
1	AHCv1.0	Initial release

Application

This unit of competency describes the skills and knowledge required to identify and analyse aspects of tree biomechanics that affect the physical loads and strengths of trees, branches and anchorage in the ground; understand the assessment of tree strength and the loads that occur; and assess factors that can weaken the tree and are likely to increase the chance of failure.

This unit applies to individuals with broad and coherent theoretical and technical knowledge with depth in one or more disciplines or areas of practice and cognitive, technical and communication skills to demonstrate autonomy, well developed judgement and responsibility in undertaking complex self-directed work and learning to provide specialist advice and functions.

The role involves the self-directed application of specialised knowledge in arboriculture with substantial depth in areas such as with substantial depth in areas such as tree statics, dynamics, wind loading and structural failure.

No occupational licensing, legislative or certification requirements are known to apply to this unit at the time of publication.

Pre-requisite Unit

Nil.

Unit Sector

Arboriculture (ARB)

Elements and Performance Criteria

Element	Performance criteria
Elements describe the essential outcomes.	Performance criteria describe the performance needed to demonstrate achievement of the element.
1. Determine existing physical loads and	1.1 Determine existing physical loads affecting trees 1.2 Identify areas of high stress on trees and the factors that affect

Element	Performance criteria
strengths of trees, branches and anchorage	these areas of high stress 1.3 Assess root plate environment including depth and consistency of soil, spatial limitations and history of site excavations 1.4 Assess prior tree pruning operations to branches and roots 1.5 Determine extent of decay and damage of trunk and root system 1.6 Assess strength and material properties of structural wood, particularly in areas of high stress
2. Determine wind load	2.1 Determine wind environment of tree 2.2 Determine surface area of structure exposed to wind 2.3 Determine crown surface area exposed to wind 2.4 Assess aerodynamic drag factor of tree crown in relation to trunk diameter and extent of hollowness 2.5 Estimate primary loads occurring in seasonal climatic events 2.6 Determine wind-load of prevailing storms 2.7 Determine load associated with saturated foliage 2.8 Consider additional drag associated with saturated foliage
3. Determine structural integrity by static load testing	3.1 Determine appropriate static load on trees for structural integrity testing as an estimate of a wind-equivalent load 3.2 Calibrate static load testing instruments so loads are accurately applied and maintained within limits of structural safety during a static test 3.3 Carry out a static test that loads the tree, measures the trunk strength and assesses root plate anchorage in the ground 3.4 Monitor loads and forces electronically 3.5 Monitor tree to ensure loads are kept within safe limits and damage is avoided to tree 3.6 Maintain accurate records of all data from static test. 3.7 Compare data with benchmarks obtained from stable tree populations 3.8 Document a report on structural integrity testing of tree from the static load test
4. Determine tree dynamic response	4.1 Research tree biomechanics studies using dynamic methods of analysis 4.2 Understand simple models of tree dynamics 4.3 Review complex models and finite element analyses that provide multimodal approaches representing dynamics of branches on trees 4.4 Calculate existing mass of branches 4.5 Determine degree of open-grown form of tree by calculation of the of branch mass

Element	Performance criteria
	4.6 Calculate vector of force on the tree 4.7 Determine the tree dynamic response in defined wind velocity and direction 4.8 Document a report on structural integrity testing of tree from the dynamic load analysis
5. Document a structural integrity report	5.1 Research level of contribution of material properties in tree dynamics 5.2 Research dynamic effect of branches on frequency and damping 5.3 Determine level of contribution of form and morphology in tree dynamics 5.4 Review suitability of invasive and non-invasive methods of testing 5.5 Evaluate and determine likelihood of structural failure 5.6 Confirm level of anchoring potential of root system and stability of tree 5.7 Document a structural integrity report and provide to client

Foundation Skills

Foundation Skills essential to performance are explicit in the performance criteria of this unit of competency.

Range of Conditions

Unit Mapping Information

Not in unit mapping for CfE, but is used in AHC80115 - no equivalent.

Links

Companion Volume implementation guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=c6399549-9c62-4a5e-bf1a-524b2322cf72>

Assessment Requirements for AHCARB701 Analyse tree biomechanics

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Performance Evidence

The candidate must be assessed on their ability to integrate and apply the performance requirements of this unit in a workplace setting. Performance must be demonstrated consistently over time and in a suitable range of contexts.

The candidate must provide evidence for and demonstrate:

- determining existing physical loads affecting trees
- identifying areas of high stress on trees and the factors that affect these areas of high stress
- assessing root plate environment including depth and consistency of soil, spatial limitations and history of site excavations
- assessing prior tree pruning operations to branches and roots
- determining extent of decay and damage of trunk and root system
- assessing strength and material properties of structural wood, particularly in areas of high stress
- determining wind environment of tree
- determining surface area of structure exposed to wind
- determining crown surface area exposed to wind
- assessing aerodynamic drag factor of tree crown in relation to trunk diameter and extent of hollowness
- estimating primary loads occurring in seasonal climatic events
- determining wind-load of prevailing storms
- determining load associated with saturated foliage
- considering additional drag associated with saturated foliage
- determining appropriate static load on trees for structural integrity testing as an estimate of a wind equivalent load
- calibrating static load testing instruments so loads are accurately applied and maintained within limits of structural safety during a static test
- carrying out a static test that loads the tree, measures the trunk strength and assesses root plate anchorage in the ground
- monitoring loads and forces electronically
- monitoring tree to ensure loads are kept within safe limits and damage is avoided to tree

- maintaining accurate records of all data from static test.
- comparing data with benchmarks obtained from stable tree populations
- documenting a report on structural integrity testing of tree from the static load test.
- researching tree biomechanics studies using dynamic methods of analysis
- understanding simple models of tree dynamics
- reviewing complex models and finite element analyses that provide multimodal approaches representing dynamics of branches on trees
- calculating the existing mass of branches
- determining degree of open-grown form of tree by calculation the of branch mass
- calculating the vector of force on the tree
- determining the tree dynamic response in defined wind velocity and direction
- researching the level of contribution of material properties in tree dynamics
- researching the dynamic effect of branches on frequency and damping
- determining the level of contribution of form and morphology in tree dynamics
- reviewing suitability of invasive and non-invasive methods of testing
- evaluating and determining likelihood of structural failure
- confirming level of anchoring potential of root system and stability of tree
- documenting a structural integrity report and provide to client.

Knowledge Evidence

The candidate must demonstrate knowledge of:

- physical loads affecting trees
- areas of high stress on trees
- root plate environment including depth and consistency of soil, spatial limitations and history of site excavations
- prior tree pruning operations to branches and roots
- extent of decay and damage of trunk and root system
- assessment of strength and material properties of structural wood
- wind environment of tree
- surface area of structure exposed to wind
- crown surface area exposed to wind
- aerodynamic drag factor of tree crown in relation to trunk diameter and extent of hollowness
- estimation of primary loads occurring in seasonal climatic events
- wind-load of prevailing storms
- load associated with saturated foliage
- additional drag associated with saturated foliage
- static load
- static load test
- appropriateness of a static load on trees for structural integrity testing as an estimate of a wind equivalent load
- calibrating static load testing instruments

- limits of structural safety during a static test
- measurement of trunk strength
- assessment of root plate anchorage in the ground
- monitoring loads and forces electronically
- monitoring of tree to ensure loads are kept within safe limits
- avoidance of damage to tree
- maintenance of accurate records of all data from static test
- benchmarks obtained from stable tree populations
- reporting on structural integrity testing of tree
- researching tree biomechanics studies using dynamic methods of analysis
- simple models of tree dynamics
- complex models and finite element analyses
- multimodal approaches representing dynamics of branches on trees
- calculations of existing mass of branches
- open-grown form of tree
- vector of force on trees
- tree dynamic response
- wind velocity and direction
- material properties in tree dynamics
- dynamic effect of branches on frequency and damping
- form and morphology in tree dynamics
- of invasive and non-invasive methods of testing
- likelihood of structural failure
- level of anchoring potential of root system
- stability of tree
- structural integrity reporting.

Assessment Conditions

It is an industry requirement that competency in this unit requires the assessment of:

- five (5) static load tests, and
- five (5) dynamic load analyses.

Assessment must be demonstrated consistently over time in a suitable range of contexts and have a productivity-based outcome. No single assessment event or report is sufficient to achieve competency in this unit.

Assessment may be conducted in a simulated or real work environment, however determination of competency requires the application of work practices under work conditions.

The mandatory equipment and materials used to gather evidence for assessment include:

- equipment:
 - computer

- word processing software
- internet connection
- wind environment statistics
- static load equipment
- models of tree dynamics
- materials:
 - structural integrity report

Assessors must satisfy current standards for RTOs in the assessment of arboriculture units of competency.

Assessment must be conducted only by persons who have:

- tree biomechanics vocational competencies at least to the level being assessed
- current tree biomechanics skills directly relevant to the unit of competency being assessed

Links

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