This QRG will demonstrate how to complete **Failure Containment** load case checks for Ausgrid Distribution assets.

Failure Containment Requirements

The requirements for Failure Containment are set out in Ausgrid Network Standard NS220.

Ausgrid requires designers to check termination structures against the **Failure Containment condition** (also known as ***broken wire***). This check is to mitigate potential pole failure due to:

- an unbalanced load being applied to a structure; and
- the loss of a stay wire (where installed).

Through-termination structures shall be designed to withstand the equivalent longitudinal load displacement of one phase per circuit; the combination of which has the worst-case loading effect on the structure. For HV and LV circuits on the same structure, this will result in the removal of one phase from both HV & LV circuits.

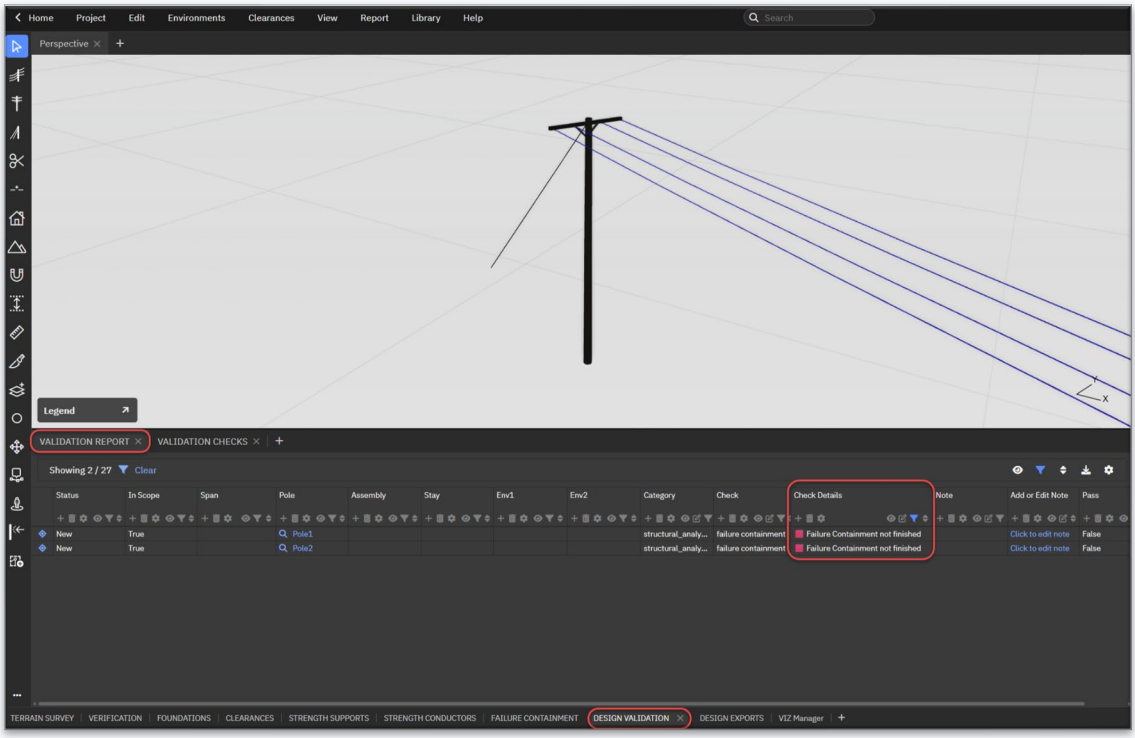
For stayed structures, the pole and foundation shall be capable of withstanding the Failure Containment load with the stay wire removed and all phase conductors assumed to be intact. This requirement ensures that the pole will not collapse in the event of a stay component failure under moderate weather conditions.

For structures with multiple stay arrangements, only one stay component is to be removed for this load check condition.

Validation Report Checks

Neara has been developed to ensure that Failure Containment checks are carried out for the scenarios described above. The steps outlined below must be followed to satisfy the Failure Containment requirements. Successful completion of these checks will be acknowledged within the ***DESIGN VALIDATION*** workspace.

Ensure that pole statuses are set appropriately in the ***VERIFICATION*** workspace, as these set the Failure Containment check requirements.



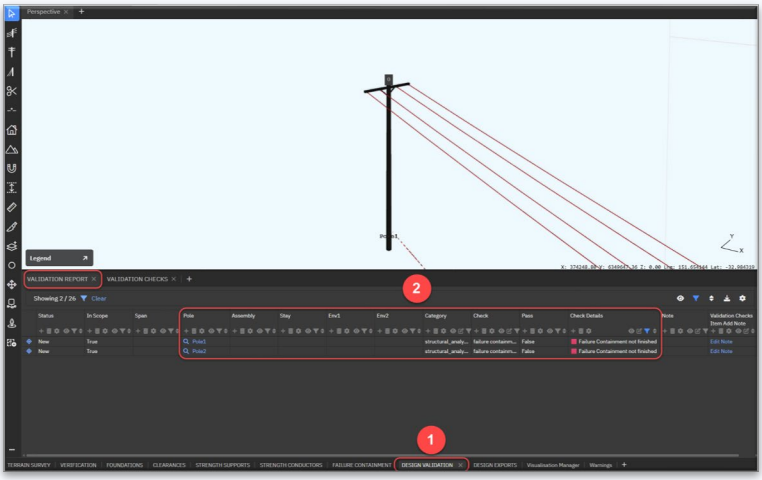
Failure Containment Procedure

Single-Circuit Terminal Structure

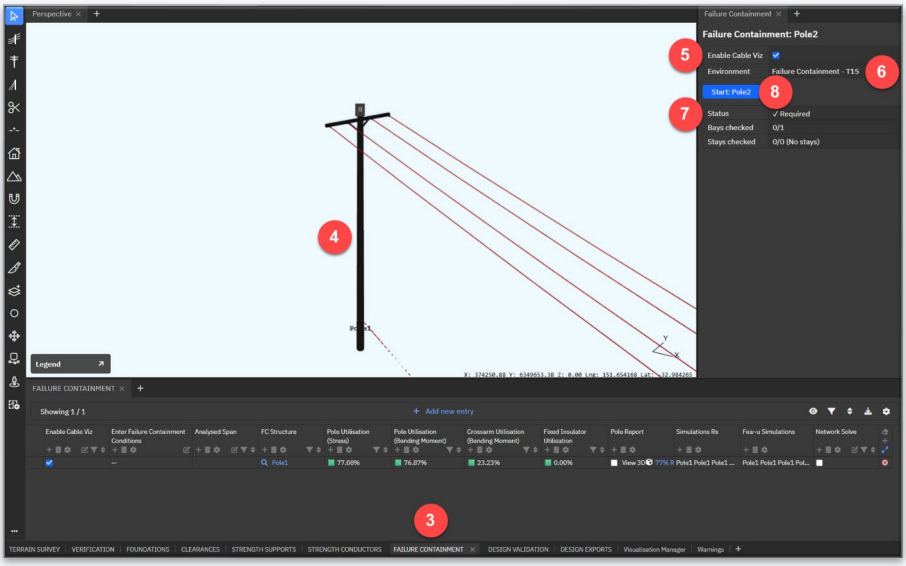
All single-ended termination structures require the following Failure Containment (FC) check. Although unlikely to ever be the dominating load case for a single-ended termination, a FC check is still required.

Pass/Fail Criteria: Pole is to **PASS** structural assessment against FC load case

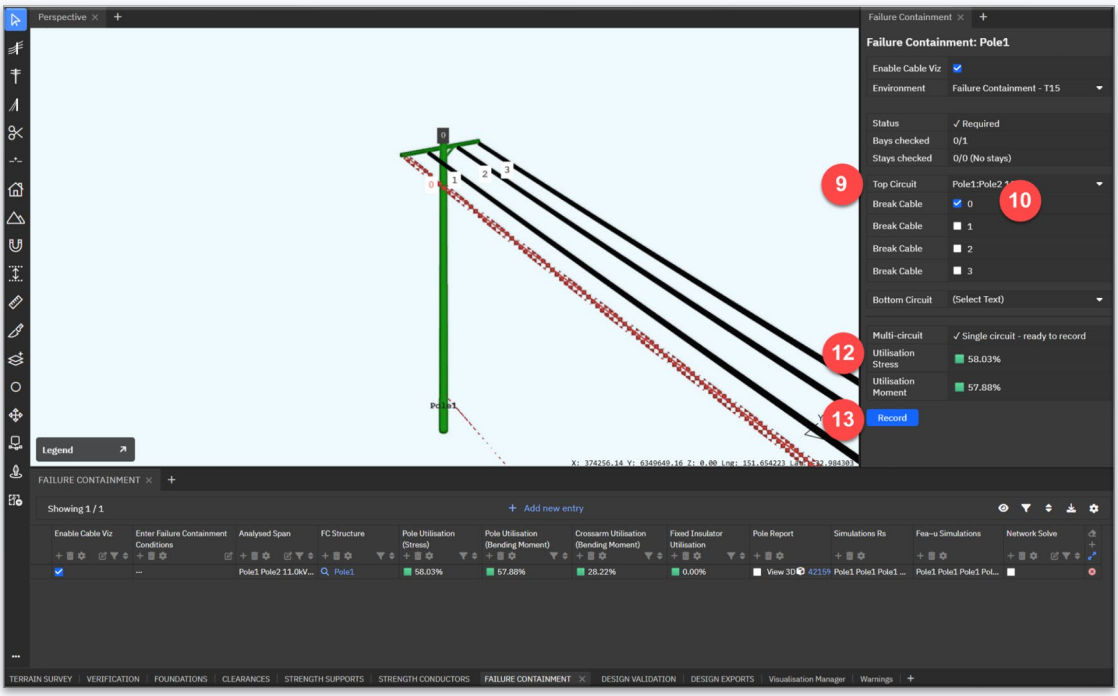
1. Navigate to the ***DESIGN VALIDATION*** workspace
2. Identify the poles requiring Failure Containment checks



3. Navigate to the ***FAILURE CONTAINMENT*** workspace
4. Select the target pole
5. Select the ***Enable Cable Viz*** tickbox – this will allow you to display the conductors being broken
6. Select the corresponding **Environment** : ***Failure Containment – T15***
7. The ***Status*** display will show what is required for that structure. In this example, only the ***bay*** requires a Failure Containment check as there is no stay attached to this structure.
8. Select the blue ***Start: Pole 'x'*** button.



Single-Circuit Terminal Structure (Continued)



9. Select the ***Top Circuit*** (Pole1:Pole2 11kV in this example above)
10. Break the conductor that would provide the worst-case loading profile. In this example, the outermost conductor will apply the worst-case loading effect.
11. As there is no ***Bottom Circuit***, it isn't necessary to complete this step
12. The strength check result will be displayed; green (<100% utilisation) indicates a Pass.
13. Select the blue ***Record*** button to save the result
14. Navigate to the ***DESIGN VALIDATION*** workspace to confirm the acceptance of this ***Pass*** result

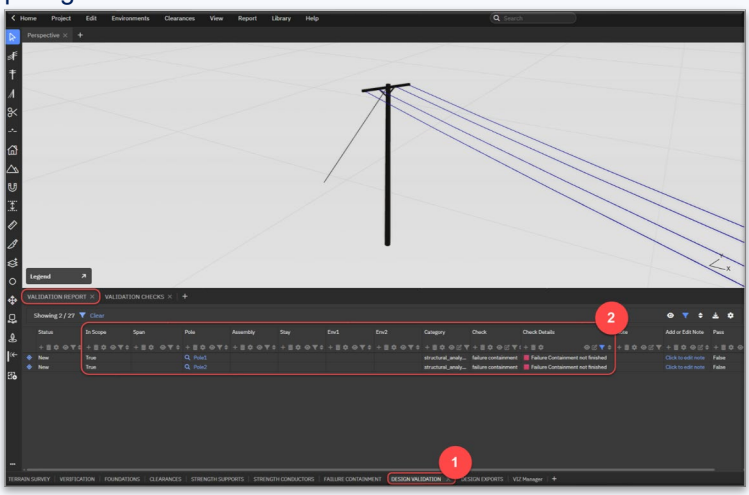
Single-Circuit Terminal Structure with Stay

All termination structures and / or structures containing stays, require the following Failure Containment (FC) check. Although unlikely to ever be the dominating load case for a single-ended termination, a FC check is still required.

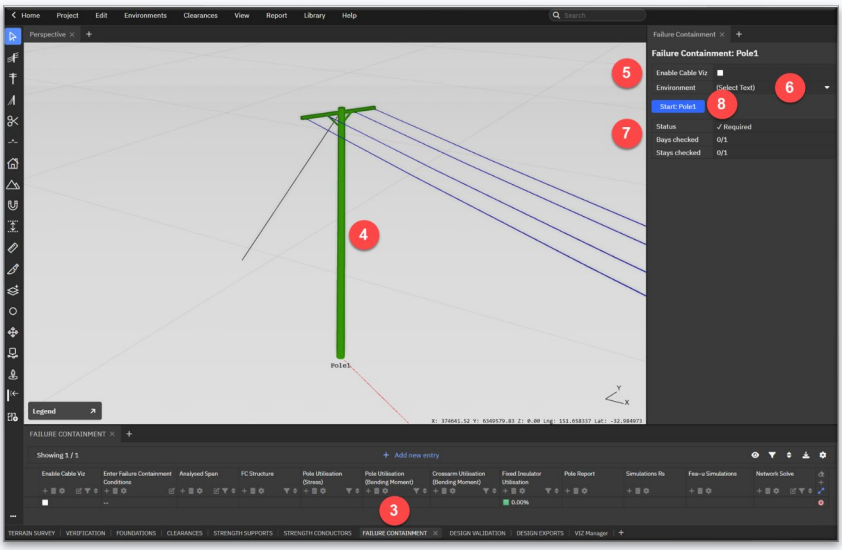
Pass/Fail Criteria: Pole is to **PASS** structural assessment against FC load case (broken conductor wire)

Pole is to **PASS** structural assessment against FC load case (broken stay wire)

1. Navigate to the ***DESIGN VALIDATION*** workspace
2. Identify the poles requiring Failure Containment checks

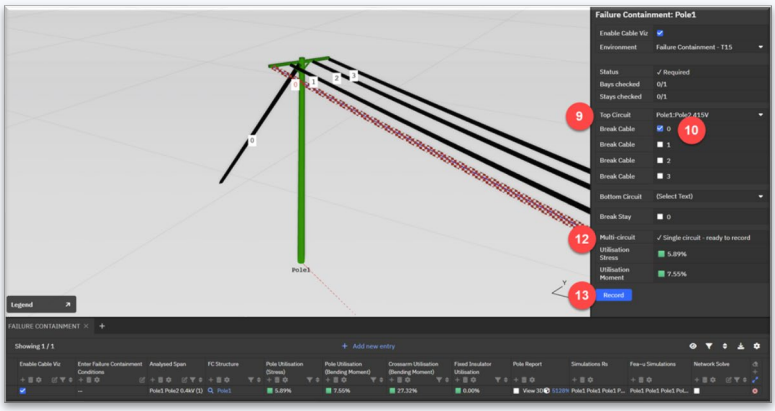


3. Navigate to the ***FAILURE CONTAINMENT*** workspace
4. Select the target pole
5. Enable the ***Cable Viz*** tickbox – this will allow you to display the conductors being broken
6. Select the corresponding **Environment** : ***Failure Containment – T15***
7. The ***Status*** display will show what is required for that structure. In this example, **both** the ***bay*** and the ***stay*** require Failure Containment checks (separately).
8. Select the blue ***Start: Pole 'x'*** button

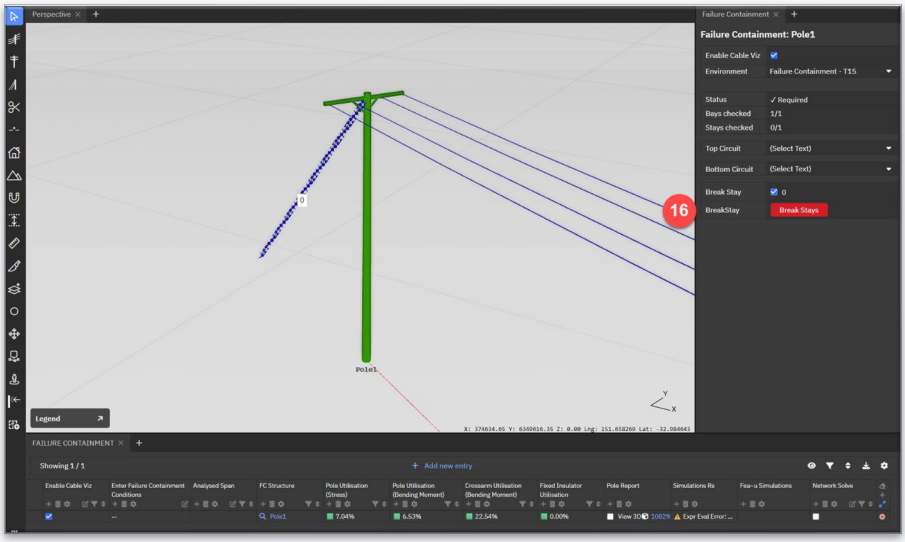


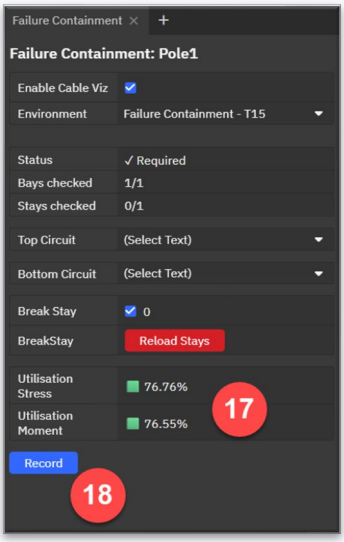
Single-Circuit Terminal Structure with Stay (Continued)

9. Select the ***Top Circuit*** (Pole1:Pole2 11kV in this example).
10. Break the conductor that would provide the worst-case loading profile. In this example, the outermost conductor will apply the worst-case loading effect.
11. As there is no ***Bottom Circuit***, it isn't necessary to complete this.
    Do not break the stay at the same time as this requires an independent check.
12. The strength check result will be displayed; green indicates a Pass (<100% utilisation).
13. Select the blue ***Record*** button to save the result. This will reset the FC display.



14. Remain on the ***FAILURE CONTAINMENT*** workspace to complete the **Stay** FC check
15. Select the ***Break Stay*** tickbox (remembering the Environment is already configured to ***Failure Containment – T15***).
16. Select the red ***Break Stay*** button
17. The strength check result will be displayed; green indicates a Pass (<100% utilisation).
18. Select the blue **Record** button
19. Select the red ***Reload Stays*** button otherwise the stay wire will remain broken for all other design strength checks
20. Navigate to the ***DESIGN VALIDATION*** workspace to confirm the acceptance of this **Pass** result. Any ***'Failure Containment not finished'*** status should have been cleared.



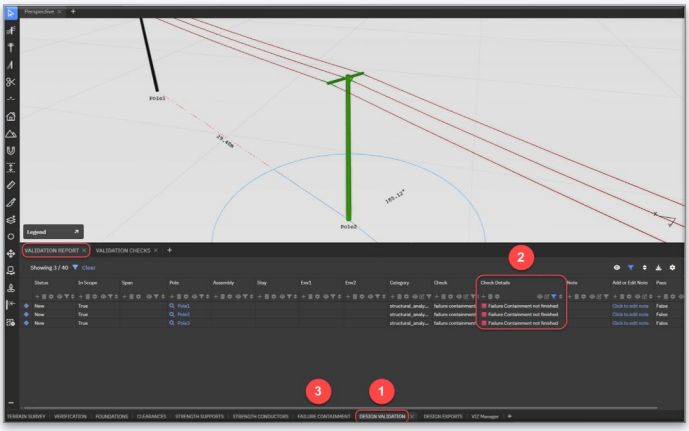


Single-Circuit Through-Termination Structure

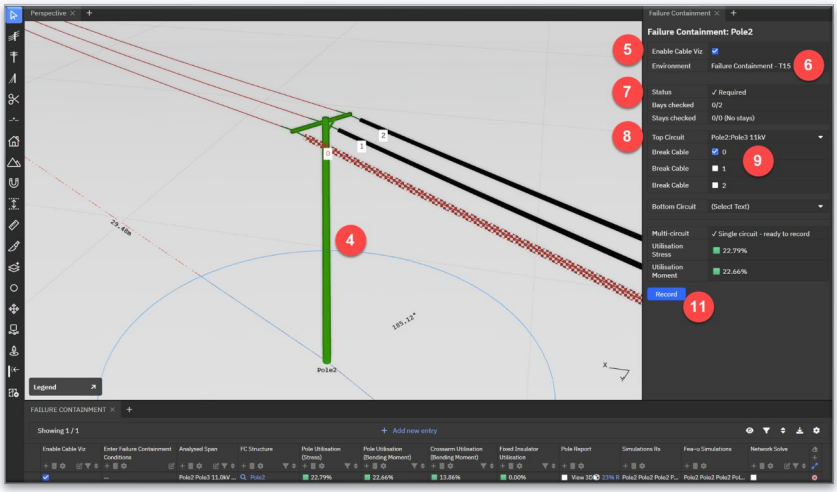
All through-termination / strain structures require the following Failure Containment (FC) checks.

Pass/Fail Criteria: Pole is to **PASS** structural assessment against FC load case for all bays.

1. Navigate to the ***DESIGN VALIDATION*** workspace
2. Identify the poles requiring Failure Containment checks

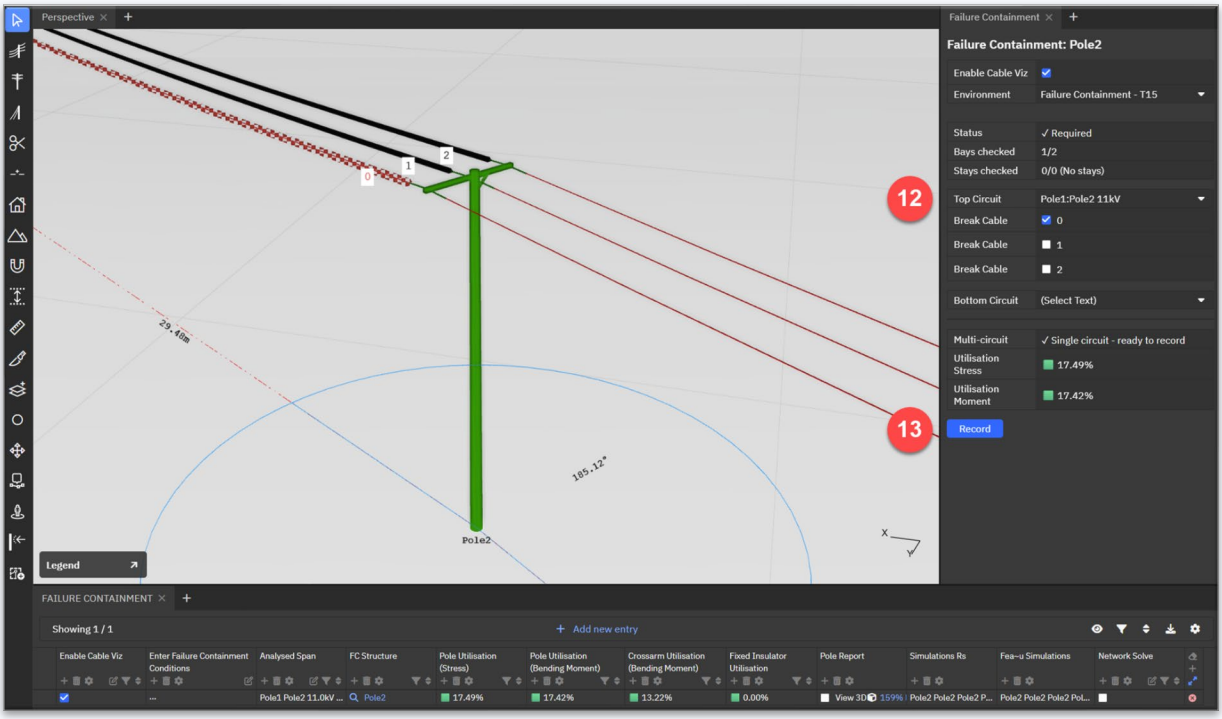


3. Navigate to the ***FAILURE CONTAINMENT*** workspace.
4. Select the target pole
5. Select the ***Enable Cable Viz*** tickbox – this will allow you to display the conductors being broken.
6. Select the corresponding **Environment** : ***Failure Containment – T15***
7. The ***Status*** display will show what is required for that structure. In this example, two bays require a FC check. Select the blue ***Start: Pole 'x'*** button.
8. Select the ***Top Circuit*** (Pole2:Pole3 11kV in this example) – this span will be highlighted in the ***Perspective View***
9. Break the conductor that will provide the worst-case loading. In this example the outer most conductor will apply the worst-case loading effect.
10. As there is no ***Bottom Circuit***, it isn't necessary to complete this step.
    The strength check result will be displayed; green indicates a Pass.
11. Select the blue ***Record*** button to save the result



Single-Circuit Through-Termination Structure (continued)

12. Repeat this same process for the adjacent span (Pole1:Pole2 11kV in this example). Break the conductor that will provide the worst-case loading. In this example the outer most conductor will apply the worst-case loading effect.
    The strength check result will be displayed; green indicates a Pass.
13. Select the blue ***Record*** button
14. Navigate to the ***DESIGN VALIDATION*** workspace to confirm the acceptance of this **Pass** result. Any ***'Failure Containment not finished'*** status should have been cleared.



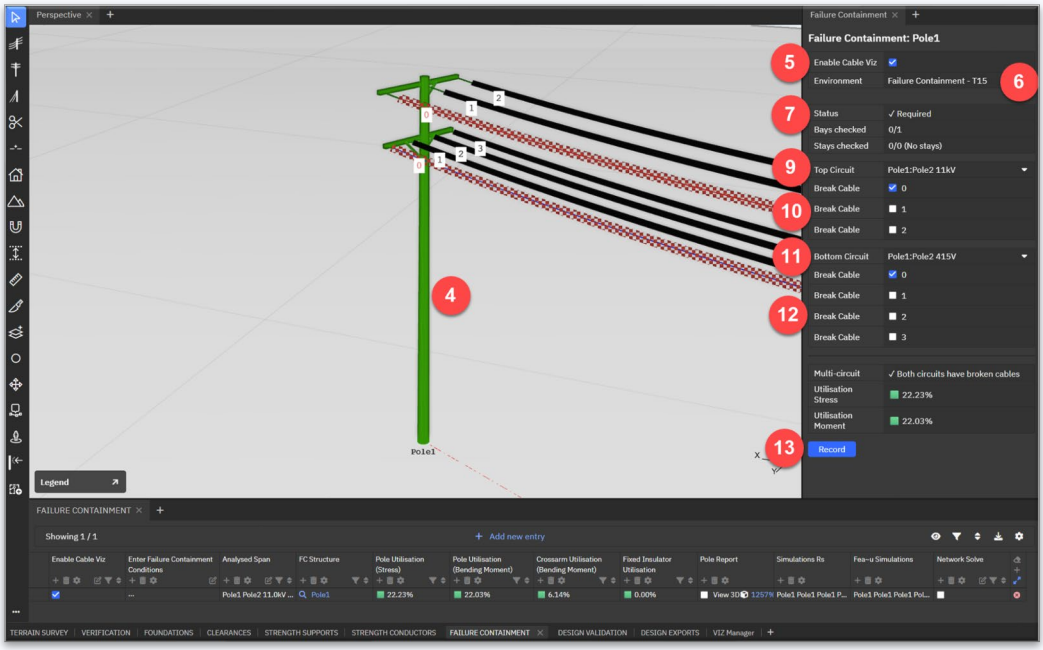
NOTES:

- The designer is responsible for identifying the worst-case failure containment scenario resulting from broken conductor combinations.
- While it is not mandatory for the crossarm to satisfy the failure containment load case, it is good engineering practice to achieve compliance where practicable, such as by reducing conductor tensions or selecting a higher-capacity crossarm.
- The FAILURE CONTAINMENT workspace may also be used to adjust pole loading to represent construction and maintenance conditions. Select either the Maintenance – T15 or Construction – T15 environment as appropriate.

Multiple-Circuit Terminal Structure

Where multiple circuits are arranged vertically, Failure Containment checks are completed for each bay and grouped together for each circuit to meet the requirements of Network Standard NS220.

1. Navigate to the ***DESIGN VALIDATION*** workspace
2. Identify the poles requiring Failure Containment checks
3. Navigate to the ***FAILURE CONTAINMENT*** workspace.



4. Select the target pole
5. Select the ***Enable Cable Viz*** tickbox – this will allow you to display the conductors being broken.
6. Select the corresponding **Environment** : ***Failure Containment – T15***
7. The ***Status*** display will show what is required for that structure. In this example, only the bay requires a Failure Containment check.
8. Select the blue ***Start: Pole 'x'*** button.
9. Select the ***Top Circuit*** (Pole1:Pole2 11kV in this example above)
10. Break the conductor in this circuit that would provide the worst-case loading profile. In this example the outermost conductor will apply the worst-case loading effect.
11. Select the ***Bottom Circuit*** (Pole1:Pole2 415V in this example above)
12. Break the conductor in this circuit that would provide the worst-case loading profile. In this example the outermost conductor will apply the worst-case loading effect.
13. The strength check result will be displayed; green indicates a Pass. Select the blue ***Record*** button to save the result.
14. Navigate to the ***DESIGN VALIDATION*** workspace to confirm the acceptance of this ***Pass*** result. Any ***'Failure Containment not finished'*** status should have been cleared.