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MARITIME ELECTRIC
A FORTIS COMPANY

September 21, 2018



Ms. Cheryl Mosher
Regulatory Services
Island Regulatory and Appeals Commission
PO Box 577
Charlottetown PE C1A 7L1

Dear Ms. Mosher:

***2019 Capital Budget Filing Docket UE20728***
***Response to Interrogatories from Commission Staff***

Please find attached the Company's response to the Interrogatories filed by Commission Staff with respect to the 2019 Capital Budget filing. Attachments 2, 3 and 4 will be filed separately due to the commercial sensitivity of the information contained in those documents. An electronic copy will follow.

Yours truly,

MARITIME ELECTRIC

Jason C. Roberts
Vice President, Finance and
Chief Financial Officer

JCR50
Enclosure

180 Kent Street • PO Box 1328 • Charlottetown, PE C1A 7N2
**telephone** 1-800-670-1012 • **fax** 902-629-3665 • **maritimeelectric.com**

# I N T E R R O G A T O R I E S

**Responses to Interrogatories**
**from**
**Commission Staff**

**2019 Capital Budget Application**
**UE20728**

**Submitted September 21, 2018**

**The Island Regulatory and Appeals Commission (the "Commission"), in assessing the reasonableness of the 2019 Capital Budget Application submitted by Maritime Electric Company, Limited ("Maritime Electric" or "MECL"), requests responses to the following interrogatories:**

1. With respect to **Section 4.3(a)** Combustion Turbine 3 Turbo-Generator Overhaul, please:

   a. Provide the full particulars of the project costs listed in Appendix C, Table 1 by line item (i.e. Material, Internal Labour and Project Management).
   b. Provide all quotes obtained from suppliers, particularly with respect to Material.

***Response***

a. **Project Cost Estimate**
The estimate to complete all work associated with the CT3 Turbine Inspection and Overhaul Project is $1,235,000. Table 1 provides a breakdown of the total project cost.

| Description | Project Cost |
|---|---|
| Material | $ 1,023,000 |
| Internal Labour | 40,000 |
| Project Management | 172,000 |
| **TOTAL** | **$ 1,235,000** |

The breakdown of the material component in Appendix C is outlined in the General Electric Equipment and Services Proposal included as Appendix 1 of the Appendix C document. These amounts are as follows:

**Material**
Firm Fixed Price Service Bulletin Implementation USD $331,360 + (30%) = CAD $430,768
(as quoted by General Electric see Appendix C, Appendix 1)

HPT Coupling Nut Replacement USD $96,000 + (30%) = CAD$124,800
(as quoted by General Electric see Appendix C, Appendix 1)

Field Service – Engine Removal CAD $28,021
(as quoted by General Electric see Appendix C, Appendix 1)

Field Service – Engine Installation CAD $50,743
(as quoted by General Electric see Appendix C, Appendix 1)

Optional – Engine Test USD $48,640 + (30%) = CAD $63,232
(as quoted by General Electric see Appendix C, Appendix 1)

Optional Service Bulletin Implementation (as described in Appendix C, Appendix 2)
CAD $306,329

| | |
|---|---|
| Certification of Lifting Apparatus | CAD $3,000 |
| Cranage | CAD $5,000 |
| Custom Duty | CAD $2,500 |
| Factory Acceptance Testing (witness by Maritime Electric in Houston) | CAD $8,000 |
| **TOTAL** | **$1,022,393 (rounded) to $1,023,000** |

**Internal Labour**
The estimate of internal labour costs is based on previous engine removal and installation. The use of Maritime Electric personnel to dismantle the combustion turbine (engine), remove it from the enclosure package in an OEM-supplied shipping container and subsequently reinstall into the package after completion of the Service Bulletins has been estimated at 5 people working 14 days, 12 hour days at an estimated cost of approximately $40,000.

**Project Management**
Project management provides for the estimated cost of internal staffing time to develop the project, scope of work and related work plan, source material and resources, execute and complete the associated documentation and closure of the project. The project team contributing a portion of their time to the project consists of:

Supervisor, Combustion Turbines
Staff Engineer
Chief Engineer, Superintendent Mechanical Maintenance

b. See Appendix C containing Appendix 1 and Appendix 2 for General Electric budgetary quotations.

2. With respect to **Section 4.4(a), (b)** Borden Plant Projects:

   a. How are the provisional amounts for combustion turbine improvements and buildings and services improvements calculated?
   b. What improvements are planned for the 2019 year?
   c. Please provide all quotes/estimates obtained in relation to the proposed improvements.

***Response***

a. Due to the age of the machinery at the Borden Generation Station (1971, 1972) some parts for the equipment are no longer available and require fabrication to allow for the unit's continued safe and reliable operation. Based on the annual inspections of the units Maritime Electric requires timely replacement or retrofit of these component(s). Provisional amounts are estimated, based on past experience, to cover the cost of vintage equipment no longer being able to be directly sourced.

b. The improvements for these units are based on the results of annual inspection and testing of the units to be conducted in 2019 and, as a result, are not planned improvements. The provisional amounts are budgeted to allow the fabrication of parts identified for replacement post inspection.

c. These quote/estimates will be obtained post project identification.

3. With respect to **Section 5.2(a)** Polemount and Padmount Transformer Equipment:

   a. Please provide full particulars of the project, including expenditures and work to be performed.
   b. Please provide any quotes or estimates MECL obtained for labour and/or materials.
   c. Are the transformers replacing existing transformers? If so, please provide confirmation that the transformers to be replaced are at the end of their useful life.

***Response***

a. This budget provides for the purchase and installation of various types and kVA sizes of polemounted and padmounted transformers. Providing polemount and padmount transformers to serve customers is core utility business. Having an appropriate stock of polemount and padmount transformers for new services, for replacement of failed units and for storm damage is a requirement for Maritime Electric to meet its obligation to service customers each year. The budget will enable the purchase of the individual transformers as well as their installation and consists of the following estimated budget amounts:

| | |
|---|---|
| Equipment | $ 2,678,000 |
| Installation | 690,000 |
| TOTAL | $ 3,368,000 |

b. Maritime Electric obtains quotes for the supply of polemount transformers in a collaborative effort along with other Fortis utilities. The Company then enters into a multi-year contract based on the best evaluated costs from transformer vendors that can supply polemount transformers to meet the Maritime Electric polemount transformer specification. A contract with ABB was signed in 2016 and is up for renewal in 2019 with an option for a two year extension.

   Each quarter estimates of polemount transformer material input costs, such as silicone core steel, amorphous core steel, copper wire, aluminum wire, insulation and mineral oil are adjusted based on the reference indices from Electrical Equipment Manufacturers Association of Canada (EEMAC). The labor and transportation costs estimates are associated with installing polemount transformers are for a line truck and crew to do the installation and terminations.

   Padmount transformers are tendered to transformer vendors on an as needed basis based on customer requirements each quarter. Evaluations are completed on the quotes received in each quarter and will be available in the budget year. The budget amounts proposed are based upon experience and expected changes to transformer costs. The labor and transportation cost estimates associated with installing padmount transformers include a boom truck and crew delivering the padmount transformer and a line truck and crew to complete the installation and terminations, which will vary depending on where the job is located.

c. When connecting new services to the grid the transformers are a new addition to the system. When performing spill prevention, rebuilds or voltage conversions, the transformers are typically replacing existing transformers that have reached the end of their useful life. However, all transformers removed from service are assessed for the opportunity to reuse. If the transformer meets existing transformer specifications, it is put directly back into stock. If the transformer does not meet existing transformer specifications then a refurbishment assessment is done. If a refurbishment is cost effective compared to the cost of a new unit, the refurbishment is carried out and the unit returned to stock.

4. With respect to **Section 5.2(b)** Pre-1982 Polemount Transformers Life Extension, please provide an expenditure summary which includes a breakdown of the number of units replaced, testing costs and labour costs.

***Response***

The work is completed using an approved patented procedure and tools whereby the transformer oil sample is taken from the unit while it remains in service so no customer interruption is experienced. The age of these transformers is such that they may contain concentrations of PCB's. The actual PCB concentration must, by law, be determined prior to 2025 and also for determining waste stream at the time of removal. Although the 2,500 units being tested are pre-1982 vintage (when PCBs were in use), many of them are still in good physical condition with additional years of useful life, provided the maximum PCB concentration level is not exceeded. Confirmation of the PCB levels will enable units to remain in service, thus extending their expected life.

The following outlines the estimated project budget:

| | |
|---|---|
| Estimated material supplies (drilling plugs, sample tube) per unit | $80 |
| Estimated labour and transportation cost per unit<br>(Including aerial device line truck, qualified staff, specialized tools, and two traffic control teams) | $240 |
| Total estimated capital cost per unit | $320 |
| Total number of units to be tested | 2,500 |
| Total project cost | $800,000 |

5. With respect to **Section 5.4(b)** Reliability Driven Line Extensions and **Appendix E:**

   a. According to Appendix E, there are two alternative routes being considered with respect to the Bonshaw Circuit.

      i. Please provide a comparison of the two proposed routes in terms of benefits and cost.
      ii. What further investigations will be performed to identify the preferred route?
      iii. When will these investigations be completed, and at what cost?

   b. Please provide a summary of expenditures (i.e. materials, labour, etc.) together with supporting cost information for both the West Royalty Substation 3rd Circuit and the Bonshaw Circuit.

***Response***

a. i. The West River bridge option requires 33 customers to be converted to 25 kV and 3.8 kilometres of overhead line construction.

The directional drilling option requires 37 customers to be converted to 25 kV, 0.5 kilometres of underground line and 2.5 kilometres of overhead line construction.

The main reason that two options are being considered is because it may be difficult to get permission to cross the West River bridge/causeway with overhead lines. Potential restrictions tied to scenic vista protection and permit requirements by Navigation Canada and Transport Canada are anticipated. The under river option does not have these concerns and, based on a similar project that was recently carried out in New Brunswick, the cost of directional drilling work is expected to be reasonable.

Both options have similar reliability benefits by enabling customers in this area to be fed from two different substations. As well, both options are also expected to be similar in cost.

ii. Maritime Electric plans to review both route options in detail early next year to determine which is preferred from an environmental, constructability and cost perspective.

iii. This review will be done in-house by Maritime Electric survey and engineering staff.

b. **West Royalty Substation 3rd Circuit ($265,000)**
Labour = $215,000
Materials = $50,000

**Bonshaw Circuit ($1,040,000)**
Labour = $834,000
Materials = $206,000

6. With respect to **Section 5.5(a)** Single Phase and Three Phase Rebuilds and **Appendix F:**

   a. Please provide the age of each distribution line in MECL's distribution system.
   b. Why were the lines identified in Appendix F chosen to be rebuilt in 2019?
   c. How and upon what criteria did MECL make these determinations?
   d. Upon review of Appendix F, some of the lines which are proposed to be rebuilt have only 30% (or less) of the poles identified as "old eastern cedar".
      i. Why must these lines be rebuilt?
      ii. Does MECL intend to replace all poles along the line rebuild, or only those that are described as "old eastern cedar"?
   e. For line rebuilds costing more than $500,000 (namely, the Iona Road Single Phase Rebuild, and the Howlan Road Single Phase Rebuild) please provide a detailed breakdown of proposed expenditures, including the number of poles to be replaced and the estimated replacement costs.

***Response***

a. Maritime Electric does not currently have the historical age of each distribution line recorded in its system.

   There are approximately 3,200 lines in Maritime Electric's distribution system. Each line is comprised of poles, wire, insulators, cross arms, brackets, etc. These components are of varying ages as repair and refurbishment work has been carried out on various sections of lines over time and is ongoing as long as the line remains in service. For this reason, it is very difficult to provide a meaningful age for a distribution line that has not been recently constructed (and the lines proposed for rebuild do not fall into that category).

   As new lines are built, Maritime Electric's asset database and line mapping system is being updated. This will help to ensure that age information associated with distribution line construction and related components will be more readily available in the future.

b. As outlined in the project description and justification information provided in Appendix F, these lines were selected based on criteria such as: conductor age and condition, pole age and condition, span length, number of customers fed, number of outage events, etc. Local knowledge related to line conditions was also obtained from the district superintendents and area representatives, as they are most familiar with the problem lines in their service area.

c. In addition to the rationale provided in the 2019 Capital Budget document, the information provided in answer 6(b) above and answer 6(d) below provides the criteria used by Maritime Electric in determining which lines should be rebuilt.

d. i. Eastern Cedar poles are not the only poles that require replacement due to age and/or deterioration. Pole deterioration is only one factor in determining when to replace lines. Some lines have large numbers of splices which is an indication that the conductor is deteriorating. Load growth is another contributing factor.

ii. All poles are checked for strength and condition and if they are acceptable they are not replaced. Many poles get replaced over time on older lines and these recently installed poles are not replaced if they are in good condition. That said, it is reasonable to expect that all eastern cedar poles in a rebuild project will get replaced due to age related deterioration.

e. For rebuild budget purposes, Maritime Electric estimates the number of poles to be replaced and determines if the conductor needs replacement and/or upgrading.

The decision to keep or replace a pole is determined during the detailed survey that occurs just prior to construction. Survey makes every effort to leave good poles in place whenever possible.

Re-spanning (i.e. shortening span length) the line to accommodate a larger conductor size may require removal of certain poles depending on their location. Often, service poles in the right of way need to be replaced along with the main line poles to ensure that the service take-off is structurally sound.

**Iona Road Single Phase Rebuild**
Labour = $449,500
Material = $106,000

Maritime Electric expects to replace most of the poles (approximately 90) and re-span the line for the new upgraded conductor size of Quail (2/0). The Company plans to rebuild on the same side of the road and maintain service to customers during this work.

**Howlan Road Single Phase Rebuild**
Labour = $415,500
Material = $97,200

Maritime Electric expects to replace most of the poles (approximately 70) and re-span the line for the new upgraded conductor size of Quail (2/0). The Company plans to rebuild on the same side of the road and maintain service to customers during this work.

7. With respect to **Section 5.5(c)(ii)** Accelerated Distribution Component Replacement - Eastern Cedar Pole Replacement Program:

   a. Please provide a complete copy of the independent assessment performed by EDM International Inc. (Appendix H includes only the field inspection and testing results).
   b. Please provide full particulars of the Eastern Cedar Pole Replacement Program.
   c. Please provide the cost to replace each pole, including labour and materials.
   d. What is Maritime Electric's pole procurement strategy?
   e. How will MECL ensure a rotation of pole replacements as poles reach the end of their useful life?

***Response***

a. The EDM International Inc. report "Inspection and Testing of Eastern Cedar Poles" is attached (Attachment 1).

b. The EDM report provides Maritime Electric with two viable options to replace the remaining eastern cedar poles. The two options are as follows:

**Option 1: Random Replacement**
This option is a pole for pole replacement option. It would involve Maritime Electric crews working as quickly as possible to eliminate the eastern cedar poles in a mostly random order of condition.

**Option 2: Inspection Based Priority Replacement**
This option is also a pole for pole replacement option but structured so that Maritime Electric would have crews work to eliminate high-priority poles first. The first step would be to evaluate poles through inspection and then rank them as low-, medium- or high-priority for replacement.

As budgeted, it will take Maritime Electric up to 10 years to replace all of the remaining eastern cedar poles in the distribution system. This timeline supports the argument that prioritizing pole replacements is more prudent in terms of safety and reliability, as poles that are in poor condition are more likely to fail within the early years (of the program) than the poles that are currently in fair or good condition. As such, Maritime Electric intends to pursue Option 2.

Under Option 2, poles will be evaluated in-house by Maritime Electric using employees and/or contractors. Maritime Electric employees/contractors will evaluate the poles to determine their level of priority based on a visual inspection, a sound check at the base, the number of customers that are dependent of the pole, the amount of attachments on the pole, and other factors including but not limited to the amount of vehicle/pedestrian traffic in the pole area and environmental risks associated with pole failure.

It is estimated that the cost to evaluate all of the remaining eastern cedar poles using Maritime Electric employees and/or contractors will be approximately $300,000. This works out to approximately $20 per pole and accounts for the pole for pole (as opposed

to pole line) nature of the work. It is planned that pole inspection will be completed over the first two years of the replacement program and as such, the $150,000 cost in 2019 will represent 13 per cent of the program budget.

c. Pole replacement cost can be highly variable based on the specifics of the job. Some of the factors that contribute to this variability include: pole accessibility, tree trimming requirements, flagging crews requirements, travel time to job site, size of the pole, pole attachments including communications, work method requirements, etc.

For budget purposes, a per pole replacement cost estimate of $1,667 was used based on approximately 400 main line poles and 200 service line poles being replaced under this program in 2019. The estimated cost of a main line pole replacement is $1,925 ($550 materials and $1,375 labour) and the estimated cost of a service line pole replacement is $1,150 ($300 materials and $850 labour).

d. In 2012, in an effort to obtain more favorable pricing, Maritime Electric participated in a joint national tender with other Fortis companies (i.e., FortisAlberta, FortisBC and Newfoundland Power). Stella Jones submitted the winning proposal for the tender.

Maritime Electric is currently in an agreement with Stella Jones for the supply and delivery of poles to various locations in PEI. The five year agreement allowed for two additional one year renewal terms. Maritime Electric is currently in year seven of the agreement, which expires in May 2019.

e. Maritime Electric manages its' distribution pole assets in accordance with Section 7.2 of the Company's Distribution Asset Management Program as provided below:

**7.2 Poles**
**Defining Asset Condition**
A wooden utility pole generally remains useful until:

- It fails (breaks or collapses) due to severe weather, vehicles or loss of strength associated with advanced aging;
- New requirements necessitate a pole change out. These needs might be for a taller or stronger pole to support more equipment;
- The pole is no longer required at its legacy location; and
- Through a gradual process of loss of wood fibre and loss of fibre strength, the strength of the pole decreases until it reaches the point where it no longer satisfies required safety factors under worst case conditions. At this point, inspections and/or testing will identify the need to replace this pole.

Like many other types of distribution assets, distribution poles are expected to last for a long time. Technical lives of 50 years are expected and when used under typical conditions, the maintenance free Mean Time Between Failures (MTBF) is on the order of 400,000 hours.

It should be noted that the actual mean 'in-service' life of utility poles is usually less than 50 years, as many are removed or upgraded due to such factors as road realignments or a need to upgrade to a taller or stronger pole as part of a distribution line upgrade.

Individually, the replacement value of these assets ranges from $1,000 to over $15,000. Maritime Electric has over 132,000 poles in service.

Because of the high MTBF value, relatively low installed cost and large installed base of poles, it would be extremely impractical or impossible to closely monitor and maintain each pole in the same fashion as a substation steel structure and the expense of such a program would far exceed its utility.

Instead, Maritime Electric manages its pole assets through a combination of:

- Industry standard purchasing specifications;
- Review of manufacturers' QA/QC efforts;
- Inspection of new distribution poles as they are received;
- Periodic inspection and testing of poles while they are retained in stores as spares;
- In-situ inspections and periodic testing of poles whenever they are installed and/or visited during fieldwork; and
- Intake inspection whenever a previously used pole is returned to storage from the field. Occasionally, a pole in near perfect condition is reissued to the field.

8. With respect to **Section 5.6(e)** Bridge Meters for Load Research:

   a. Will the bridge meters have a useful life greater than one year for data collection purposes?
   b. How will bridge meters be used going forward and what is their expected useful life?
   c. Why is MECL proposing to conduct demand research at this time?
   d. Why was this research, if necessary for cost allocation, not performed prior to the filing of the cost allocation study (June 29, 2018) and the anticipated rate design study (October 31, 2018)?

***Response***

a. Yes, all bridge meters installed will have an ongoing useful life similar to our existing radio frequency (RF) meters. These meters are designed to function within a traditional RF meter system, plus they have the added functionality of being able to capture interval data. Bridge meters also have the ability to remotely connect/disconnect from the meter reader vehicle.

b. The bridge meters will remain in the field and continue to collect valuable interval data for future analysis. The life expectancy of a bridge meter is approximately 20 years, similar to the Company's traditional RF meters.

c. The previous load study for the residential and general service load classes was undertaken in 1992-93. Electricity usage and profile have changed dramatically since the early 1990s with computers, home entertainment, LEDs and electric space heating usage increasing. An updated residential and general service usage profile will enable more accurate cost allocation for those rate classes. In addition, advances in metering technology and data gathering mean that undertaking this project now will be much less labor-intensive, and consequently less expensive, than in the past. The new Bridge Meters, which have only been Measurement Canada certified in the last year, capture one hour interval demand and energy usage data. They can be read through Maritime Electric's existing RF meter data-gathering process and require minimal additional time to download the data from the meter to the mobile data collectors.

d. This load research was not conducted prior to the deadline because the Company determined that gathering data with respect to farms included in the Residential Class was a higher priority. As well, Bridge Meters for residential services that can be read via radio frequency ('RF') have only recently been Measurement Canada certified. To perform load analysis, the Company requires at least one year, and preferably two years, worth of customer load data in order to get an accurate depiction of customer class usage. It is unlikely that sufficient data would have been gathered in time for the October 2018 rate design study even if Maritime Electric had pushed forward with this project when the meters were initially available. The proposed Bridge Meters for Load Research project will gather data over the next two years, with analysis completed in time for including in the next rate design study (2021 timeframe).

9. With respect to Section 5.7(a) System Equipment:

    a. Please provide estimates or quotes for all expenses identified in Table 8 that exceed $100,000.
    b. For line items in Table 8 greater than $100,000, please provide confirmation that the original assets have reached the end of their useful life.

***Response***

a. The proposed budget amount is based upon historical experience. Please refer to the recent quotes for System Equipment in Attachment 2 which has been filed separately due to the commercial sensitivity of the information contained therein.

b. System equipment (such as reclosers and voltage regulators) is replaced upon its age being past its engineered life. Some system equipment such as communication equipment is also replaced because it is technologically obsolete.

10. With respect to Section 5.8 Transportation Equipment and Appendix L:

    a. Please provide supplier quotes for the two Aerial Bucket Trucks, Hiab Boom Truck and Wire Tensioning Trailer.
    b. How was the Maritime Electric Replacement Criteria for Vehicles (Appendix L, Table 2) developed? Is the underlying rationale of the replacement criteria consistent with industry standards? If so, please provide full particulars of the standards relied on.

***Response***

a. In practice, Maritime Electric does not obtain firm quotes prior to finalizing its capital transportation budget. Instead, Maritime Electric bases its transportation budget on past pricing as Maritime Electric is typically purchasing similar equipment year after year. See below for comments on individual units in question:

Hiab Boom Truck – This vehicle is not a typical unit, so pricing from previous purchases was not available. No written quote was obtained but a verbal conversation with a known supplier combined with Maritime Electric's knowledge of vehicle pricing led to the budget price of $142,000. Below is a further breakdown of this pricing:

| | |
|---|---|
| $55,000 | chassis price (similar to chassis for CSUP trucks) |
| $60,000 | boom and deck price |
| $12,000 | fabrication of storage boxes, ladders, etc. |
| $15,000 | allowance for registration/paperwork, import fees, inflation and fluctuations in exchange rates |

1st Aerial Bucket Truck – This vehicle is a typical unit and is very similar to a truck purchased in 2018. The final pricing of this unit from 2018 formed the basis of this budget allowance and is included in Attachment 3 which has been filed separately due to the commercial sensitivity of the information contained therein. Below is a further breakdown of this pricing:

| | |
|---|---|
| $392,765 | purchase price of truck from 2018 |
| $5,000 | value of extras to add jump seat and cummings engine |
| $30,000 | allowance for fabrication of storage boxes, reel stands, compartment setup, etc. |
| $47,000 | allowance for registration/paperwork, import fees, inflation and fluctuations in exchange rates |

2nd Aerial Bucket Truck - This vehicle is a typical unit and is very similar to a truck purchased in 2018. The final pricing of this unit from 2018 formed the basis of this budget allowance and is included in Attachment 3 which has been filed separately. Below is a further breakdown of this pricing:

| | |
|---|---|
| $375,844 | Purchase price of truck from 2018 |
| $25,000 | Allowance for fabrication of storage boxes, reel stands, compartment setup, etc. |
| $42,000 | Allowance for registration/paperwork, inflation and fluctuations in exchange rates |

Wire Tensioning Trailer – This trailer is not a typical unit, so pricing from previous purchases was not available. A quote was received for the wire tensioning trailer in June of 2018. The quote is included in Attachment 3, filed separately, and a breakdown of additional charges included in the budget figure includes:

| | |
|---|---|
| $57,604 | quote for trailer |
| $17,281 | 30% USD to CAD exchange rate |
| $10,440 | freight |
| $15,000 | allowance for registration/paperwork, miscellaneous expenses, fabrication of storage boxes, etc. |

b. The replacement criteria for vehicles indicated in Appendix L, Table 2 was developed from Maritime Electric's past experience with guidance from a 2016 Newfoundland Power document titled "Vehicle Replacement Criteria" (Attachment 3). Below is a brief explanation of Maritime Electric's rationale for each class of vehicle:

Tracked Heavy Vehicles – These vehicles are significantly more expensive to purchase and they are not operated on a daily basis. So the Company decreased the replacement frequency. Of course, the condition of the units will be closely monitored and will dictate whether we replace at the 15 year milestone or not.

Heavy Vehicles – Maritime Electric's replacement criteria is very similar to the results of the survey for this class of vehicles.

Service Trucks (CSUP Trucks) – Maritime Electric's replacement criteria is slightly more frequent (based on age, similar based on mileage) than the survey results. Maritime Electric operates with two separate shifts for CSUP's using the same truck; therefore, the truck is operated twice as much as the heavy trucks. When this is taken into account, the replacement criteria is in line with the survey.

Passenger Vehicles – The survey results indicate replacement of passenger vehicles every 5-9 years, Maritime Electric's criteria of 7 years is the median of these results. The yearly average for mileage is just under Maritime Electric's criteria of 200,000 kilometres.

11. With respect to Section 6.1(a) Lorne Valley 69kV Switching Station Expansion:

    a. Please provide a detailed breakdown of the work to be performed for this project.
    b. Please also provide a detailed breakdown of the budgeted cost ($2,820,000) for this project, including the cost of labour, materials, equipment, etc. together with supporting quotes/estimates.

***Response***

a. The work to be performed is shown in Appendix M Figure 2: 69 kV Lorne Valley Conceptual Single Line Diagram 4 Breakers Ring Bus in the 2019 Capital Budget Application.

   The work consists of purchasing, installing and commissioning of circuit breakers, disconnect switches, potential transformers, station service, protection and control building and equipment. There will be civil works, foundations, grounding and fencing, structural steel and bus works required for the equipment installation. The detailed cost estimates in Section b below are based on working experience and include labor, material and equipment.

b. Detailed breakdown of the Lorne Valley Switching Station Expansion is as follows

| **Description** | **Estimated Cost** |
|---|---|
| Grubb, strip topsoil and dispose of off site | 27,000 |
| Supply, place select borrow, Class "A" and Class "D" gravel | 126,500 |
| Supply and place geotextile material, topsoil, seeding, compaction and concrete testing | 29,000 |
| Supply and install sediment fence, strawbale check dams, culvert | 16,000 |
| Circuit Breaker foundations | 45,500 |
| Cable tray footings (sonotubes) | 10,000 |
| Switch foundations | 75,000 |
| Deadend Structure foundations | 120,000 |
| Ground grid & fence grounding | 62,000 |
| Cable trench and covers | 88,000 |
| Electrical PVC conduits | 55,000 |
| Substation fence. | 22,000 |
| 69 kV Breakers | 268,000 |
| 69kV Disconnect Switches | 384,000 |
| Potential transformers, Station Service Transformers and Transfer Switches Equipment | 248,000 |
| Generator, Yard Lighting and security | 110,000 |
| Control Building, PCT and Communication Equipment Panels | 336,000 |
| 69kV Transmission Line Termination Stucture | 83,000 |
| High Voltage Buswork & Insulators | 377,000 |
| Steel Structures for Bus Work c/w foundations | 118,000 |
| Consultant Design | 100,000 |
| Contingency | 120,000 |
| **Total Estimated Cost** | $ 2,820,000 |

12. With respect to Section 6.1(b) 15/20 MVA Airport Power Transformer Replacement:

    a. Please provide a detailed breakdown of the work to be performed for this project.
    b. Please also provide a detailed breakdown of the budgeted costs ($1,100,000) for this project, including the cost of labour, materials, equipment, etc. together with supporting quotes/estimates.

***Response***

It is necessary to replace the existing 7.5/10 MVA transformer with a 15/20 MVA transformer to address the capacity issue on the 25 kV distribution system in central PEI. The following work will be performed for this project with the associated cost:

| Proposed Work | Material | Labor | Total |
|---|---|---|---|
| New 15/20 MVA (budgetary quote- April 27, 2018 see below) | | | $790,000 |
| Removal of the existing and off-loading of the new 15/20 MVA transformer | | $15,000 | $15,000 |
| Removal of the existing and installation of the new set of 69 kV fuses | $13,000 | $8,000 | $21,000 |
| Removal of the existing regulated bus and equipment (voltage regulators, voltage regulator switches, insulators, wires, etc.) | | $28,000 | $28,000 |
| Building a new 25 kV bus to reflect the On Load Tap Changer associated with new transformer | $30,000 | $40,000 | $70,000 |
| Testing and Commissioning of the new transformer and substation | | $11,000 | $11,000 |
| Contingency (15%) | | | $165,000 |
| **TOTAL** | | | **$1,100,000** |

Supporting third party pricing information is included in Attachment 4 which has been filed separately due to the commercial sensitivity of the information contained therein.

13. With respect to Section 7.1(a) Recurring Annual Capital Requirements, please provide complete details of the planned capital additions and refurbishments for 2019, including a breakdown of the costs of each addition/refurbishment.

***Response***

With respect Section 7.1 (a) Recurring Annual Capital Requirements, the $271,000 budget is a provisional amount based on historical experience and periodically adjusted for specific items. The Company maintains a Head Office in Charlottetown and Service Centre Operations in West Royalty, Sherbrooke, Roseneath and Rosebank, PEI. The combined square footage and office space covered by this provision is approximately 36 acres and over 225,000 square feet of office and storage space. This budget item covers capital expenditures not specifically provided for in operation areas such was Generation, Substation and Distribution properties.

The average annual amount for the 5 year period ending 2017 was $143,150, with some years approaching $300,000 and some under $50,000. The items listed represent smaller individual capital items and are not individually costed but represent the common areas and items that may require capital repair or replacement. They are only replaced or refurbished if deemed necessary, for example, safety, damage, no longer meet code, environmental, obsolete or no longer able to provide work support services.

The following table provides the annual costs for period 2013 to 2017.

| 2013 | 2014 | 2015 | 2016 | 2017 | Average |
|---|---|---|---|---|---|
| **$34,534** | **$300,158** | **$232,698** | **$114,862** | **$33,499** | **$143,150** |

14. With respect to Section 7.2(b) Purchased Software and Upgrades, do the costs relate to purchased software or renewal fees? Please provide quotes/estimates for each line item in Table 15.

***Response***

The software items in Section 7.2(b) are core business applications used by Maritime Electric, most have been owned for many years. The amounts in Table 15 represent the capital cost for annual vendor updates, security patches, enhancements and support of each product as well as internal labor to implement these enhancements. Quotes/estimates were not obtained from the individual vendors, rather these amounts are based on prior year expenditures. The exception to above is the line item “New Purchases” which is an allowance for software needs that are identified during the year. This can often be additional software licenses for existing software or new items required by individual departments.

15. With respect to Section 8 Capitalized General Expense:

    a. What is the dollar value of capitalized general expense recorded to date in the 2018 year?
    b. Please provide the calculation and assumptions used to support the total expenditure of $527,000.
    c. Please explain why the capitalized general expense account has steadily increased since 2014.
    d. Please explain what measures are in place to monitor this capitalized item year over year.

***Response***

a. As of August 31, 2018, the Company recorded $315,694 in General Expense Capital ("GEC") for 2018.

b. The proposed 2019 budget for GEC represents purchasing and inventory management costs that are not specific to any one project but are incurred in support of the overall capital plan. Such costs include internal labour costs as well as the associated equipment and supplies costs required by the related employees in the performance of their duties. A breakdown of these costs is provided in the following table:

| **Description** | **2019 Budget** |
|---|---|
| Purchasing | $ 68,000 |
| Inventory Management | 443,000 |
| Materials and Supplies | 16,000 |
| **TOTAL** | **$ 527,000** |

c. The following table shows the actual GEC for 2013 through 2017:

| | **2013** | **2014** | **2015** | **2016** | **2017** |
|---|---|---|---|---|---|
| GEC | $350,331 | $388,730 | $458,433 | $477,714 | $502,450 |

The main driver for the increase in 2014 is related to the re-allocation of transportation costs to capital projects. The increase in 2015 was a result of the addition of one Stores staff person. The changes since are considered inflationary increases in labour and transportation costs.

d. General Expense Capital (GEC) is monitored through a variance analysis process of comparing costs to budget by the Manager of Financial Reporting. The allocation to assets at year-end is also audited by external auditors for the completeness of additions to property, plant and equipment.

16. With respect to Section 9 Interest During Construction:

    a. Please provide full particulars of Maritime Electric's cost of borrowing.
    b. Please provide the calculation and assumptions used to support the total expenditure of $429,000.
    c. Is the estimated calculation based on the current year's projects, or historical information?

***Response***

a. Maritime Electric's Cost of Borrowing has both long-term debt and short-term debt components. With respect to long-term debt, the Company has the following long-term debt forecast for 2018 and 2019:

| Maritime Electric Long Term Debt | | | | | |
|---|---|---|---|---|---|
| **Issue Date** | **Maturity Date** | **Principal Amount** | **Interest Rate (%)** | **2018 Forecast** | **2019 Forecast** |
| 7-Dec-93 | 7-Dec-18 | 15,000,000 | 8.550 | $ 1,199,758 | $ - |
| 22-Dec-00 | 22-Dec-25 | 15,000,000 | 7.570 | 1,135,500 | 1,135,500 |
| 15-Jan-97 | 15-Jan-27 | 15,000,000 | 8.625 | 1,293,750 | 1,293,750 |
| 3-Jul-96 | 3-Jul-31 | 20,000,000 | 8.920 | 1,784,000 | 1,784,000 |
| 2-Apr-08 | 2-Apr-38 | 60,000,000 | 6.054 | 3,632,400 | 3,632,400 |
| 5-Dec-11 | 5-Dec-61 | 30,000,000 | 4.915 | 1,474,500 | 1,474,500 |
| 23-Aug-16 | 23-Aug-56 | 40,000,000 | 3.657 | 1,462,800 | 1,462,800 |
| 7-Dec-18* | 7-Dec-48 | 40,000,000 | 4.500 | 150,000 | 1,800,000 |
| **Total** | | | | **$ 12,132,708** | **$ 12,582,950** |

** Forecast First Mortgage Bond Issue*

Short-term financing is predominantly made up of bankers' acceptances. Short-term borrowings are in the form of Bankers' Acceptances which includes a combination of a stamping fee and interest rate component. The interest rate is based on the Royal Bank Canadian Dollar Offered Rate (CDOR) plus 0.1 per cent per annum. The stamping fee is 0.975 per cent per annum. Bank indebtedness can sometimes be used to bridge between other financing arrangements and very short-term cash requirements. Bank indebtedness financing is at the Company's Scotiabank overdraft rate of prime, currently 3.70 per cent.

b. Interest During Construction ("IDC") is calculated on all capital additions except land, distribution service lines (overhead and underground), distribution street lights (overhead and underground), communications equipment, engineering and survey equipment, distribution survey and stores equipment, SCADA equipment, office equipment, fleet, computer hardware and computer software. The interest rate used in calculating IDC is the annual return on rate base and it is assumed that all applicable project costs financed over an average 90 day cycle.

For the 2019 budget, the calculation for IDC is as follows:

| | |
|---|---|
| Total Proposed Capital to which IDC applies: | $ 25,350,000 |
| Forecast Average Return on Rate Base: | 6.86% |
| Average Number of Days to Finance | 90/365 days |
| Total Proposed IDC | $ 429,000 (rounded) |

c. The proposed IDC calculation for 2019 is based on 2019 proposed capital projects.

17. With respect to **Customer Contributions** ($400,000):

    a. Please explain how customer contributions are determined.
    b. Please provide a summary of customer contributions actually received for the previous five (5) years.
    c. Please provide a breakdown of the budget item(s) the customer contributions relate to (i.e. customer driven line extensions, etc.).

***Response***

a. The terms and conditions for collecting customer contributions are set out in the Company's Rates and General Rules and Regulations as filed with IRAC and amended from time to time. The Standard Facility Allowance ("SFA") for services and extensions is 90 metres of standard single phase overhead design for Residential service including required transformation and metering. The SFA for General Service and Small Industrial rate categories is 90 metres of single or three phase service including required transformation and metering. For Large Industrial Customers served from the distribution system, Maritime Electric supplies primary metering and up to 90 metres of three-phase overhead primary service.

   Customer requests or service requirements that exceed 90 metres are billed on a cost recovery basis and the contributions are required to be paid in advance of service being provided. In certain circumstances, as outlined in the Rates and General Rules and Regulations, customers are entitled to refunds of contributions if additional development takes place within five years on those facilities paid for through customer contributions.

b. The following table is a summary of customer contributions received for the last five years:

| | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|
| Annual Contributions | $643,920 | $525,236 | $382,693 | $1,262,517 | $746,454 |

c. The amount of customer contributions received in any given year is driven by customer requests and as a result can fluctuate from year to year as seen in the table shown above. Since the amount of work subject to contributions is difficult to predict and out of the Company's control, the budget amount is conservatively estimated at the lower end of recent year's actual results. The 2019 provision of $400,000 represents an estimate of the minimum amount that is expected to be contributed by customers based on past experience of which $200,000 is expected from new service line installation and replacement and the other $200,000 is customer driven line extensions.

18. Please provide a copy of Maritime Electric's capitalization policy.

***Response***

Attachment 5 contains the Company's Accounting Manual. Pages 1-25 of the Manual provides detailed information on the account classification of all property plant and equipment for the Company. The manual is designed to follow the Federal Energy Regulatory Commission ("FERC") Uniform System of Accounts. In the US, electric public utilities and licensees, are required to maintain their books and records in accordance with the Commission's Uniform System of Accounts. In Canada, while it is not a requirement, it is considered good utility practice to do so.

In following the uniform system of accounts, the account description determines what items are included and properly charged to an account. In practice, the Company does not capitalize expenditures on units of property less than $1,000 unless it is part of an approved capital project. In order to be included in the proposed capital budget, projects must be for either new assets, replacement of existing assets or refurbishment of existing assets to extend the useful life of the assets.

19. Please explain why the following budget items should be capitalized, and how they meet the criteria for capitalizing rather than expensing:

    a. Section 4.1(c) Charlottetown Plant Miscellaneous Building & Services- $25,000
    b. Section 4.2(a) Miscellaneous Boiler Projects - $8,000
    c. Section 4.3(b) Combustion Turbine Improvements & Spare Parts - $189,000
    d. Section 4.4(a) Miscellaneous Combustion Turbine Improvements - $117,000
    e. Section 4.4(b) Miscellaneous Building and Service Improvements - $26,000
    f. Section 5.1(a) Replacements Due to Storms, Collisions, Fire & Road Alterations - $891,000
    g. Section 5.5(b) Distribution Line Refurbishment - $680,000
    h. Section 5.7(b) Line Equipment - $224,000
    i. Section 6.2(b) Transmission Line Refurbishment - $865,000
    j. Section 7.1(a) Recurring Annual Capital Requirements - $271,000

***Response***

Refer to the response to IR-18.

The individual projects that make up the budget items a. to j. above are provisional for items that experience has shown capital investment is required. As such, the exact work being carried out under these budget allowances is not known when the budget is being developed. For such items, we rely on the judgement of Maritime Electric Management and past experience to decide on the proposed budget amount.

a. This budget covers items that are provisional in nature and are based on past expenditures, which include items such as:

    - Lighting system improvements
    - Process pipeline replacements
    - Sump pump replacements
    - Door and window replacements

    As previously stated, Maritime Electric relies on its Management staff to ensure that only projects that should be considered capital projects are included. For example, light bulb replacement would not be included but replacing incandescent light fixtures with LED light fixtures would be included.

b. Miscellaneous Boiler Projects is intended to cover the purchase of any new tools, replacement of tools as required or any work required to Boiler #2 which will continue to be used for plant heating.

c. The description of item 4.3(b) included in the budget as submitted is a provisional amount to cover the purchase of new parts and improvements to Combustion Turbine #3 as required and is based on past experience. Every year during the annual inspection of CT3, items are identified and need to be replaced or corrected before further damage is incurred. This budget item also covers the replacement of components that fail during the course of the year.

    The description inserted in the Capital Budget Application was incorrect.

d. Similar to Section 4.3 (b), this budget line is for combustion turbines CT1 and CT2 located in Borden-Carleton. Specifically this is for items directly attributable to the turbine or generator as opposed to the facility or enclosure.

e. Similar to Section 4.4(a), this budget line is for the enclosures for combustion turbines CT1 and CT2 and the other buildings, fences, roadways, etc. that are located at the Borden Generating Facility.

f. This budget item is provisional, based on past experience, as the cost drivers are beyond the control of Maritime Electric.

Storm costs can be either operational or capitalized depending upon the nature of the storm and the resulting damage to the system. Wind storms that cause tree contacts and take down lines (but not poles) tend to result in mostly operational costs whereas ice storms that cause poles to break are more capital intensive. Following a storm event, a damage assessment takes place and the costs are apportioned to operating and capital depending upon the nature of the restoration activity.

Replacements due to collisions, fire and road alterations are generally capitalized as collisions and fire result in damaged assets on lines that need to be put back into service as quickly as possible, and road alterations require pole or line relocations and upgrades depending upon site specifics. In all of these cases, multi-year assets such as poles and attachments and/or pole lines are typically replaced and capitalized.

g. Work carried out under Distribution Line Refurbishment is mostly inspection driven with some system deficiencies identified through district operations personnel. Through this inspection and regular field operations, deteriorated components such as poles, transformers, cross arms, conductor, insulators, cutouts and related hardware are identified and prioritized for replacement. Such components are multi-year assets and the costs are capitalized when replacement is necessary.

h. This budget item provides for line equipment that is necessary for safely and effectively carrying out work in the field. Some line equipment is common to all service vehicles and/or power line technicians while specialized equipment is shared across the company depending upon specific job requirements. With proper maintenance and testing, the line equipment can last for several years and the costs are capitalized when replacement is necessary.

i. Work carried out under Transmission Line Refurbishment is primarily inspection driven with some system deficiencies identified through district operations personnel. Through this inspection and regular field operations, deteriorated components such as poles, conductor, insulators and related hardware are identified and prioritized for replacement. Such components are multi-year assets and the costs are capitalized when replacement is necessary.

j. The items in Section 7.1 (a) Recurring Annual Capital Requirements are only capitalized if they have an expected service life greater than one year.

20. Please explain the effect that the proposed capital budget and associated amortization will have on distribution and transmission rates going forward.

***Response***

In developing the Capital Expenditure Justification Criteria Filing Docket UE20727 filed with the Commission on August 30, 2018, the Company has proposed to develop a methodology, in consultations with the Commission staff, to calculate the effect of proposed Capital Budget applications on revenue requirement and rate base for 2020 and future years. Although this methodology has not been developed, the following is an estimate of the impact the total proposed 2019 Capital Budget could have on electricity rates using a fixed charge rate calculation. The fixed charge rate is a calculation that produces a levelized annual revenue requirement for a capital investment that will provide for recovery of the asset, financing costs (debt and equity) as well as the related taxes on the return on common equity.

The fixed charge rate is calculated to be approximately 7.96 per cent. The calculation of the annual revenue requirements is as follows:

| | | |
|---|---|---|
| 2019 Capital Budget | $32,877,000 | |
| Fixed Charge Rate | X 7.96% | |
| Revenue Requirement | $2,617,009 | (a) |
| Total Annual Revenue (approximate) | $195,000,000 | (b) |
| % Increase | 1.3% | (a)/(b) |

On a levelized basis, the 2019 Capital Budget would result in an approximate one-time increase in revenue requirement 1.3 per cent. However, this estimate does not consider cost reductions resulting from related asset retirements (resulting from the new 2019 Capital replacement) which would result in lower annual depreciation as well as savings from related asset retirements, reduced losses, lower maintenance costs, improved service reliability, etc. Identifying these cost reductions will be part of developing the proposed methodology for 2020 and future years.

EDM
reliability & innovation

**Report:**

# Inspection and Testing of Eastern Cedar Poles

**Submitted to:**

## Maritime Electric

All our energy.
All the time.

MARITIME ELECTRIC
A FORTIS COMPANY

**Prepared by:**

## EDM International, Inc.

**September 17, 2018**

EDM International, Inc. 4001 Automation Way Fort Collins, CO 80525 USA T: 970.204.4001 F: 970.204.4007 E:info@edmlink.com W:edmlink.com

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# Executive Summary

Maritime Electric Company Limited (MECL) is evaluating options for the replacement of the remaining eastern cedar poles in its' electrical distribution system. EDM International Inc. (EDM) was engaged to inspect and evaluate the current condition of a sample of these eastern cedar poles.

The remaining strength of the poles inspected by EDM was compared to the loading on the poles to determine recommended actions. Of the poles inspected, 32% were classified as high-priority for replacement, 43% were classified as medium- or low-priority for replacement and 25% were suitable to remain in service and were classified as pass.

EDM recommends that MECL determine the condition of all the eastern cedar poles in the distribution system and replace the high-priority poles first followed by the medium- and low-priority poles. Poles classified as pass should receive treatment to extend their remaining life. It is also recommended that MECL continue with its' pole management plan, which involves scheduled inspections used to evaluate the condition of all pole species and treatments in the system.

# 1.0 BACKGROUND

There are approximately 138,000 wooden poles in Maritime Electric Company Limited's (MECL's) distribution system. Included in this total are approximately 17,000 eastern cedar poles, most of which were installed in the 1970's and are now at least 40 years old. In addition, eastern cedar is a relatively soft wood and this, factored in combination with age, makes eastern cedar poles more prone to failure during high loading events (such as storms) when compared to other poles in the system.

Since the 1980's, MECL has proactively replaced thousands of eastern cedar poles. Currently, eastern cedar poles are being replaced at a rate of approximately 900 poles per year. At this rate, it will take approximately 20 years to replace all of the remaining eastern cedar poles.

Given the factors noted above and field observations from distribution system inspections and other daily activities, MECL engaged EDM International Inc. (EDM) to evaluate the current condition of a sample of eastern cedar poles to aid in the development of a structured pole replacement plan.

# 2.0 ACTIVITIES

The following activities were performed to evaluate and analyze the condition of the eastern cedar poles in MECL's system:

- Initial Research and Site Work Preparation
- On-Site Testing and Data Collection
- Data Interpretation and Analyses

The activities are described in more detail below.

## 2.1 Initial Research and Site Work Preparation

The initial research and site work preparation activities represent work that was performed prior to field-testing. EDM performed the following tasks as part of this activity:

- Compilation of industry standard specifications for eastern cedar poles.
- Research and compilation of environmental conditions that might affect pole life such as wind.
- Review and compilation of MECL's GIS information for the field inspection software used.
- Compilation of the pole sample based on the GIS information provided by MECL.

## 2.2 On-Site Testing and Data Collection

EDM and MECL representatives travelled to several locations across PEI to perform appropriate tests on eastern cedar poles as part of the on-site testing and data collection activity. MECL's

Geographic Information System (GIS) was utilized to identify the locations of the poles to be tested. Additional input from MECL personnel assisted in locating large groupings of eastern cedar poles. Poles in the initial selection were adjusted to nearby poles when they were found to be a different species than eastern cedar. The resulting sample consisted of 40 eastern cedar poles, 15 jack pine poles, two red pine poles and one western hemlock pole (58 total).

The locations of the eastern cedar poles tested are shown in Figure 2-1.

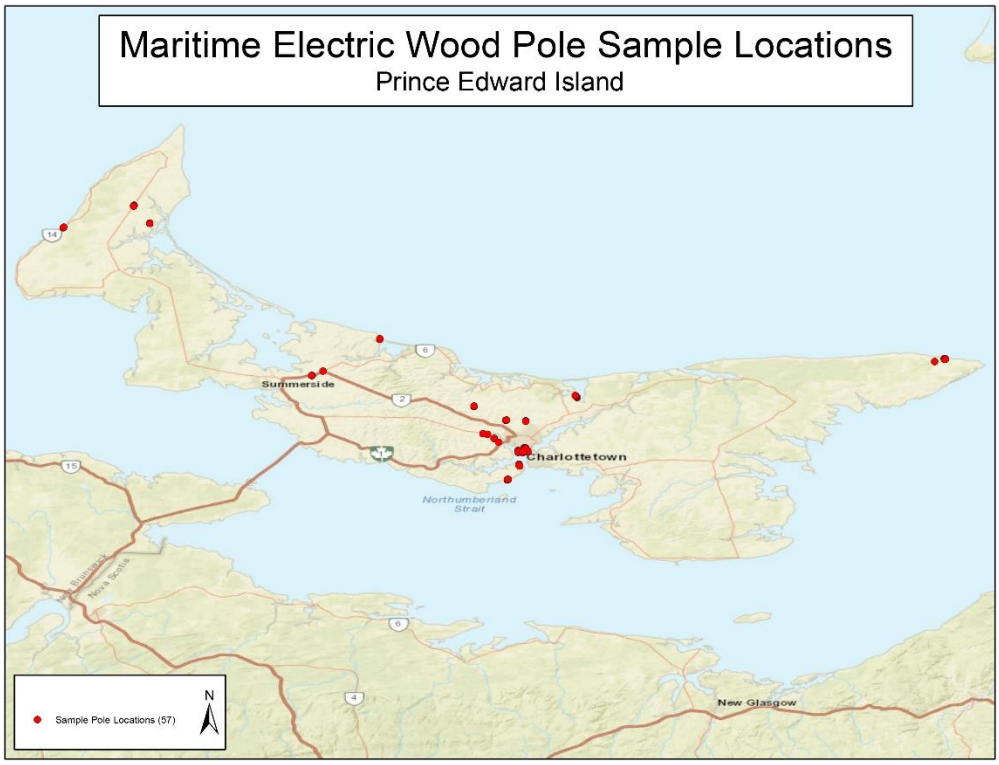



**Figure 2-1: EDM Wood Pole Inspection Map**

EDM conducted inspections and tests, and collected on-site data as part of this activity. The work included above ground inspections, probing and sounding tests, intrusive tests, and compilation of pole attachments and line information. The work listed above is described below in more detail.

### *2.2.1 Above Ground Inspections*

Above ground inspections included identifying breaks or cracks, external decay, top rot, excessive spur cut, split top, woodpecker holes, physical damage, broken ground wires, broken crossarm or hardware, signs of insect infestation, and fire damage located above ground. Photographic records were used when appropriate and will be supplied to MECL by EDM. Examples of common in-field pole conditions observed are shown below:

**Figure 2-2: Deteriorated crossarm**

**Figure 2-3: Typical pole top**

**Figure 2-4: Poor condition pole top**

**Figure 2-5: Severe below ground decay**

**Figure 2-6: Cross section view of decay**

**Figure 2-7: Severe decay in pavement**

### *2.2.2 Probing and Sounding Tests*

Probing and sounding tests were performed to detect internal decay in the poles. The procedure involved drilling into the pole at the ground line and at other locations susceptible to internal decay.

### *2.2.3 Intrusive Tests*

Intrusive tests consisted of drilling three holes into the poles at 75 to 150 mm below the ground line. The holes were drilled at approximately 120 degrees apart from each other and at an angle of 45 to 60 degrees with respect to the pole. Shell thickness was measured at the hole locations using a shell gauge and the data was logged into a field inspection software. The average shell thickness was determined using a minimum of three measurements per pole. Once the tests were complete,

the holes were sealed with plastic plugs. Examples of the software input screens used to record test data are shown in Figure 2-8 and Figure 2-9.

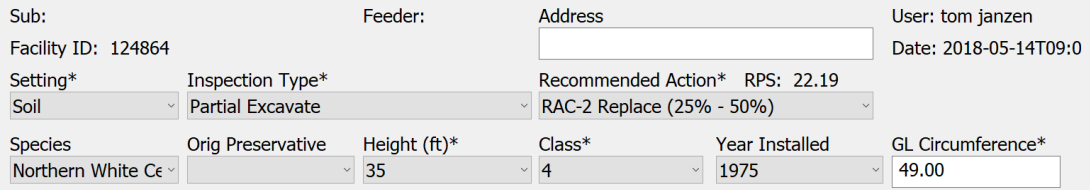



**Figure 2-8: Example of information input screen**

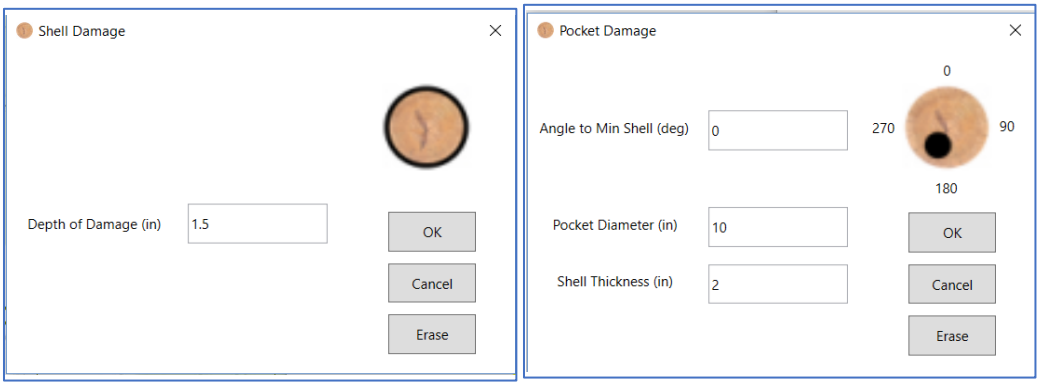



**Figure 2-9: Examples of shell rot and decay pocket input**

### *2.2.4 Compilation of Pole Attachments and Line Information*

Pole attachments (conductors, equipment, height of supports, etc.) and line information was recorded to perform loading analyses. The information collected in the field was used to model typical loads on poles using PLS-CADD. Examples of the information collected are shown in Figure 2-10.

| Date | StructID | BrandYear | EstYear | OrigTreat | Class | EstClass | Height_m | EstHeight | Height_ft | PoleSpecies | PoleComments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2018-05-16 | 26049 | 1975 | 1 | Cedar | 4 | 0 | 12.5 | 0 | 45 | NC | |

| InvItem1 | InvType1 | InvQuantity1 | InvHeight1 | InvIDNum1 | InvComment1 |
|---|---|---|---|---|---|
| Primary | 477 ACSR Cosmos | 1 | 33.64 | | 477 cosmos 121' 139' |

| InvItem2 | InvType2 | InvQuantity2 | InvHeight2 | InvIDNum2 | InvComment2 |
|---|---|---|---|---|---|
| Primary | 477 ACSR Cosmos | 2 | 30.4 | | 477 |

| InvItem3 | InvType3 | InvQuantity3 | InvHeight3 | InvIDNum3 | InvComment3 |
|---|---|---|---|---|---|
| Neutral | 4/0 ACSR (1/2") | 1 | 27.85 | | |

| InvItem4 | InvType4 | InvQuantity4 | InvHeight4 | InvIDNum4 | InvComment4 |
|---|---|---|---|---|---|
| Comm | Cable TV | 1 | 21.15 | | |

| InvItem5 | InvType5 | InvQuantity5 | InvHeight5 | InvIDNum5 |
|---|---|---|---|---|
| Guy | DOWN | 1 | 28.67 | |

**Figure 2-10: Pole and line information for use in loading analysis**

### 2.3 Data Interpretation and Analyses

Field data from each pole in the sample was gathered and the remaining strength of each pole was calculated using D-Calc™, a pole damage analysis program. The program enabled EDM to quickly and accurately evaluate the effects of pole damage and/or decay in the field. Additional information on the D-Calc™ software is shown in Appendix A.

Typical circuit and pole attachment configurations were modeled by EDM using PLS-CADD to determine the pole strength required to support the loads experienced by the pole. The required pole strength was then compared to the actual remaining pole strength calculated using D-Calc™ to determine replacement priorities. Poles that were found to have a remaining strength less than what is required to carry the loading based on the PLS-CADD modeling were deemed as high-priority for replacement. Typical loading data and calculations for priority level classification of the poles are shown in Appendix B.

## 3.0 RESULTS

Results from the research conducted, the on-site tests, and the analyses conducted are presented in this section. A table showing the data collected, the results calculated and priority recommendations for all of the poles tested (including species other than eastern cedar) are provided in Appendix C. A small sample of poles of a similar age to the eastern cedars that had been treated by the supplier were also tested. Of these poles, none were found to require replacement. The treatment that these poles received slowed down decay compared to the non-treated eastern cedar poles. The results in this section are based only on the tested eastern cedar poles tested; poles that were species other than eastern cedar are not included.

### 3.1 Initial Research

Initial research conducted by EDM confirmed that eastern cedar is a relatively soft wood with a rated fiber strength of 26,000 kPa (CSA 015-05). This rated fiber strength is significantly lower than that of other species found in MECL's system such as Jack Pine wood, which has a rated fiber strength of 44,000 kPa. Western red cedar, which is a more common variety of cedar used for power poles, has a fiber strength of 39,000 kPa. This is likely the cause of eastern cedar poles failing more frequently than other species in MECL's system during high loading events such as storms.

In the past, cedar poles were often chosen for power line construction because cedar was known to resist decay more than other species in an untreated condition. Although untreated cedar poles contain some natural resistance to decay, they are still known to deteriorate faster than treated poles. The rate of decay is dependent on the moisture, temperature, oxygen and food (wood) available for fungi growth.

### 3.2 On-Site Testing and Data Collection

The eastern cedar poles inspected in the sample showed a variety of pole conditions. The internal and external decay observed in some of the poles indicated that they are at risk of failure, especially during high loading events. The section of the poles that was found to contain the most decay was between the ground line and approximately 18 inches below it. In some instances, additional degradation was caused by physical damage to the poles such as chipping during the installation of ground line treatment in the 1980s and by snow clearing equipment for roads and sidewalks.

The strength of a pole is dependant on the condition of its outer shell. Figure 2-1, taken from the Oregon State University Wood Pole Maintenance Manual: 2012 Edition, shows how quickly the pole strength is reduced due to the loss of its outer shell.

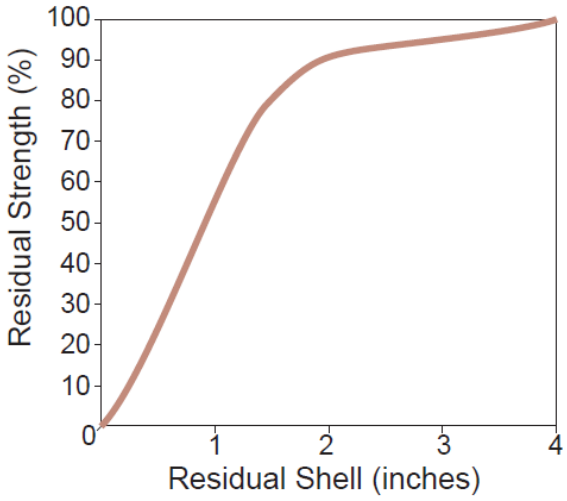



**Figure 3-1: Theoretical strength vs. residual shell thickness of a pole**

(Oregon State University Wood Pole Maintenance Manual 2012)

### 3.3 Data Interpretation and Analyses

D-Calc™ was used to calculate the approximate remaining strength of the poles tested. The distribution of poles in each of the remaining strength categories is shown in Figure 4-1.

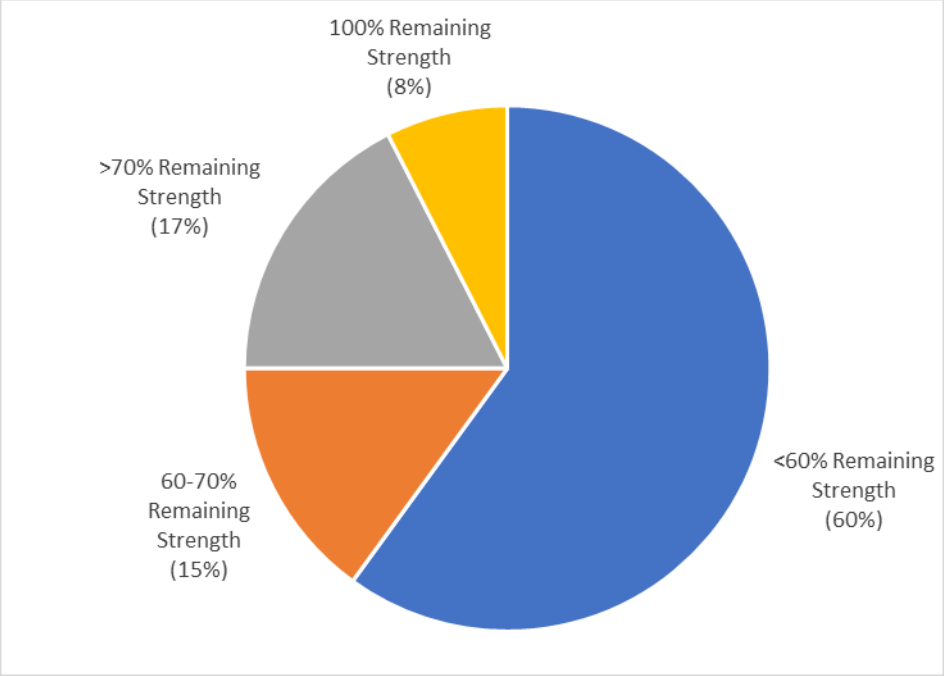



**Figure 3-2: Cedar Pole Remaining Strength**

According to the Canadian Standards Association (CSA) requirements, "when the strength of a wood pole structure has deteriorated to 60% of the required design capacity, the structure shall be reinforced or replaced" (CSA document C22.3 Section 8.3.1.3). Based on the pole tests and subsequent calculations, 60% of the eastern cedar poles tested do not meet this CSA requirement. Of this 60%, it is estimated that more than half do not have enough remaining strength to withstand heavy loading events such as storms.

## 4.0 RECOMMENDATIONS

EDM divided the eastern cedar poles from the sample into four replacement priority categories: high, medium, low, and pass. The criteria for each category was based on the pole strength required to support loads and the calculated remaining strength of the eastern cedar poles in the sample. The distribution of poles within each priority level category is shown in Figure 5-1. Approximately 32% of the eastern cedar poles that were tested were deemed as "high-priority" for replacement and approximately 25% of the poles in the sample were deemed as a "pass" and are currently suitable for treatment.

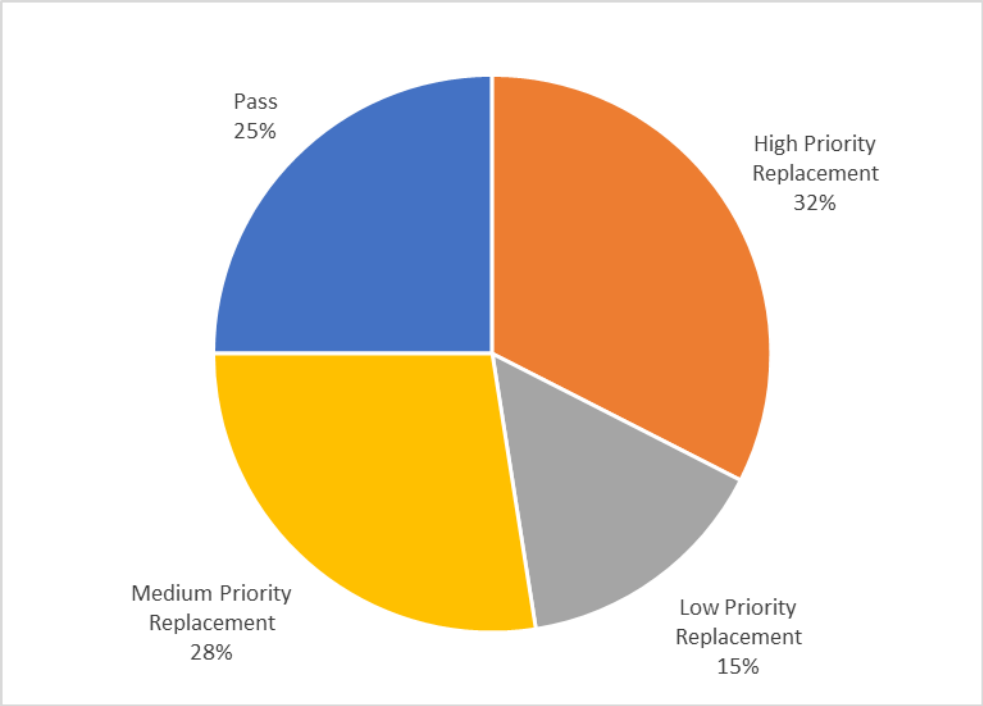



**Figure 4-1: Replacement Priority by Remaining Strength and Loading**

Given the test results, EDM recommends that MECL develop a plan to accelerate the replacement of the remaining eastern cedar poles in their system to reduce the risk of pole failures. There are three main options for a pole replacement plan:

1. Option 1: All of the eastern cedar poles are replaced as quickly as possible, in no particular order and with no priority given to pole condition.
2. Option 2: Test all of the eastern cedar poles to determine remaining strength prior to replacement. Poles that are found to be of medium- and low- priority could be treated at the time of testing to help ensure that they remain in reasonably good condition until they are replaced at a later date. Poles are then replaced in order with priority given to pole condition.
3. Option 3: Strategically identify and test at least enough eastern cedar poles each year to ensure that high-priority poles are being replaced first, and make adjustments to testing and priority replacement as the program progresses.

A cost-benefit and risk analysis should be conducted to determine which of the three options is preferred. Although there is an additional cost to options 2 and 3, they would allow poles that are not of high-priority for replacement to remain in use while poles that are most at risk could be replaced first. In addition, some life extension would be provided to poles that are treated.

If MECL chooses option 2 or a similar plan that involves testing the poles, it is recommended that qualified pole testers that analyze both the internal and external condition of the poles

perform the tests. Measurements of remaining shell thickness, decay pockets, damage, and pole circumference are all essential measurements used to accurately determine remaining pole strength. It is also important that the tests are performed at and below the ground line as this is usually the most common area for decay to occur. Additional inspection holes may be necessary above the ground line if sounding tests indicate that voids are present.

Poles that have a remaining strength of 70% or greater are recommended for treatment to help ensure their integrity until a later part of the replacement program. Treating poles that have less than 70% of strength remaining is not recommended because, at this stage of the pole's condition, the treatment is less effective. The effects of treating poles with respect to their useful life is shown in Figure 4-2. The graph shows the percentage of poles remaining over time for both non-treated (non-remediated) poles and poles that received regular treatment (remediated). After approximately 50 years, there are approximately two times more treated poles than non-treated poles remaining.

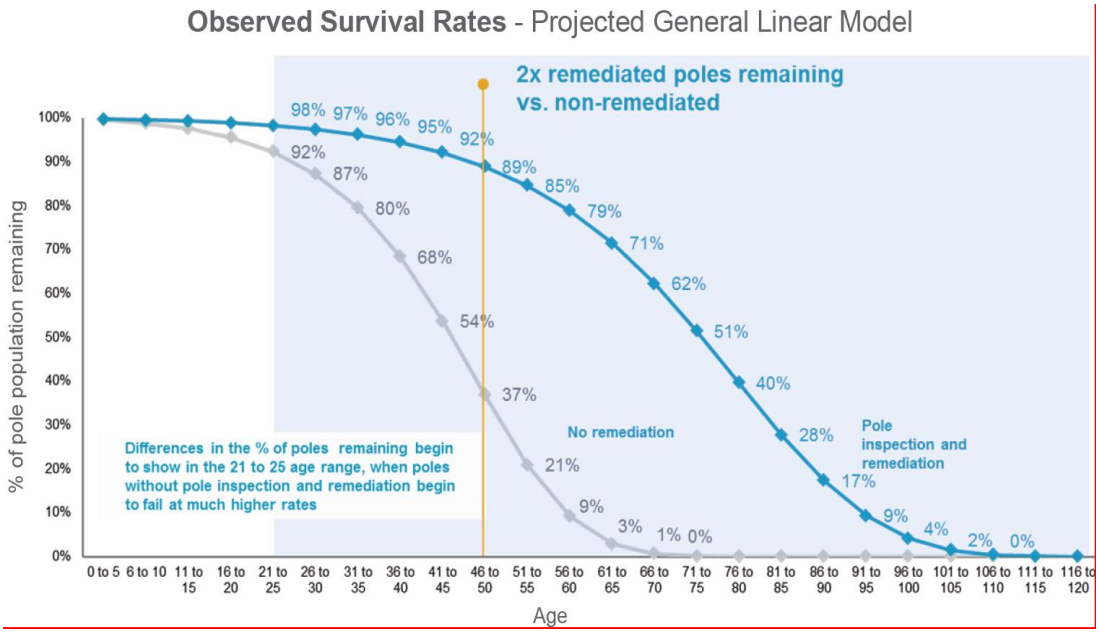



**Figure 4-2: Remediated vs. Non-Remediated Pole Life**

(by Nelson G. Bingel III • David Bonk (Osmose))

EDM also recommends that MECL performs line assessments for sections of lines that contain multiple high-priority poles. In this case, it is likely more effective to rebuild the entire sections of lines rather than replacing each pole individually.

## APPENDIX A - D-CALC GRAPHICS

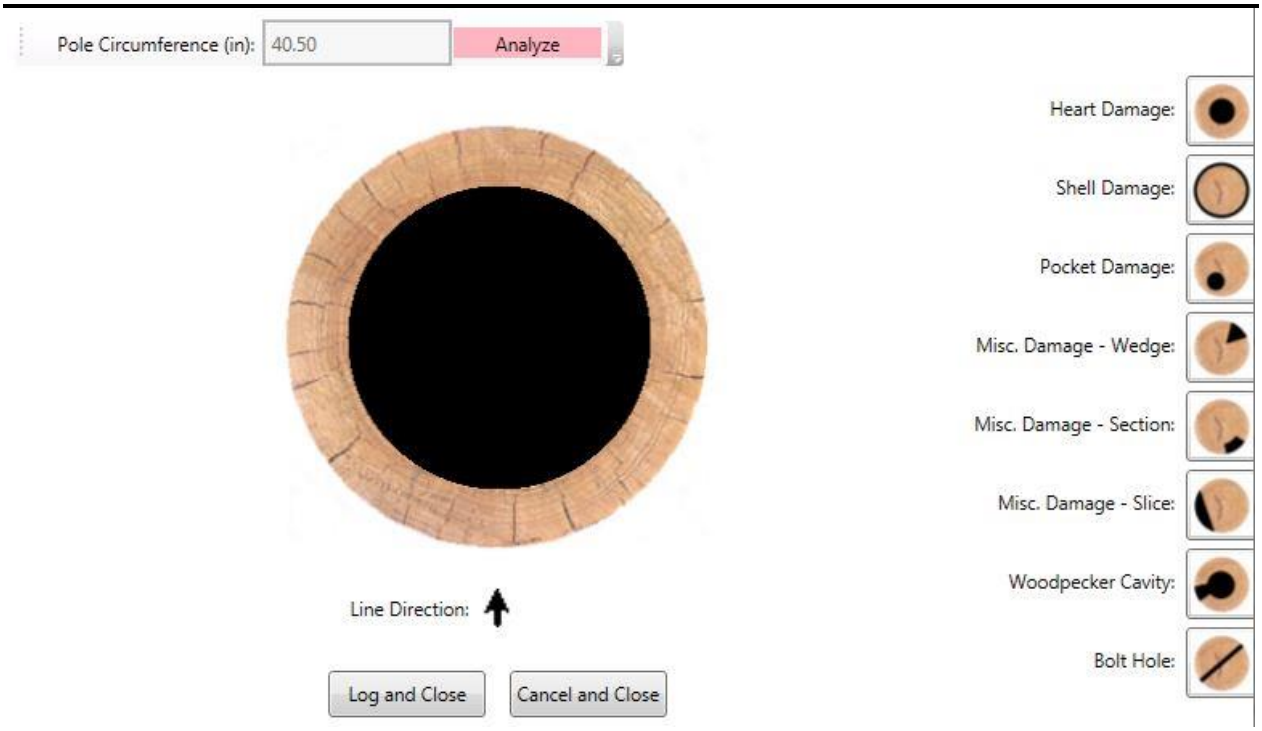



*Figure 1: Structure ID 10387 Height 0”*

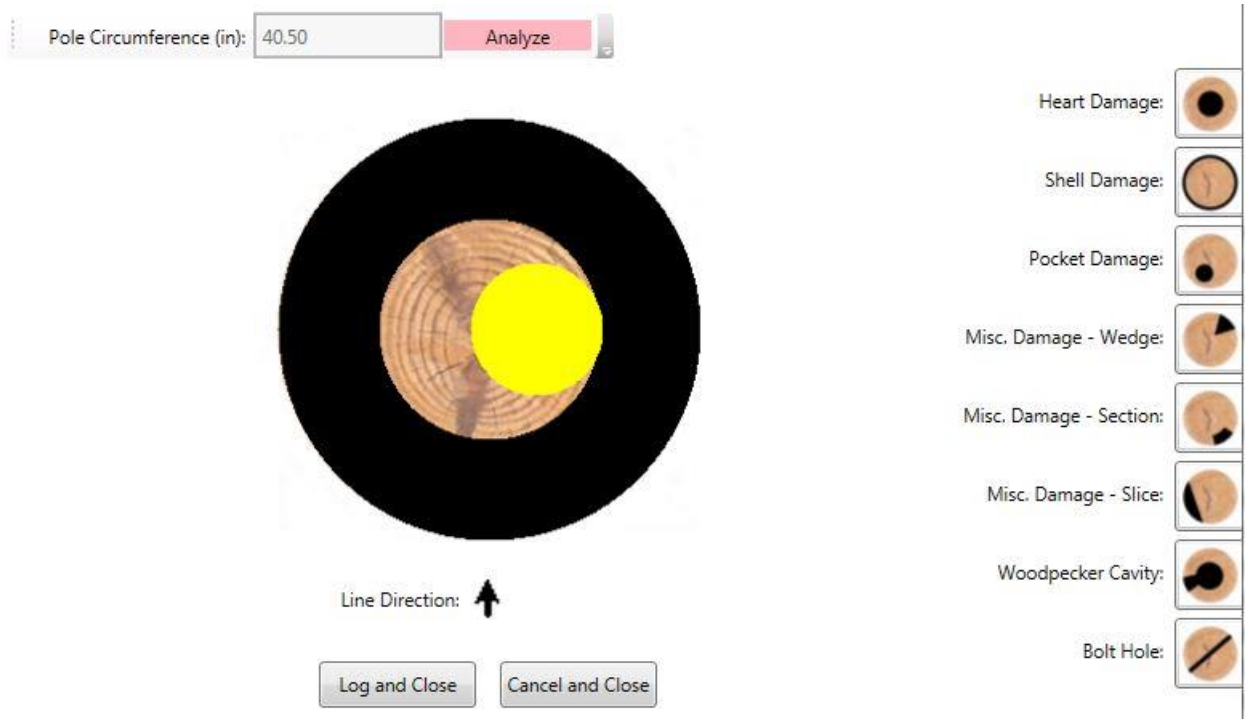



*Figure 2: Structure ID 10387 Height -16”*

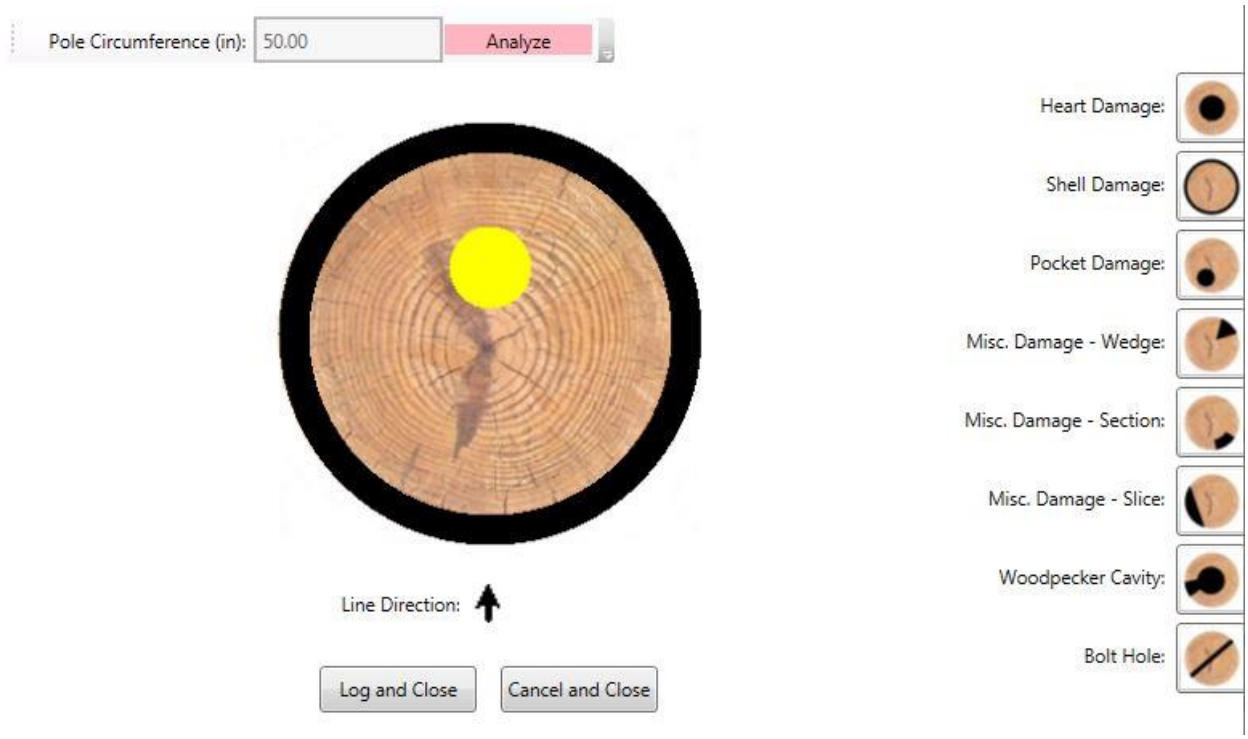



*Figure 3: Structure ID 110169 Height 0”*

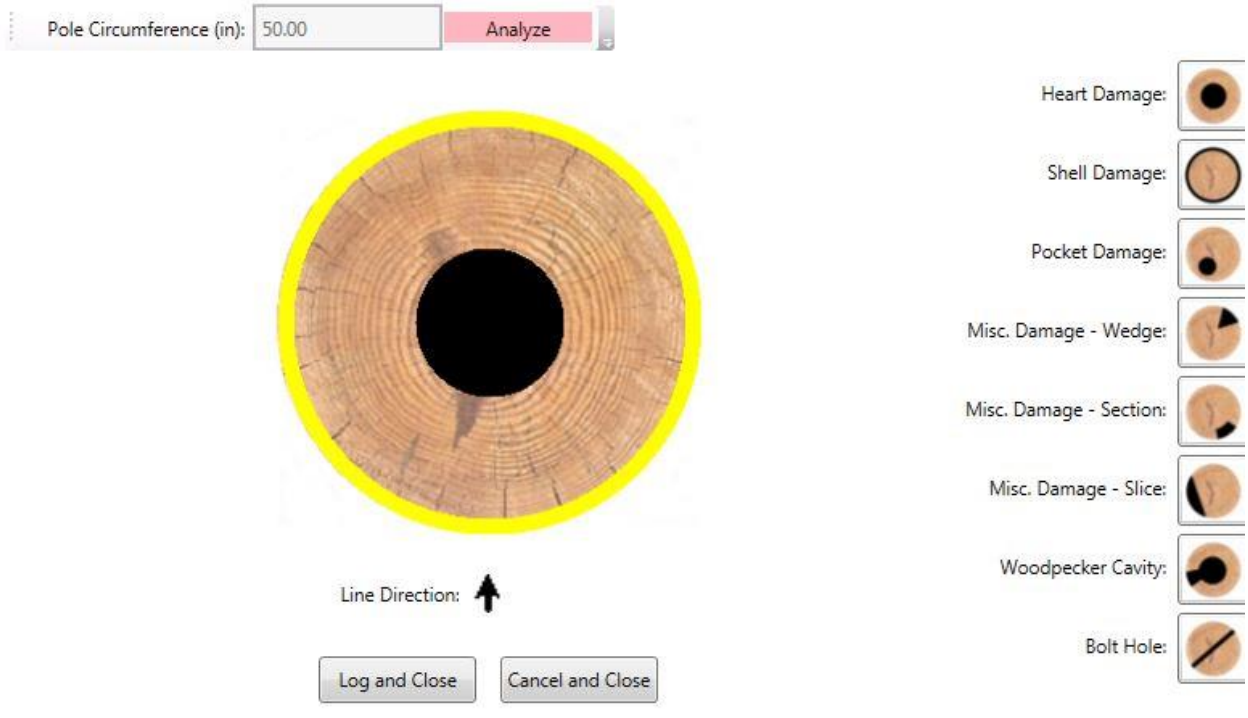



*Figure 4: Structure ID 110169 Height 12”*

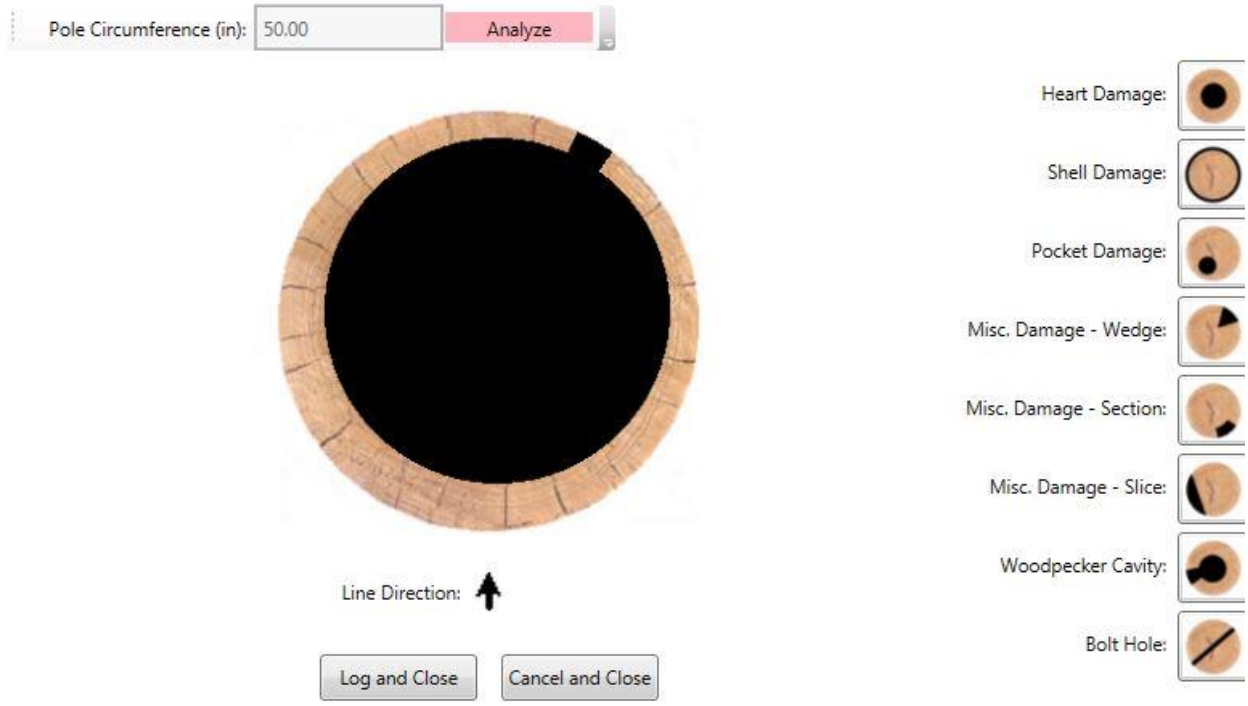



*Figure 5: Structure ID 110169 Height 36”*

*Figure 6: Structure ID 110170 – No D-Calc*


*Figure 7: Structure ID 110171 Height 0”*

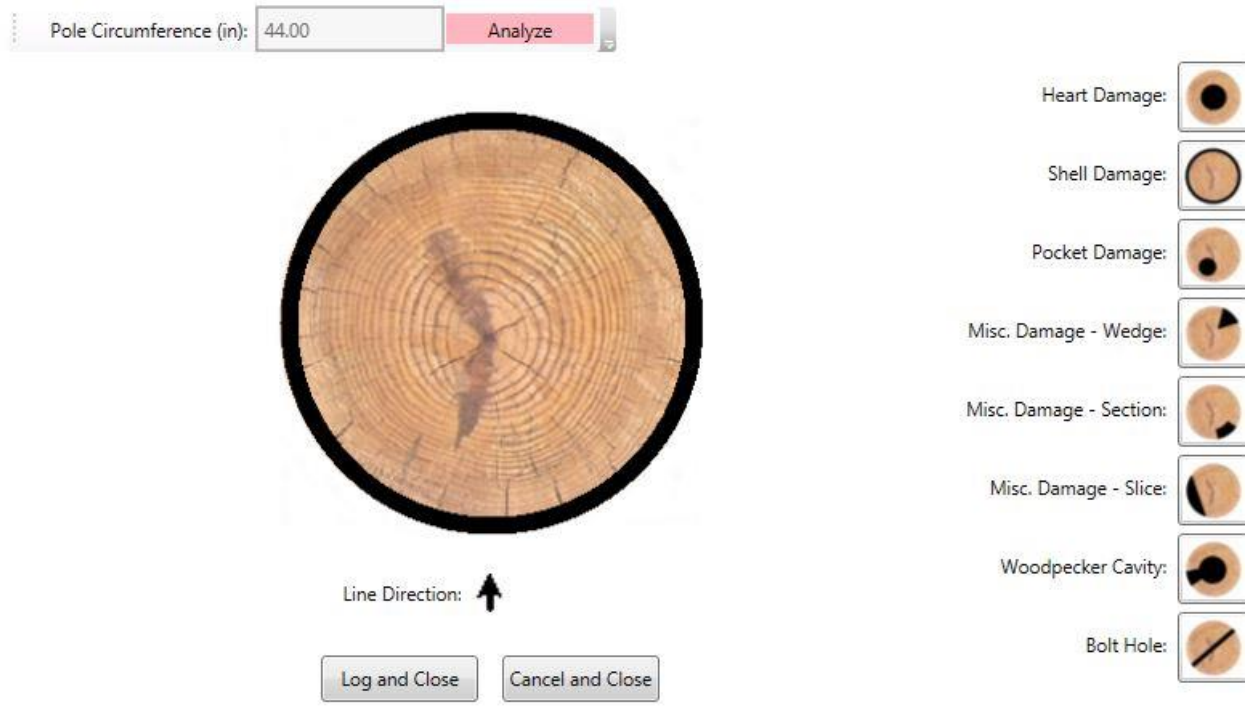



*Figure 8: Structure ID 110171 Height -12”*

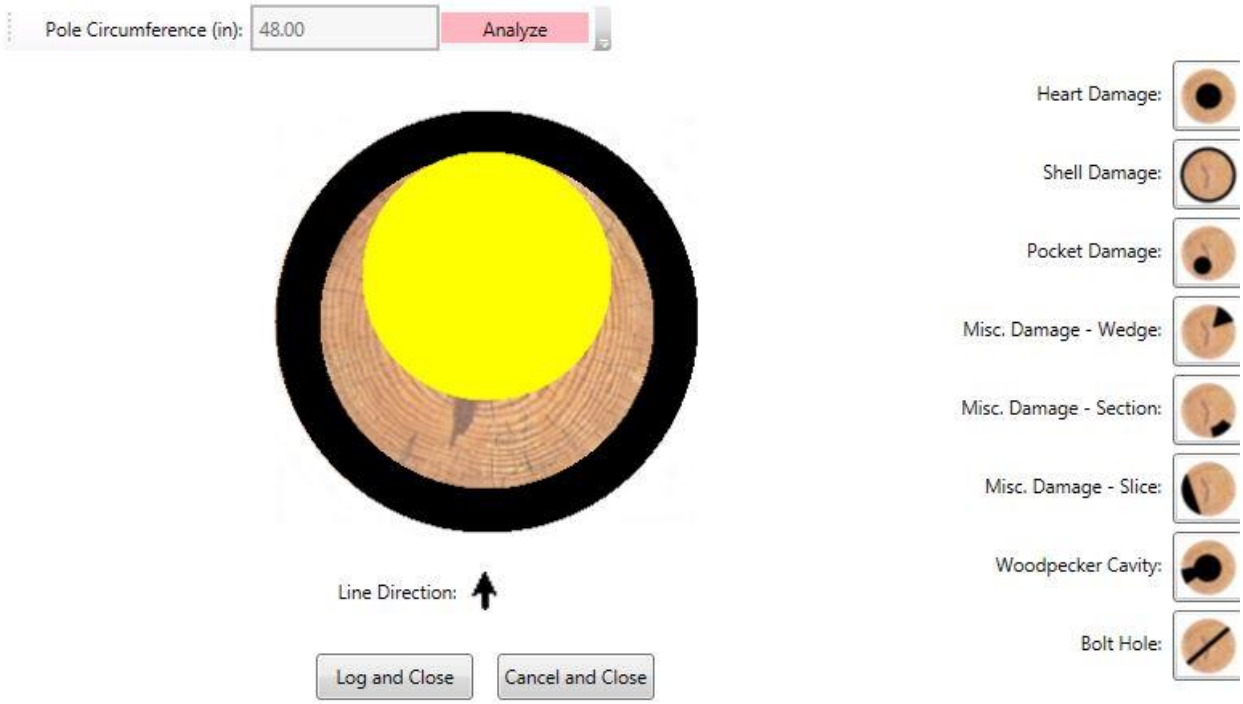



*Figure 9: Structure ID 122023 Height -18”*

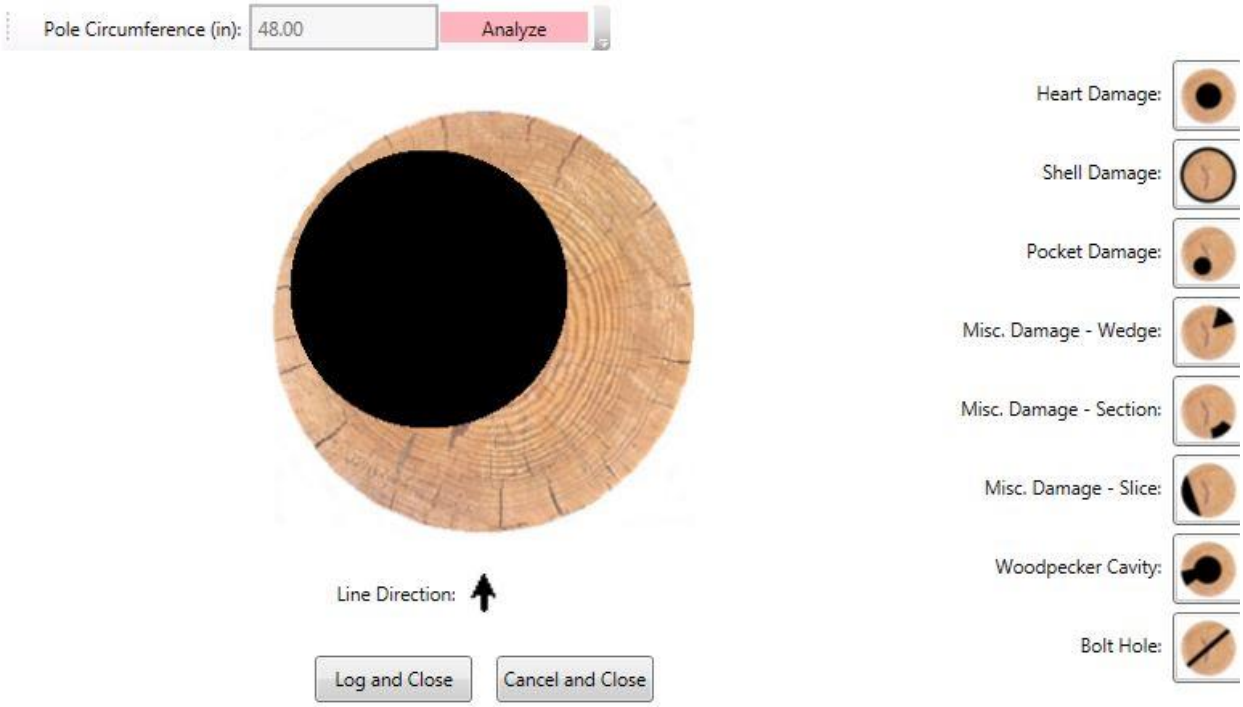



*Figure 10: Structure ID 122023 Height 0”*

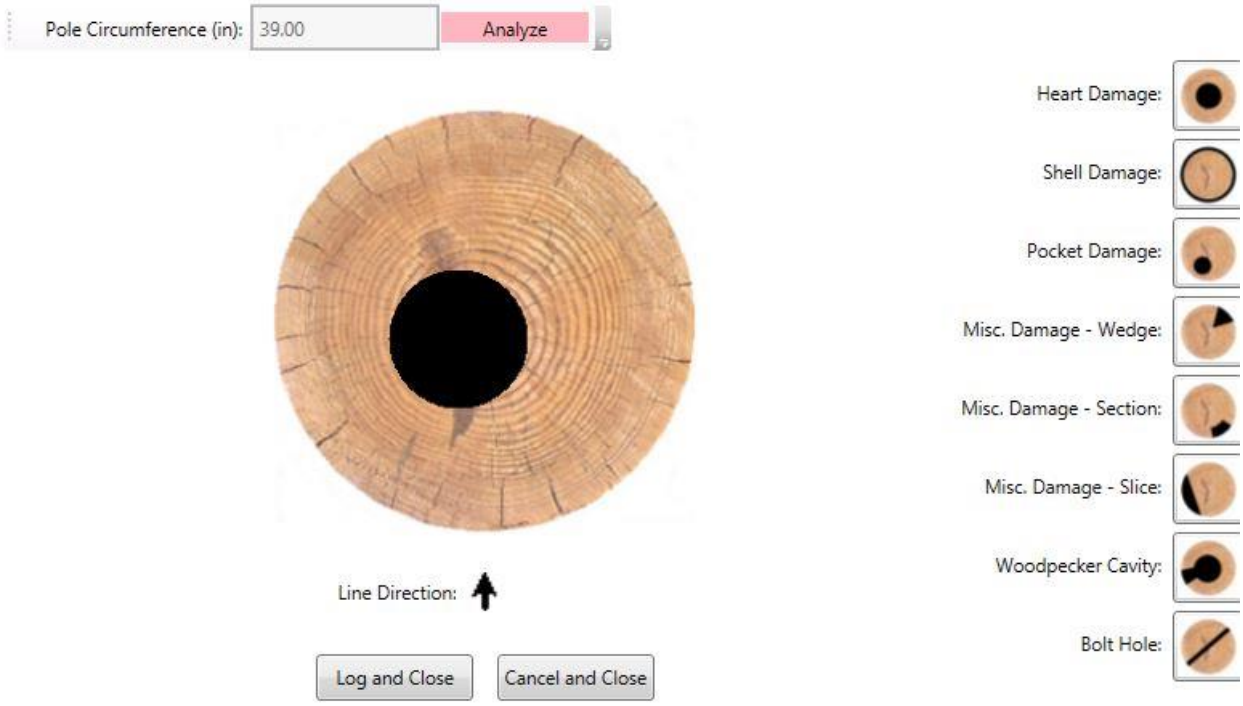



*Figure 11: Structure ID 122025 Height -12”*

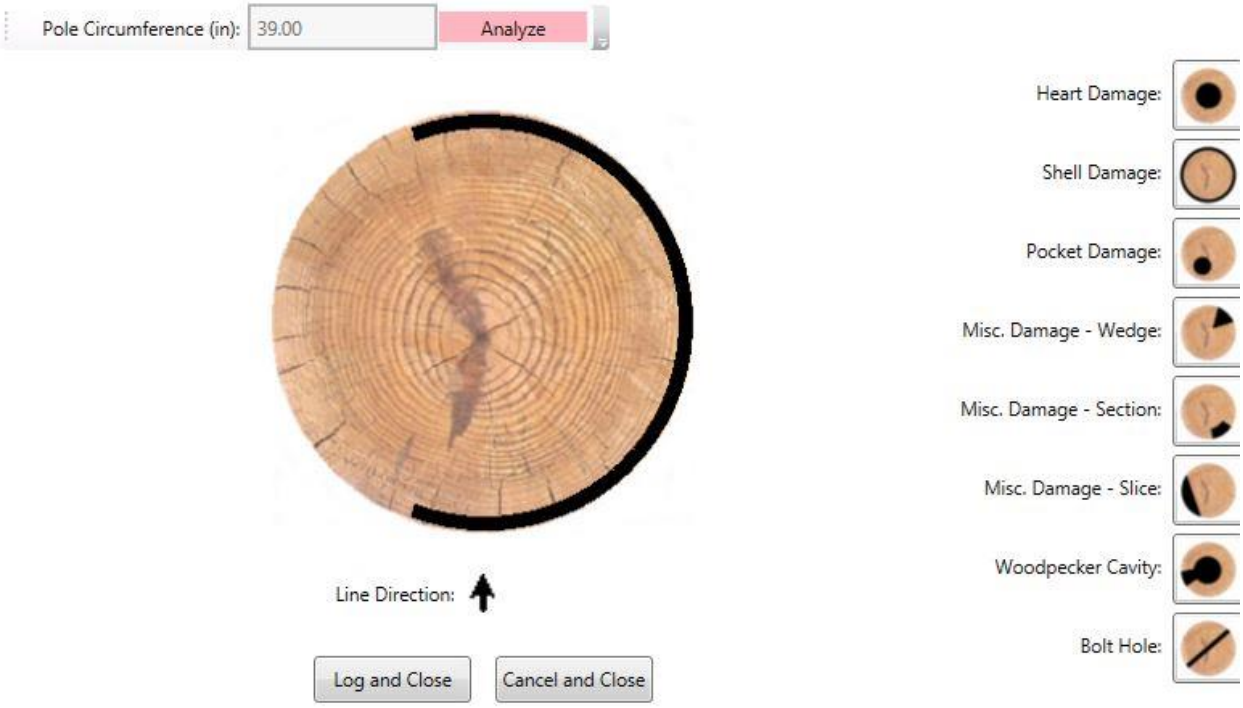



*Figure 12: Structure ID 122025 Height 24”*

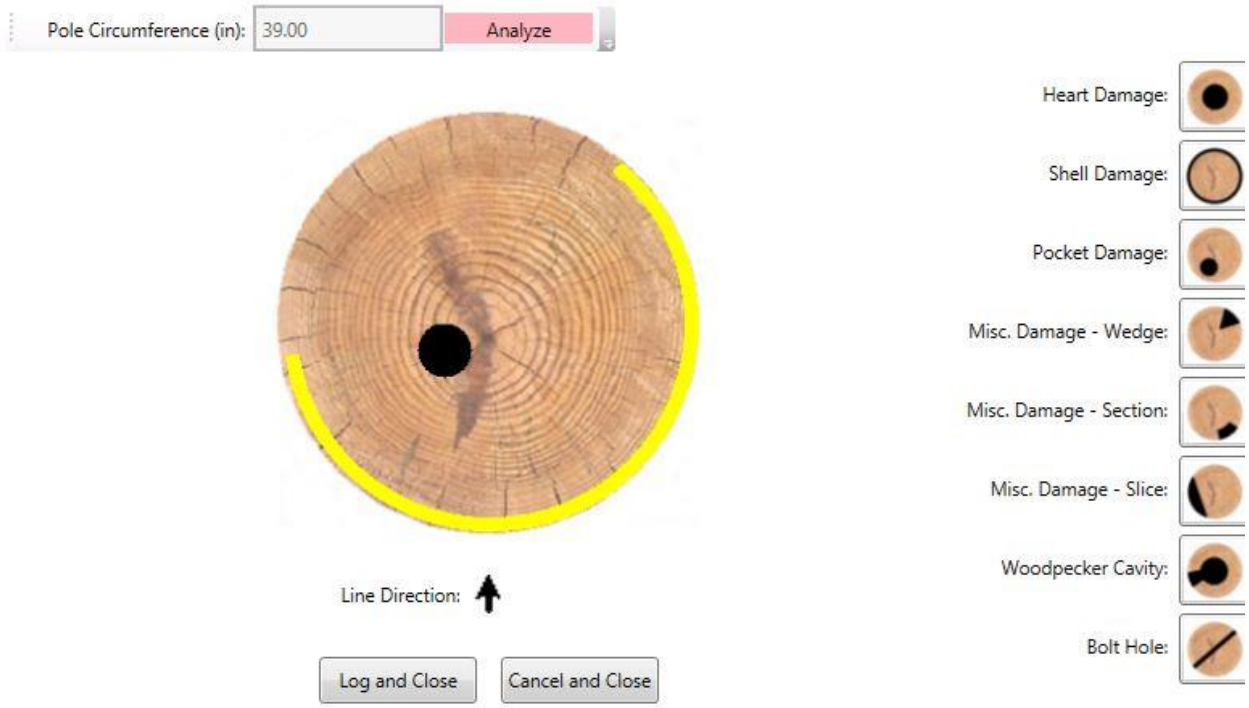



*Figure 13: Structure ID 122025 Height 0”*


*Figure 14: Structure ID 122028 Height 0”*

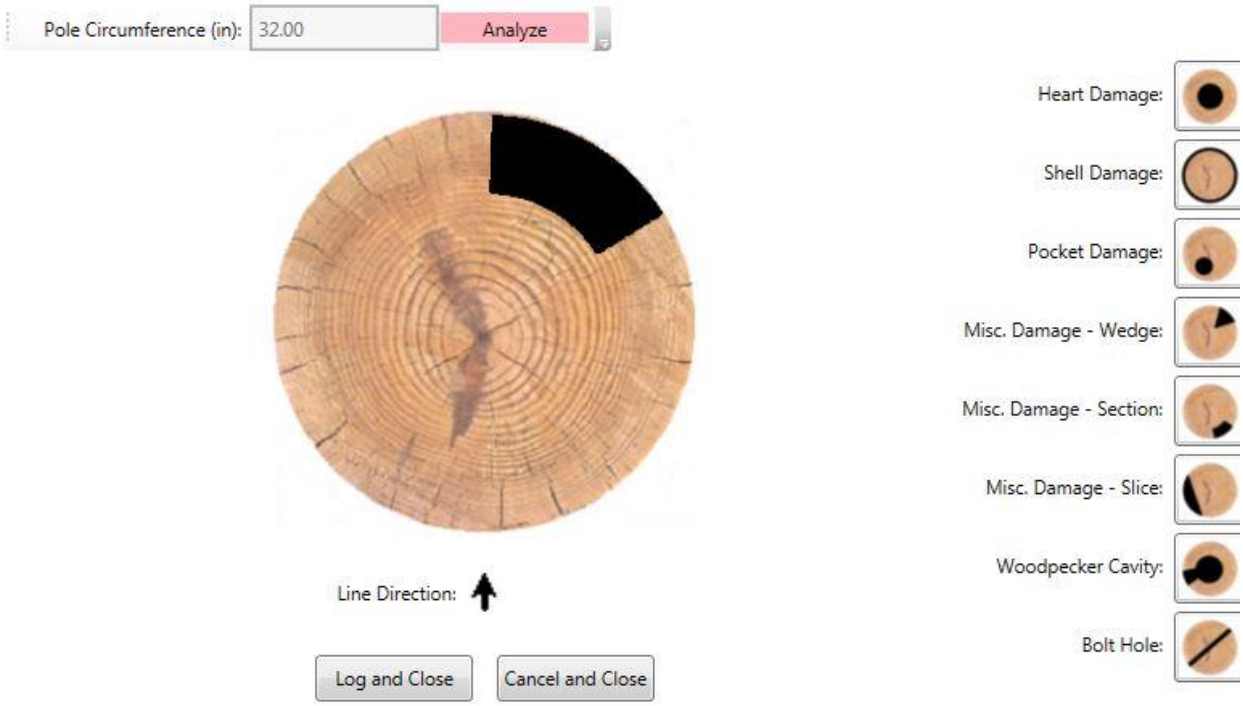



*Figure 15: Structure ID 122028 Height 24”*

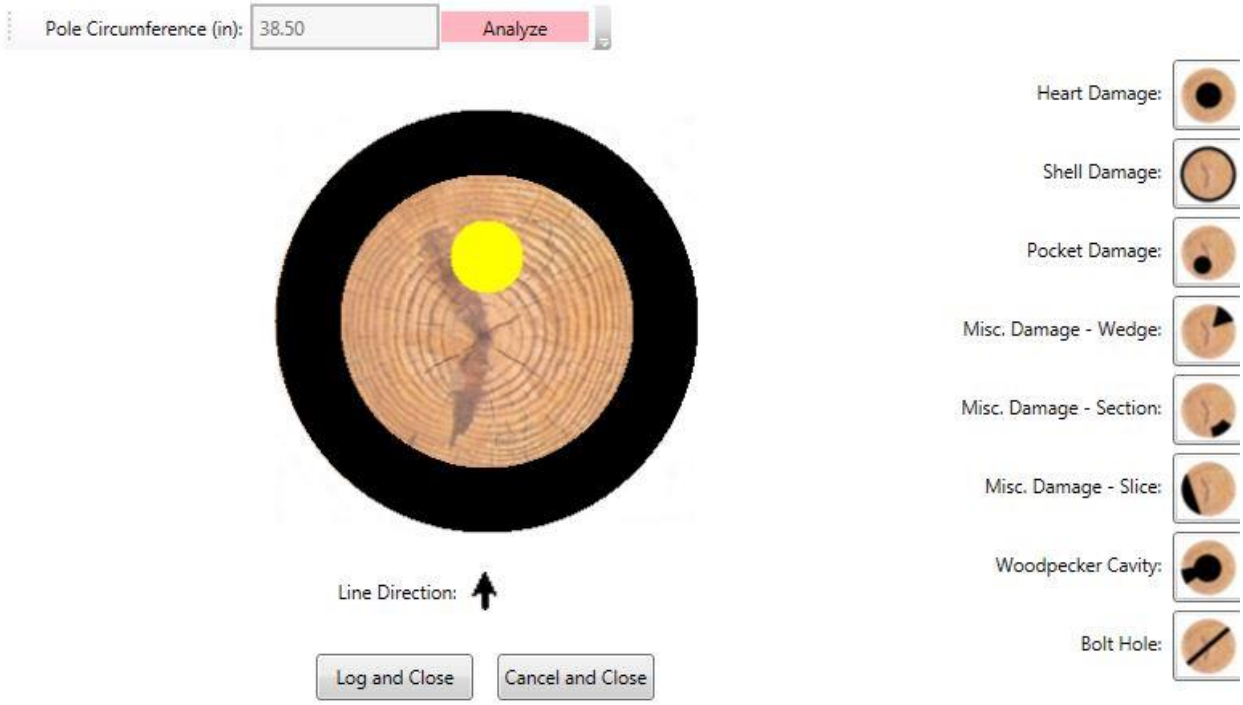



*Figure 16: Structure ID 123738 Height 0”*

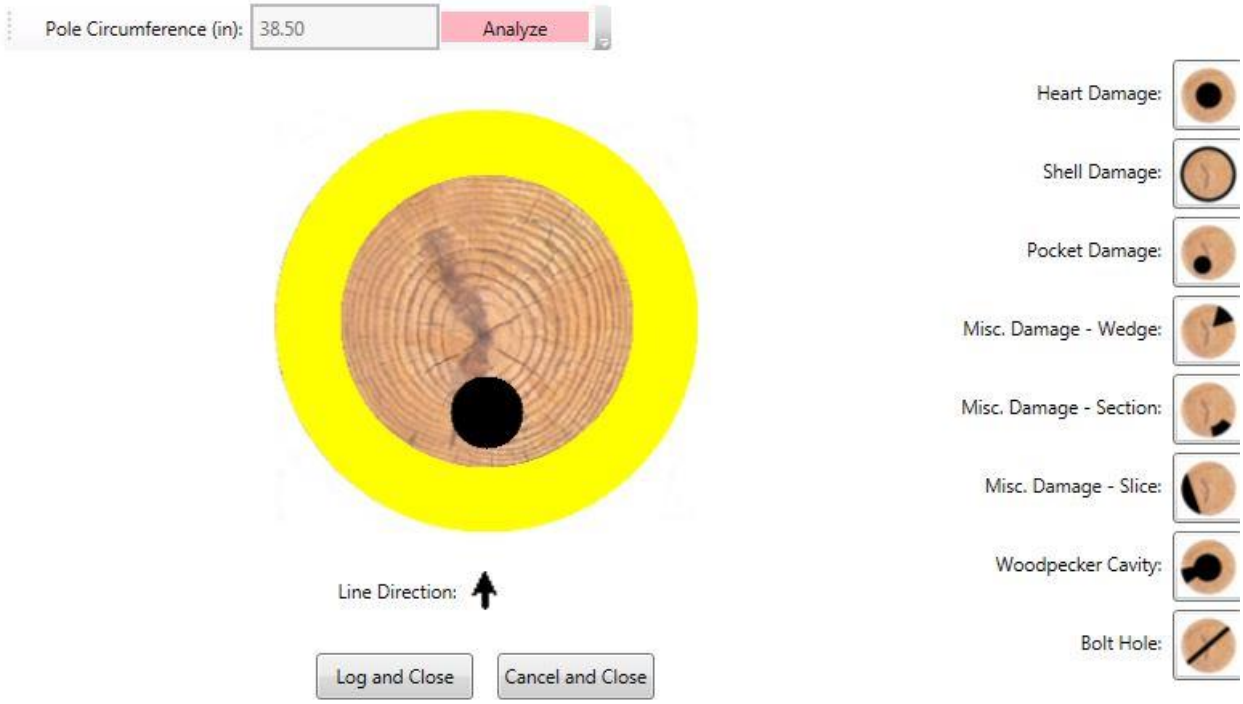



*Figure 17: Structure ID 123738 Height -18”*

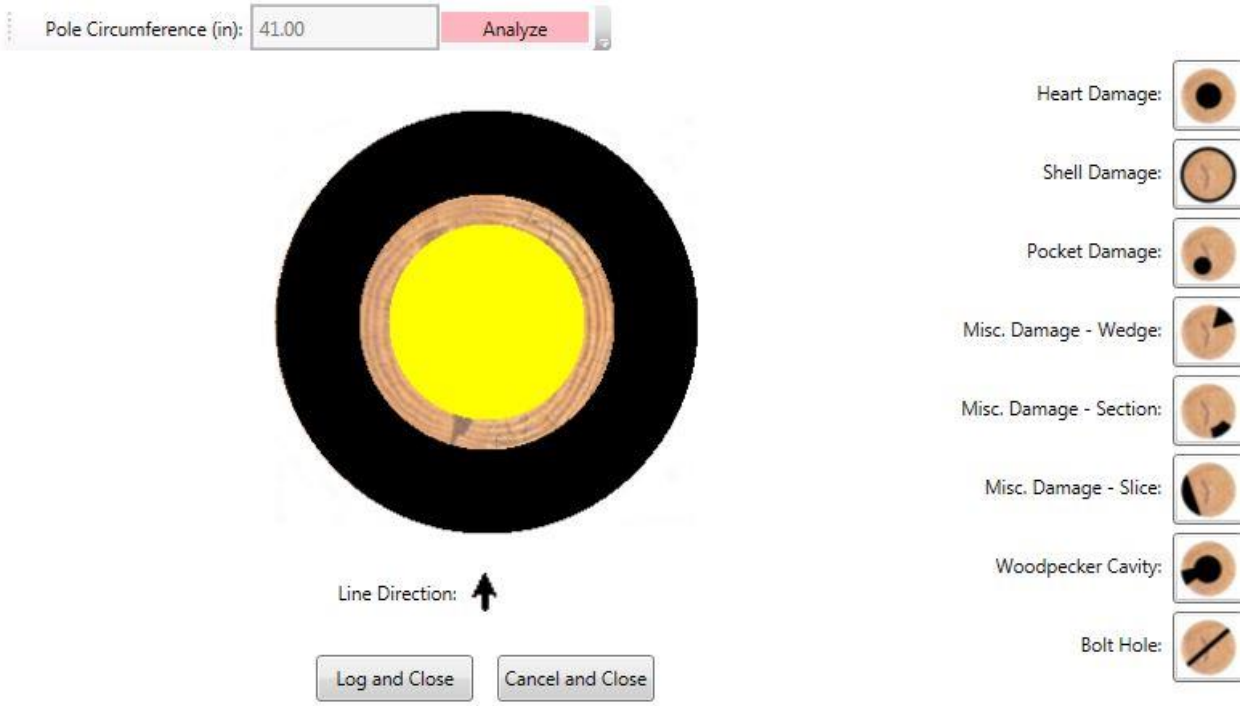



*Figure 18: Structure ID 123739 Height 0”*

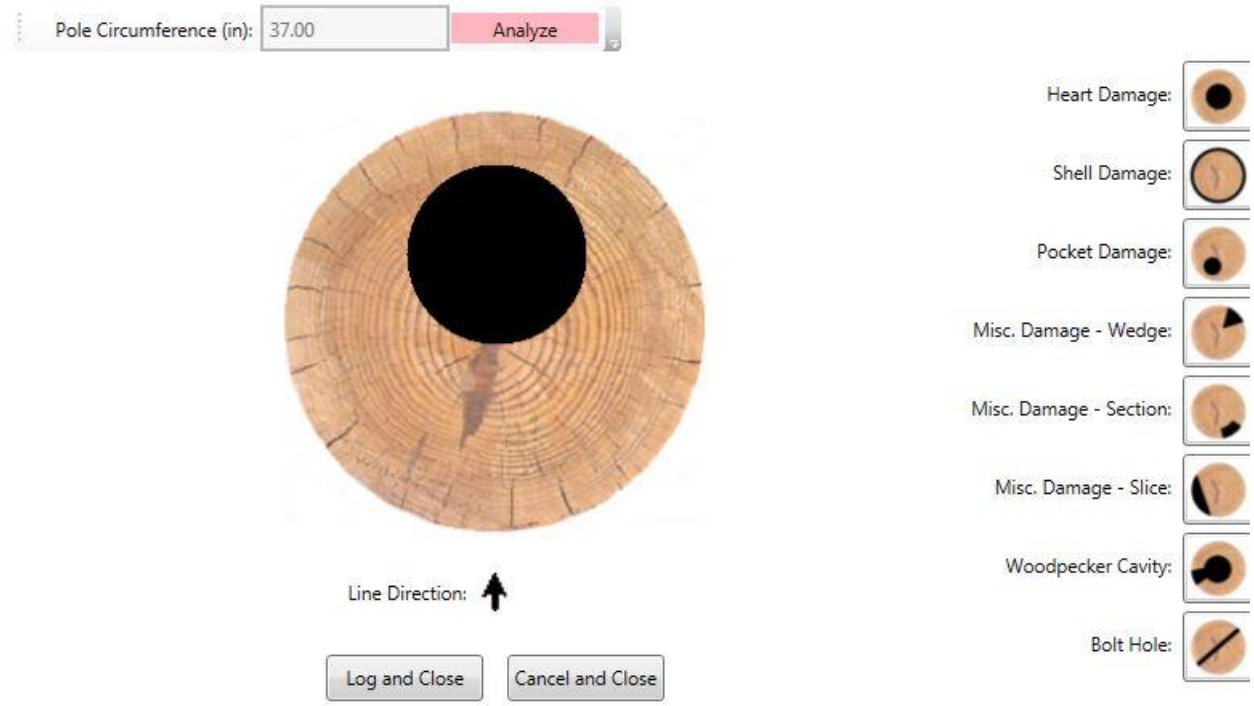



*Figure 19: Structure ID 12382 Height 24”*

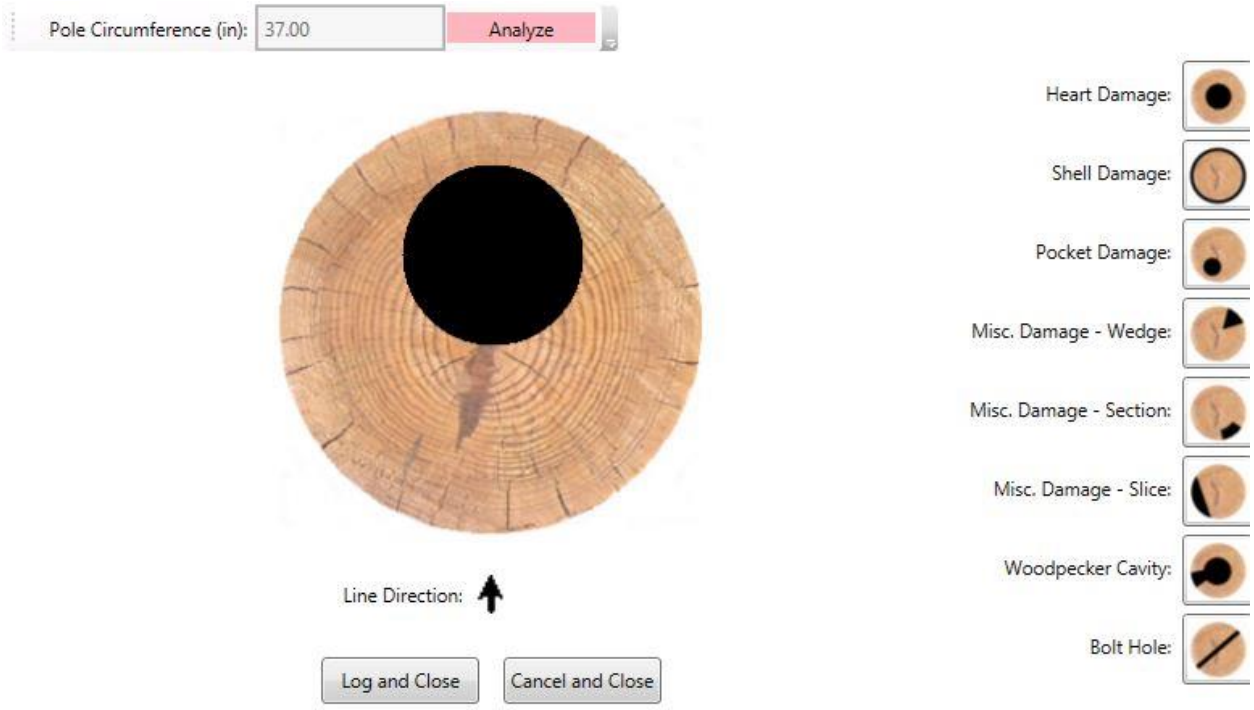



*Figure 20: Structure ID 12382 Height 48”*

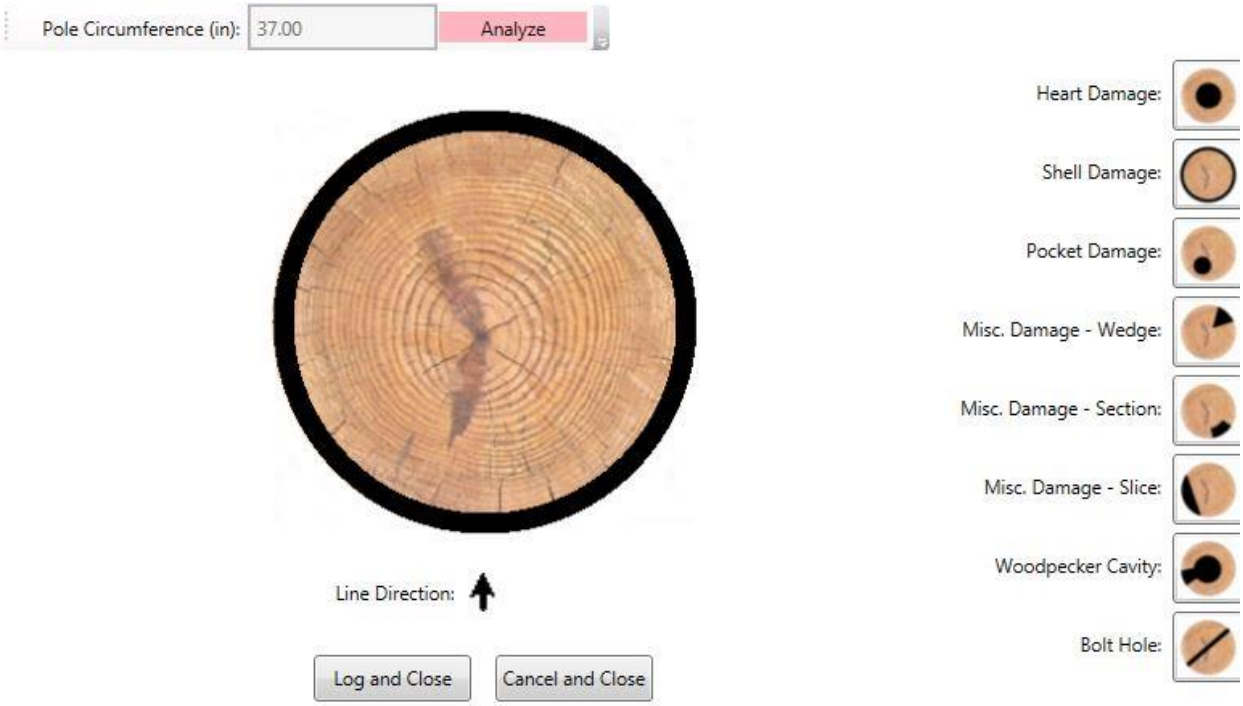



*Figure 21: Structure ID 12382 Height 0”*

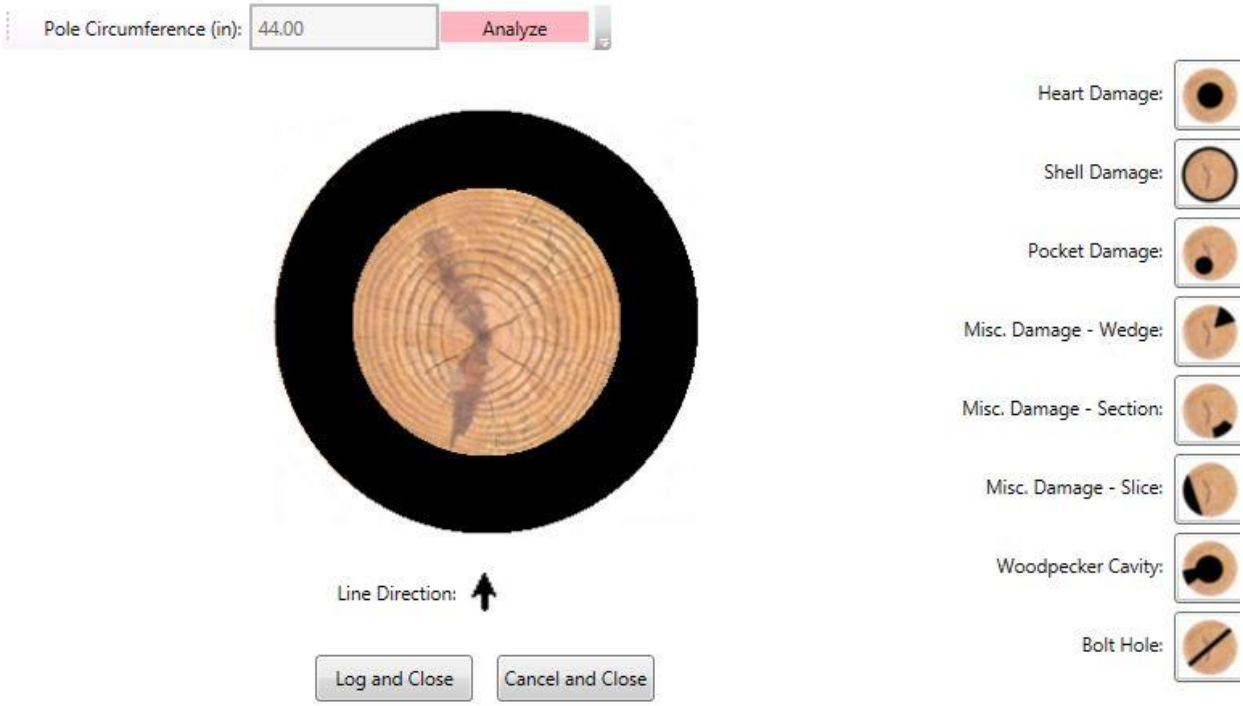



*Figure 22: Structure ID 124022 Height -6”*

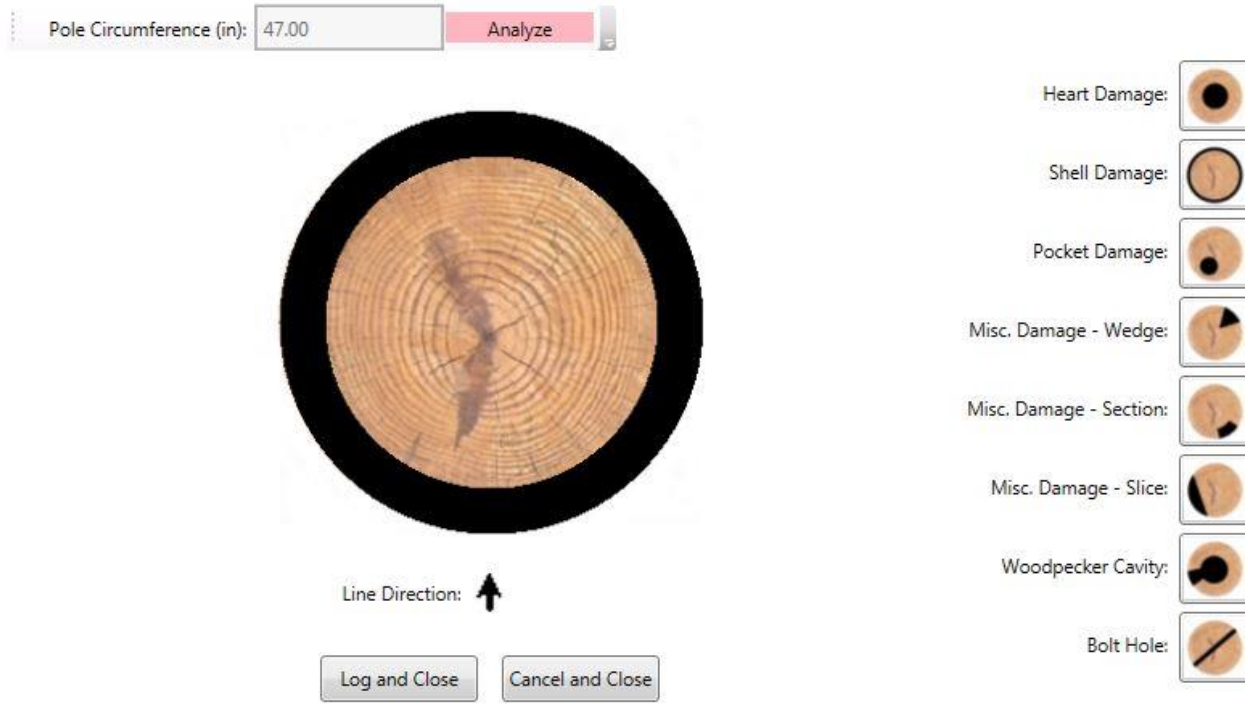



*Figure 23: Structure ID 124025 Height -12”*

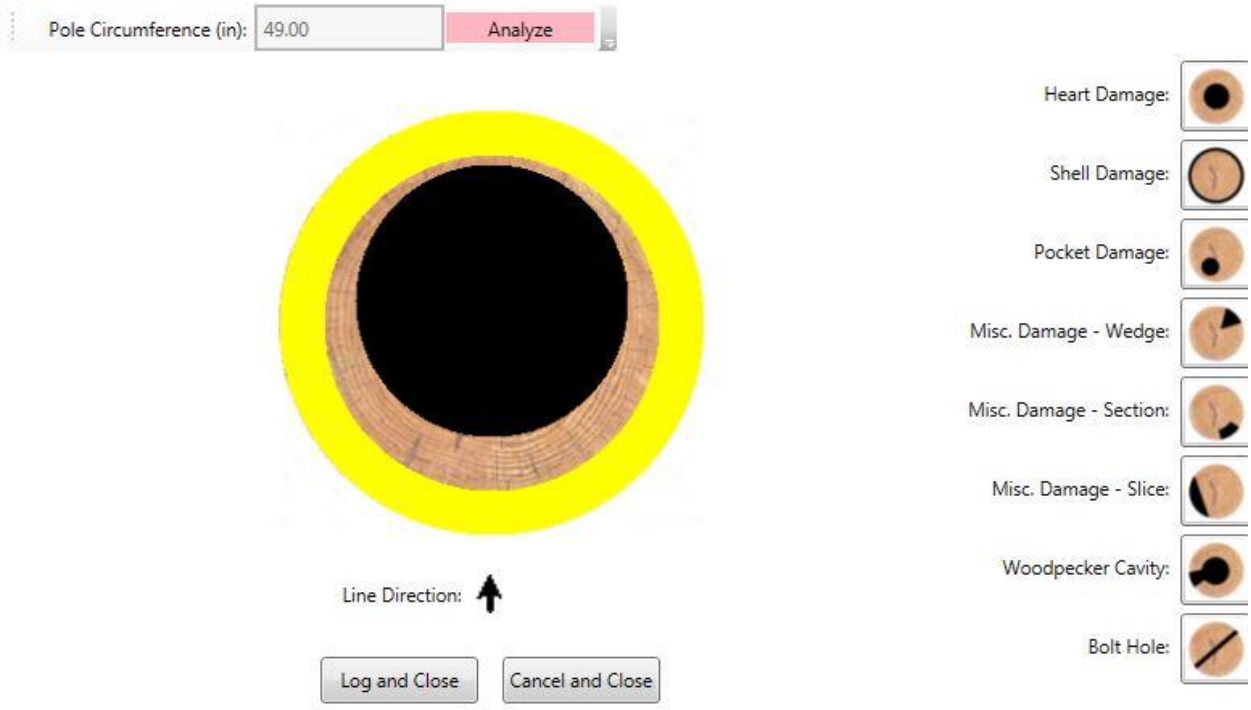



*Figure 24: Structure ID 124864 Height 0”*

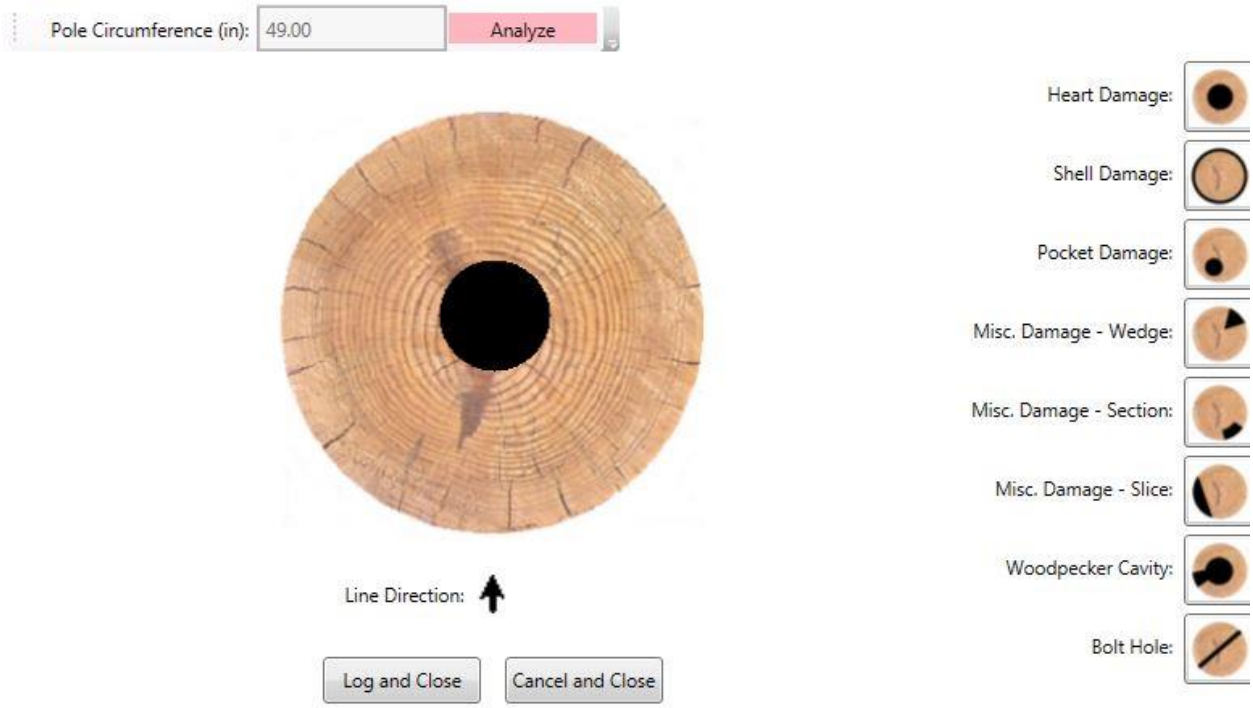



*Figure 25: Structure ID 124864 Height -6”*


*Figure 26: Structure ID 124865 Height 0”*

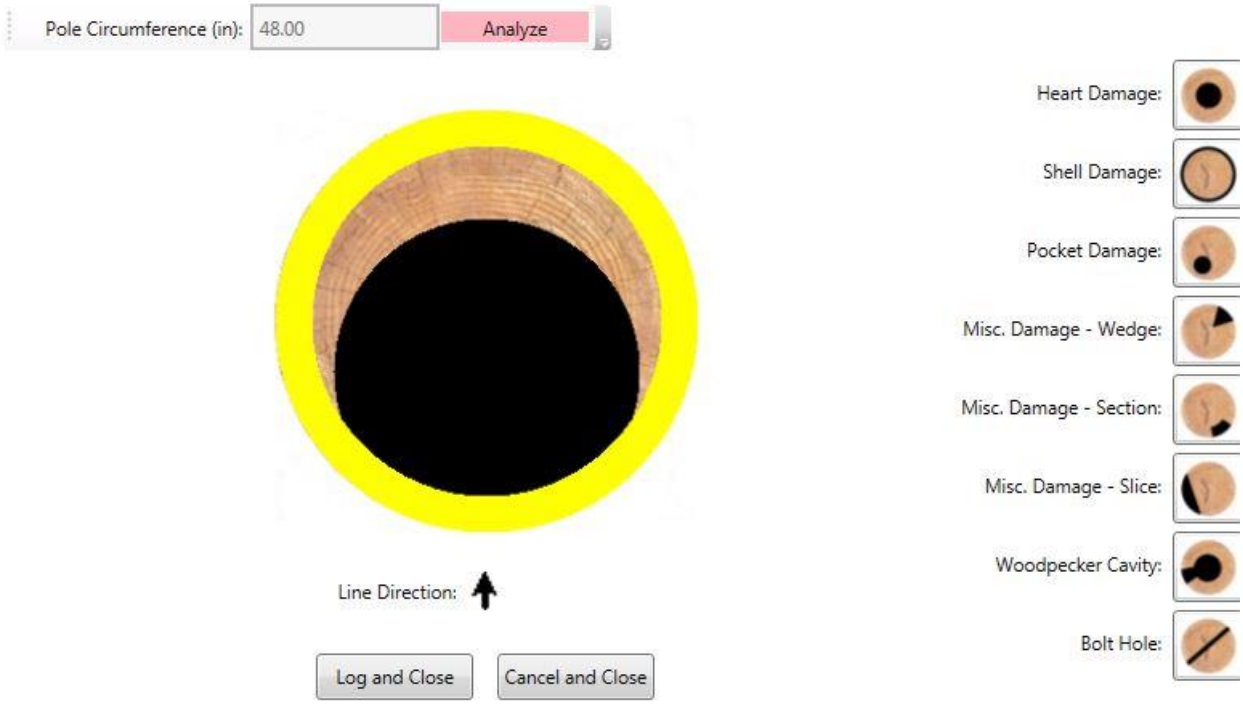



*Figure 27: Structure ID 124866 Height -12”*

*Figure 28: Structure ID 13192 – No D-Calc*

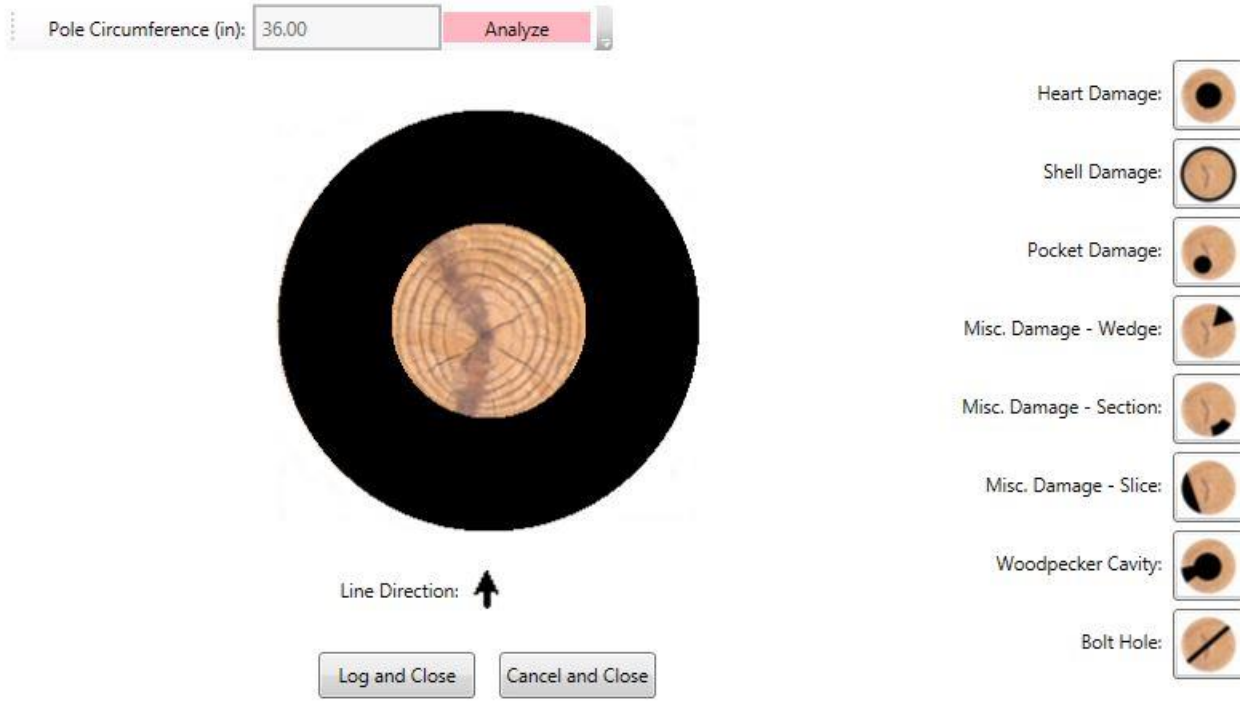



*Figure 29: Structure ID 13427 Height -16”*

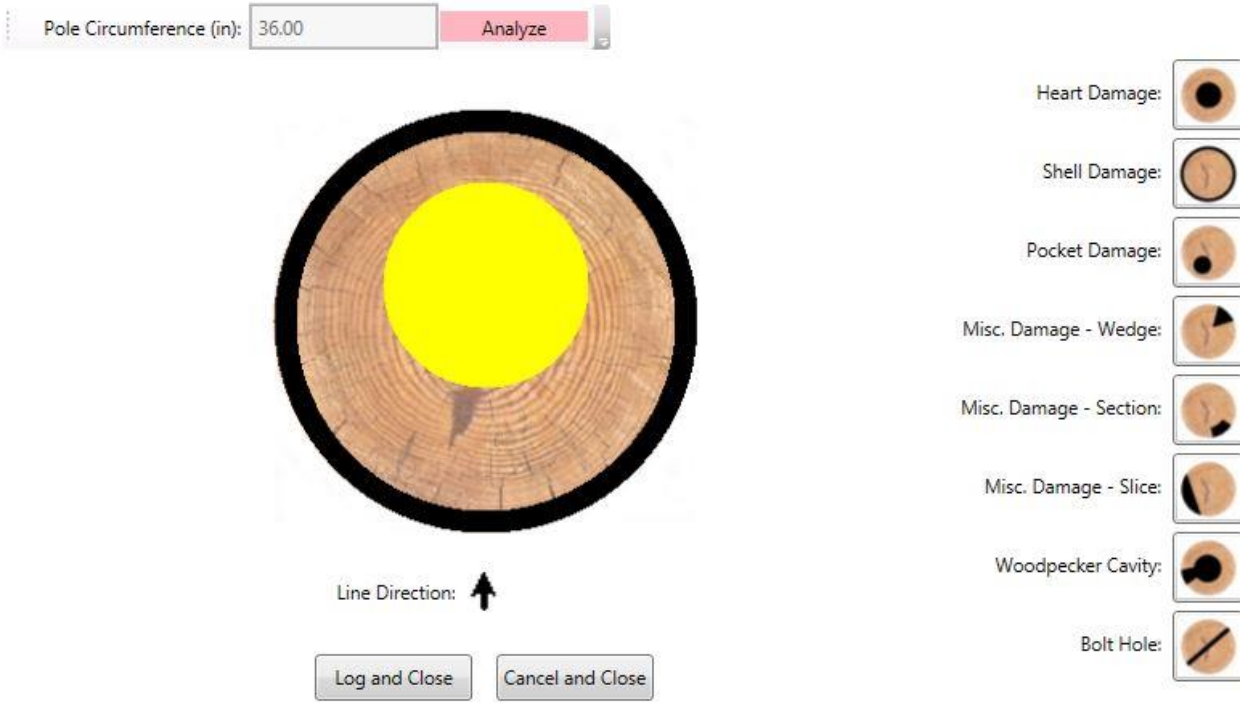



*Figure 30: Structure ID 13427 Height 0”*

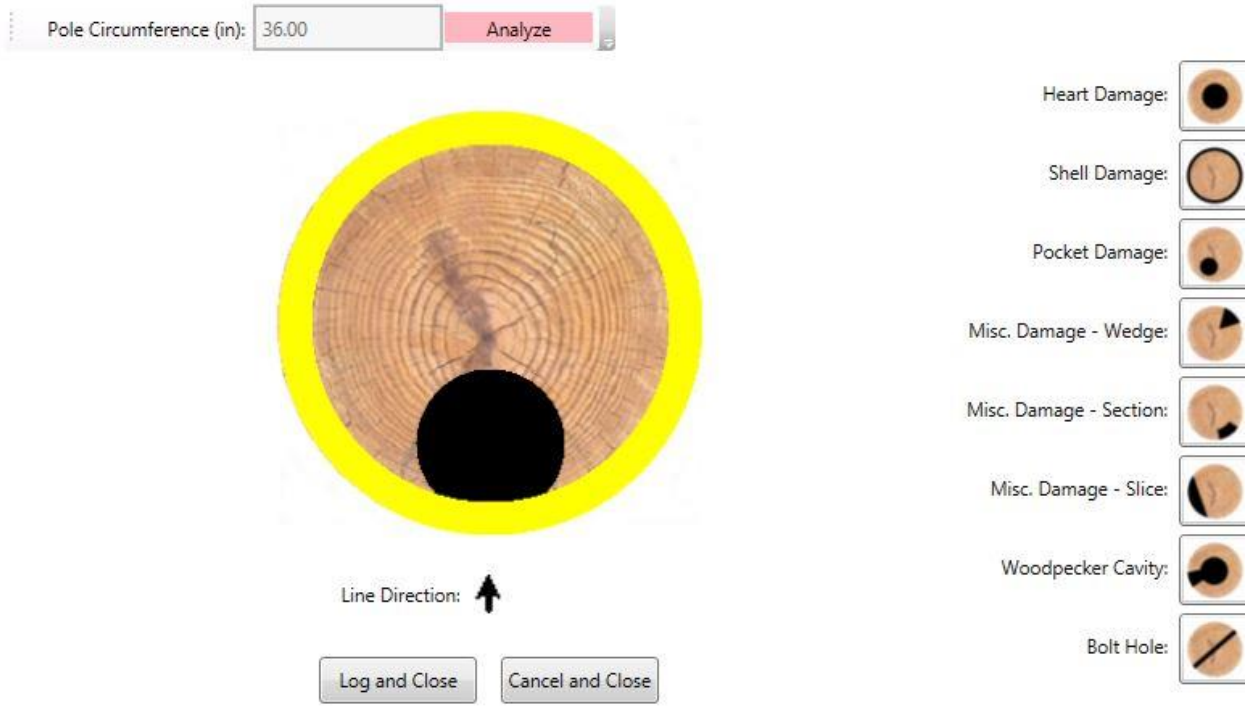



*Figure 31: Structure ID 146833 Height 0”*

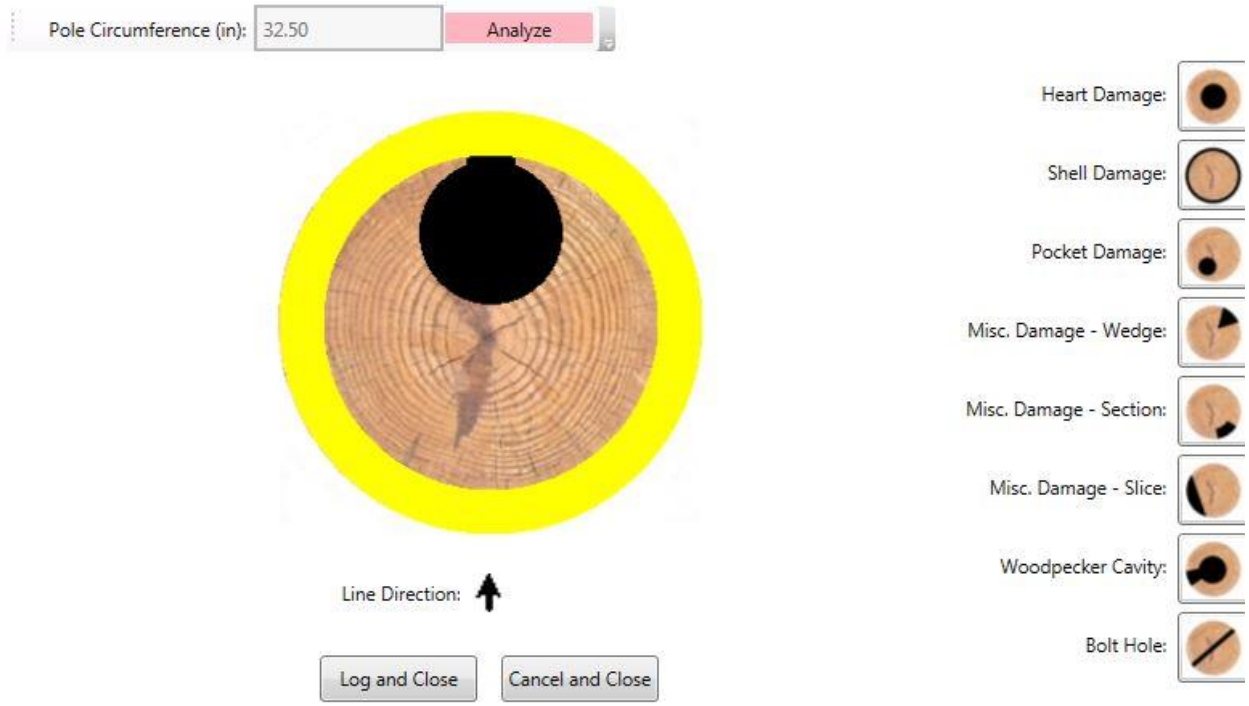



*Figure 32: Structure ID 146836 Height 0”*

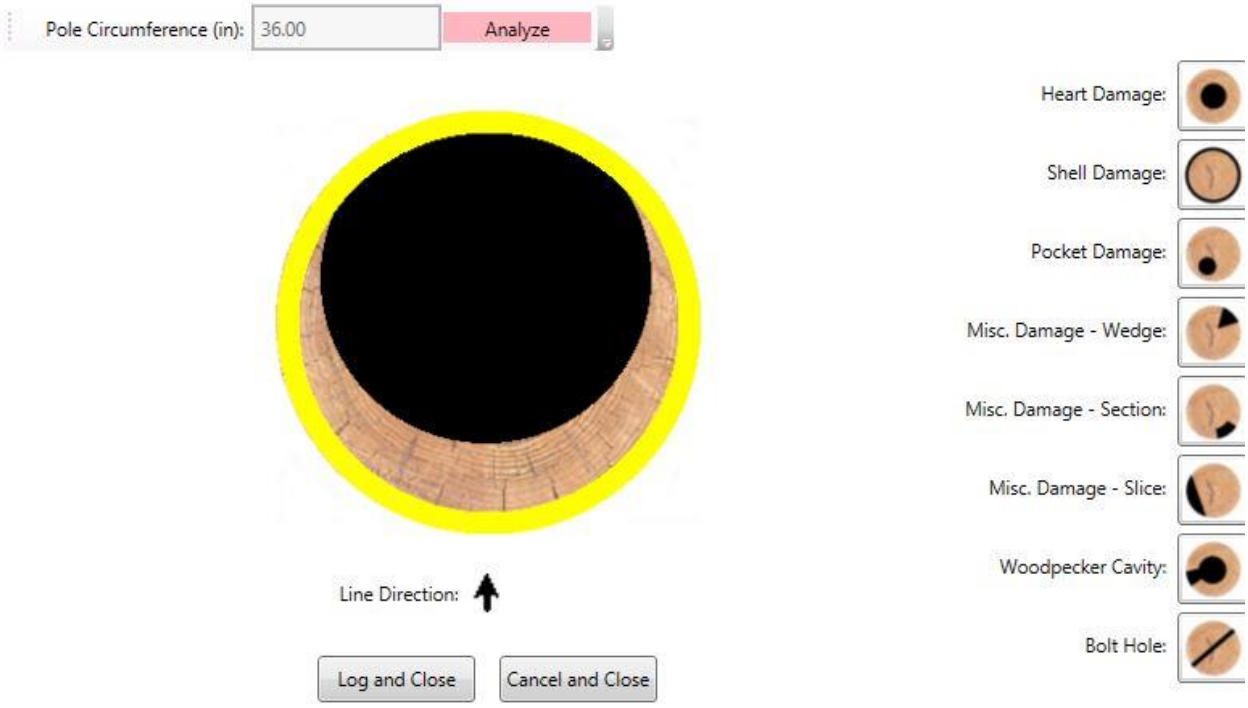



*Figure 33: Structure ID 146839 Height 0”*

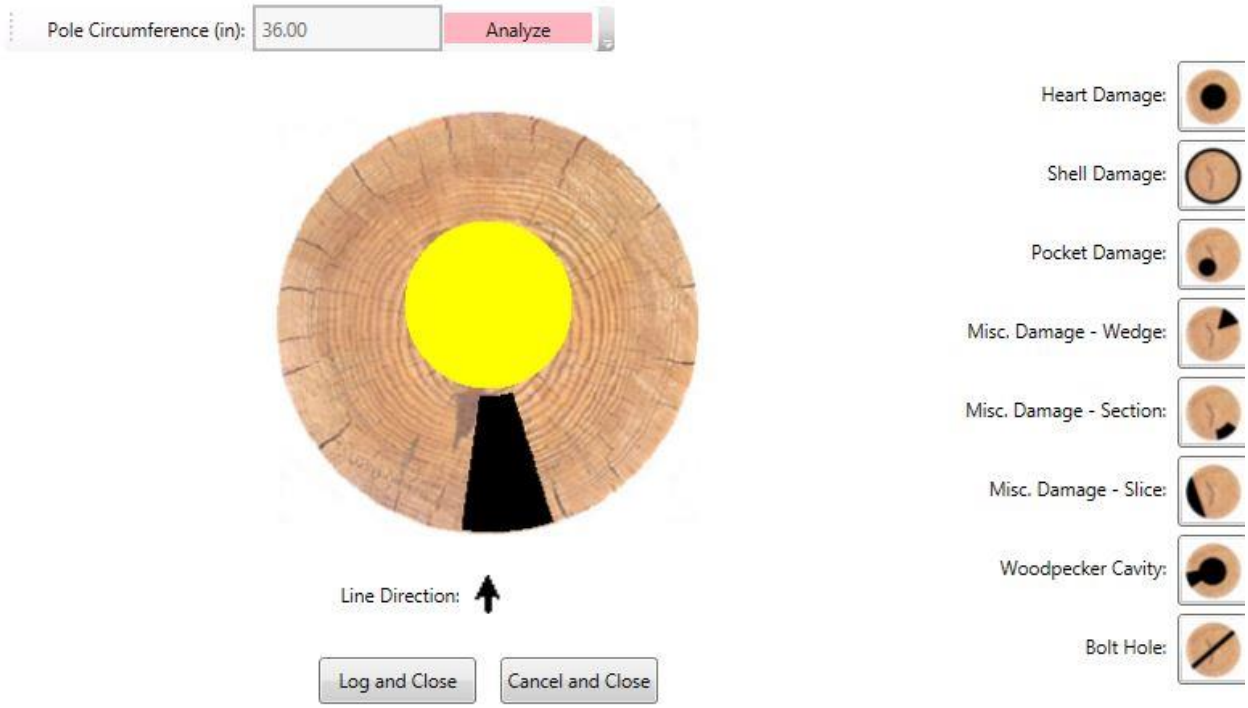



*Figure 34: Structure ID 146839 Height 54”*

*Figure 35: Structure ID 18394 – No D-Calc*

*Figure 36: Structure ID 18576 – No D-Calc*

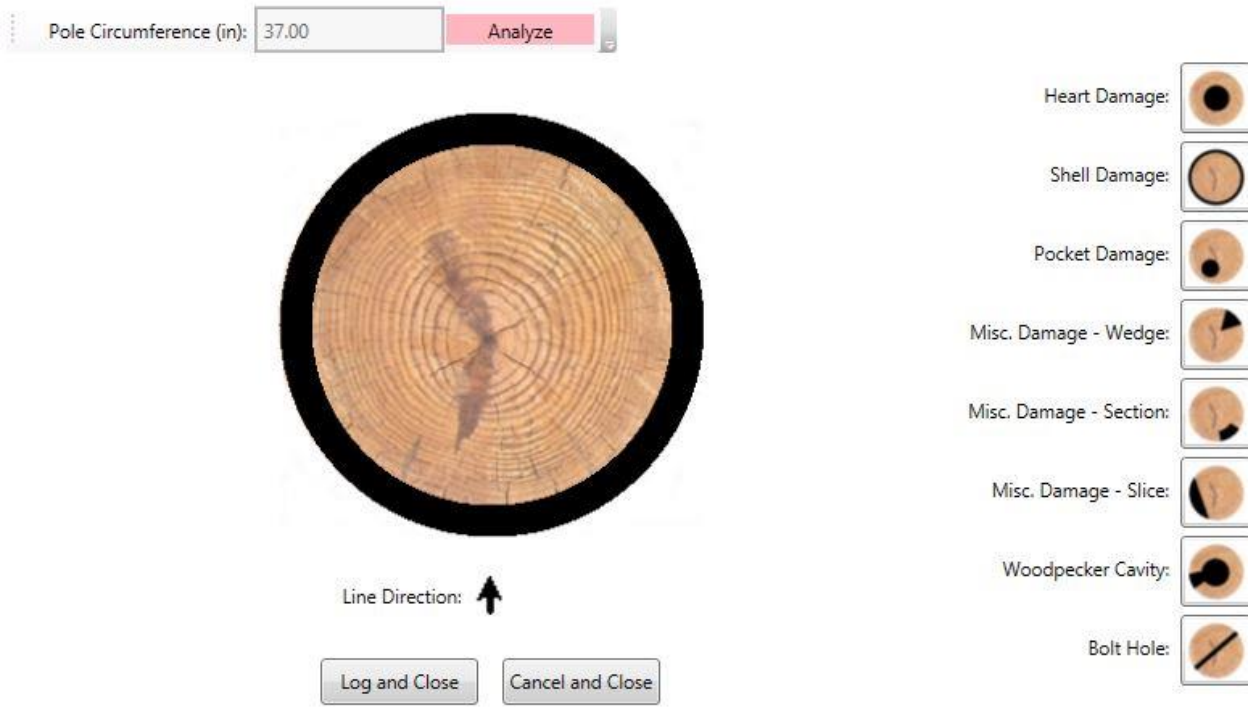



*Figure 37: Structure ID 18591 Height 0”*

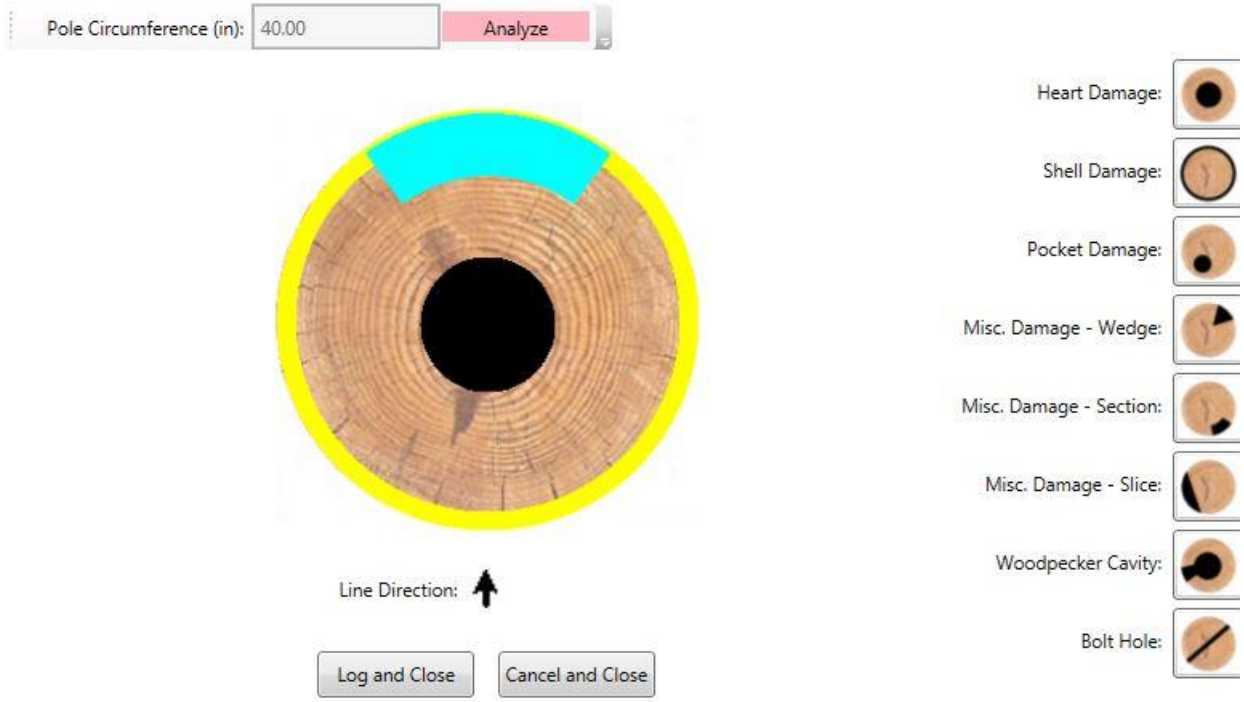



*Figure 38: Structure ID 186707 new tag Height -6”*

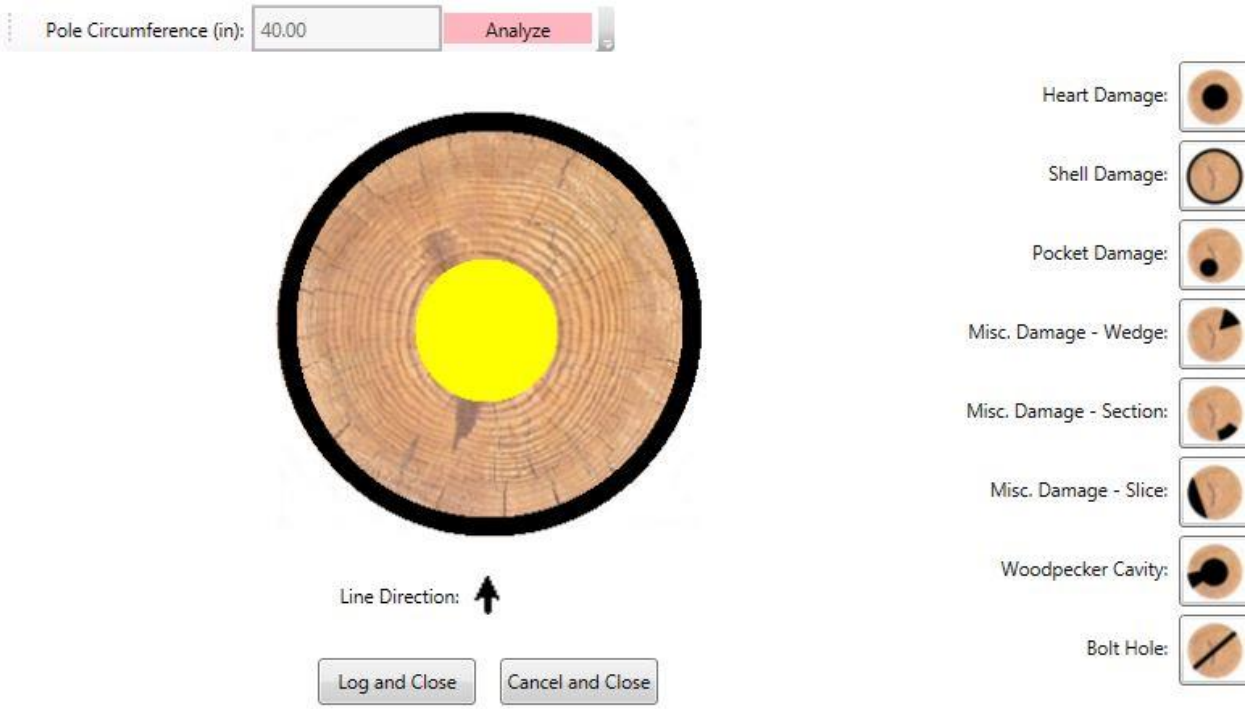



*Figure 39: Structure ID 186707 new tag Height 0”*

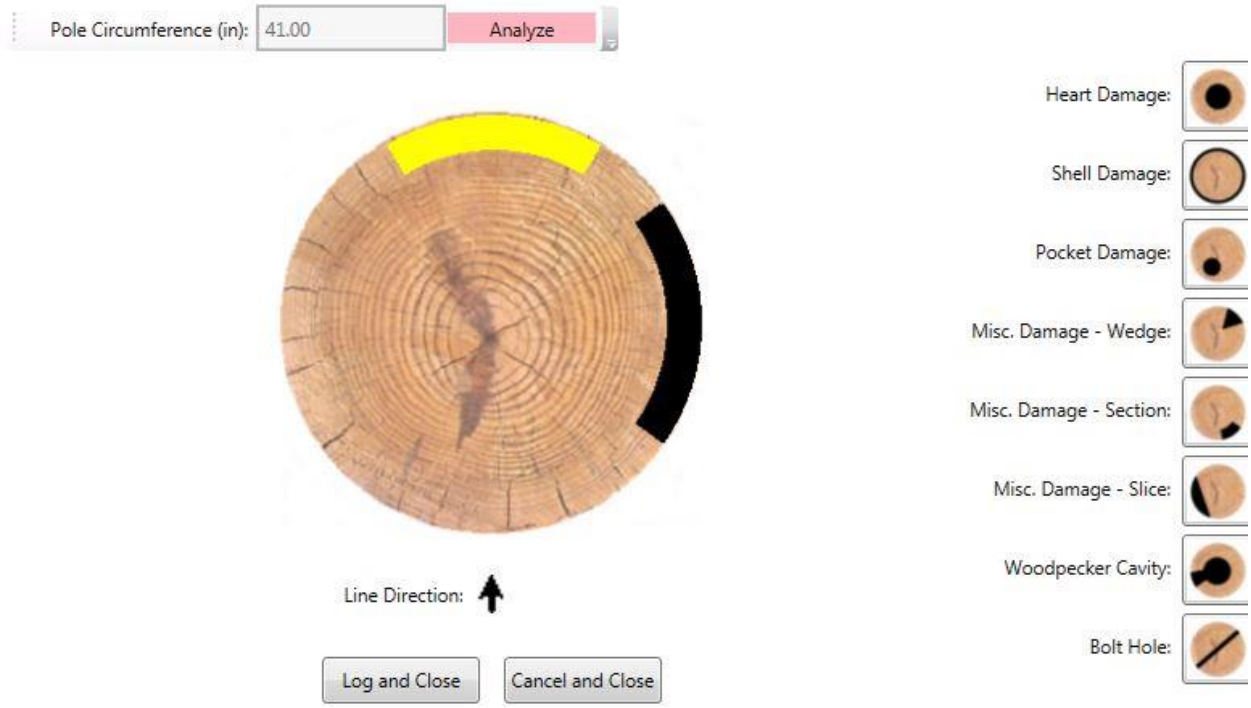



*Figure 40: Structure ID 18703 Height 0”*

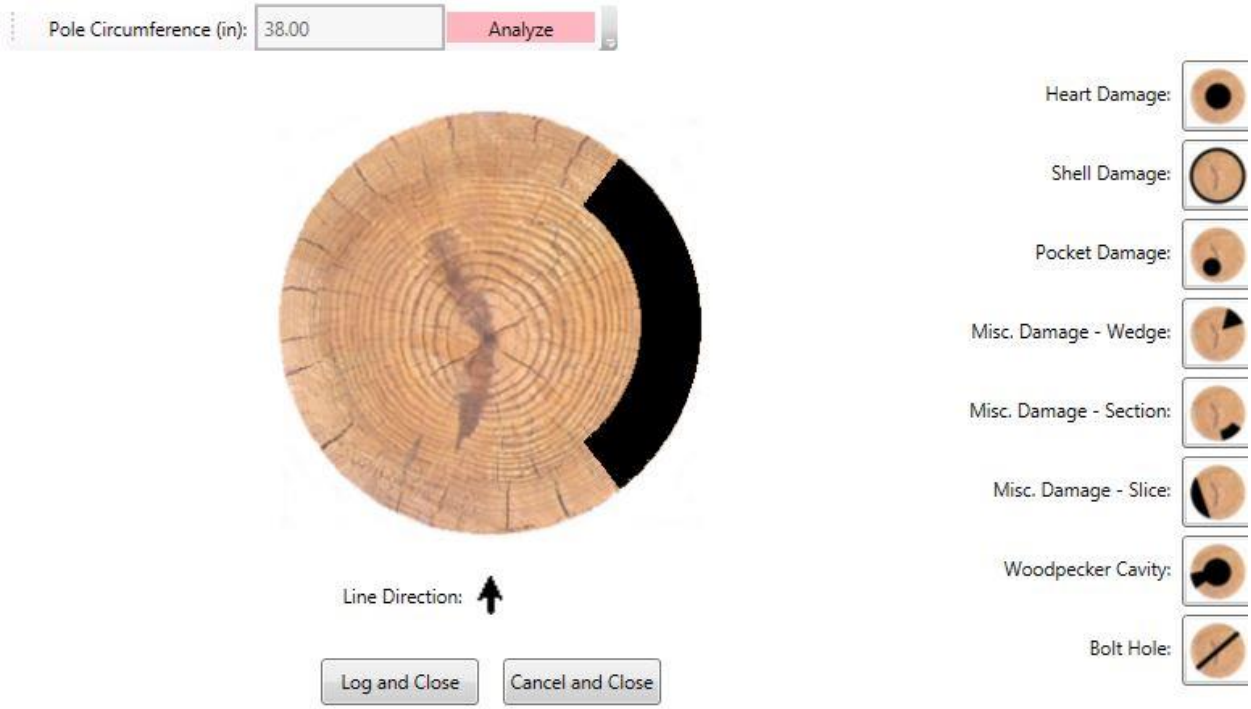



*Figure 41: Structure ID 18857 Height 6”*

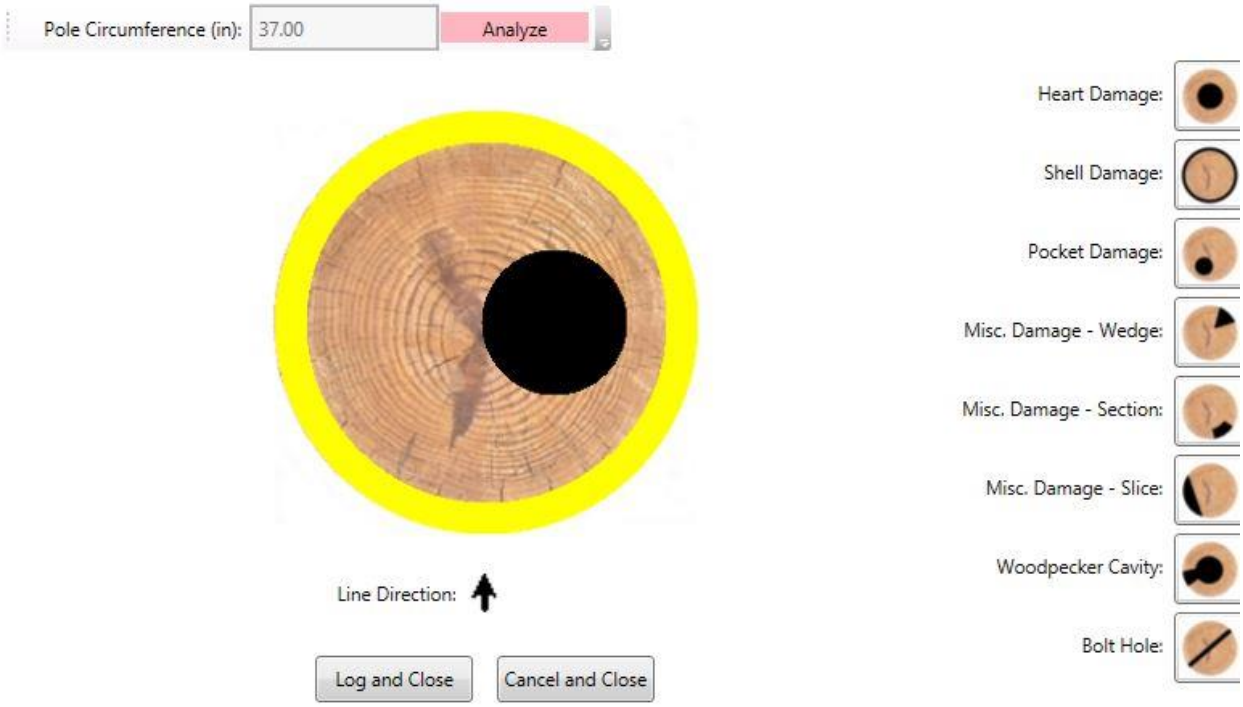



*Figure 42: Structure 20373 Height 0”*

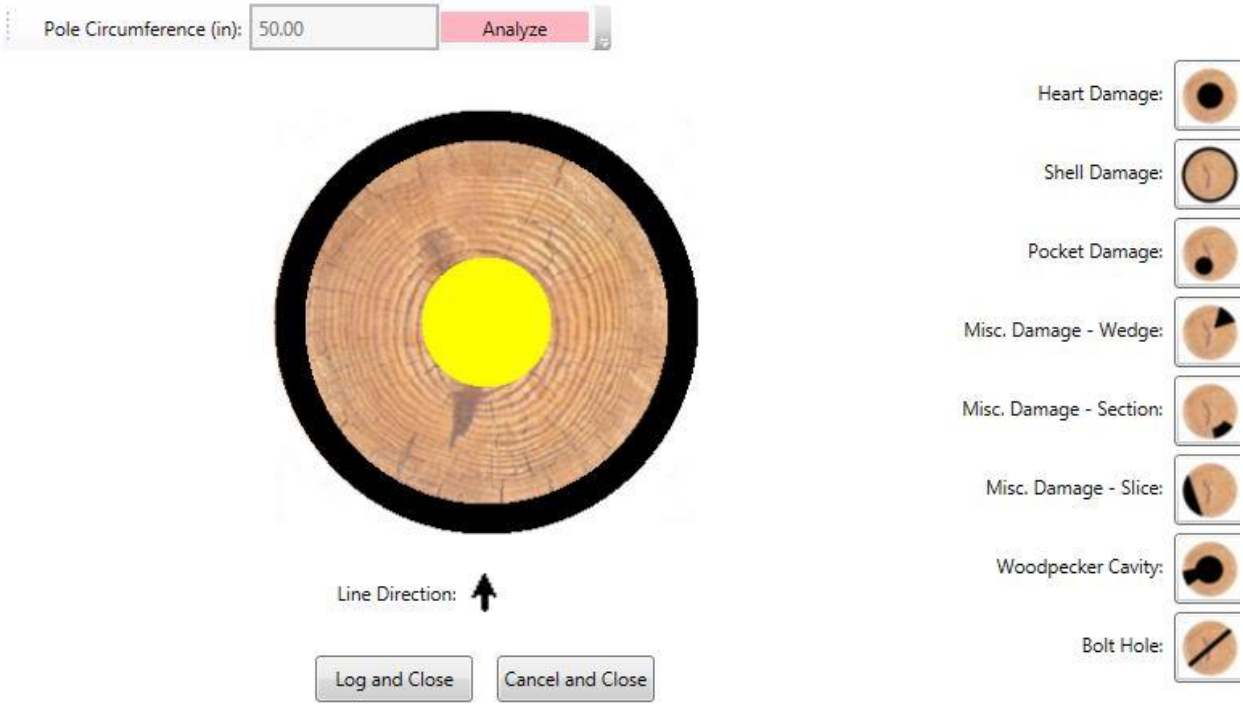



*Figure 43: Structure ID 26043 Height 0”*

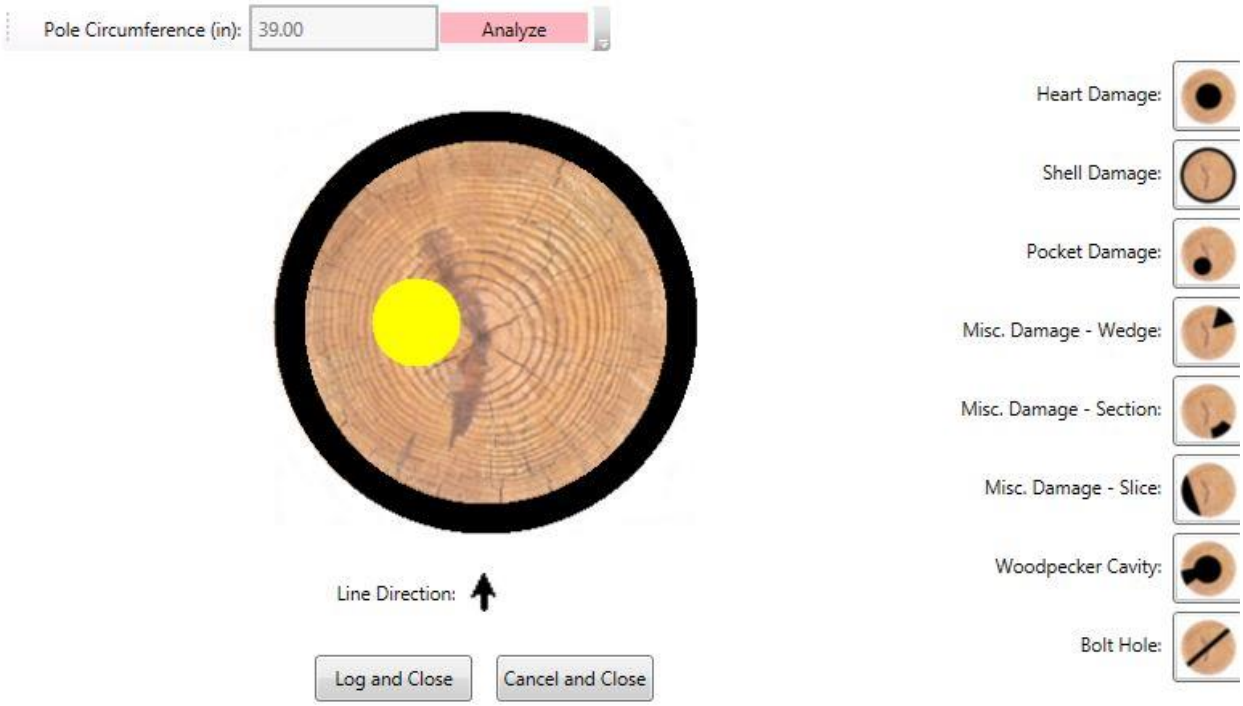



*Figure 44: Structure ID 26049 Height -12”*

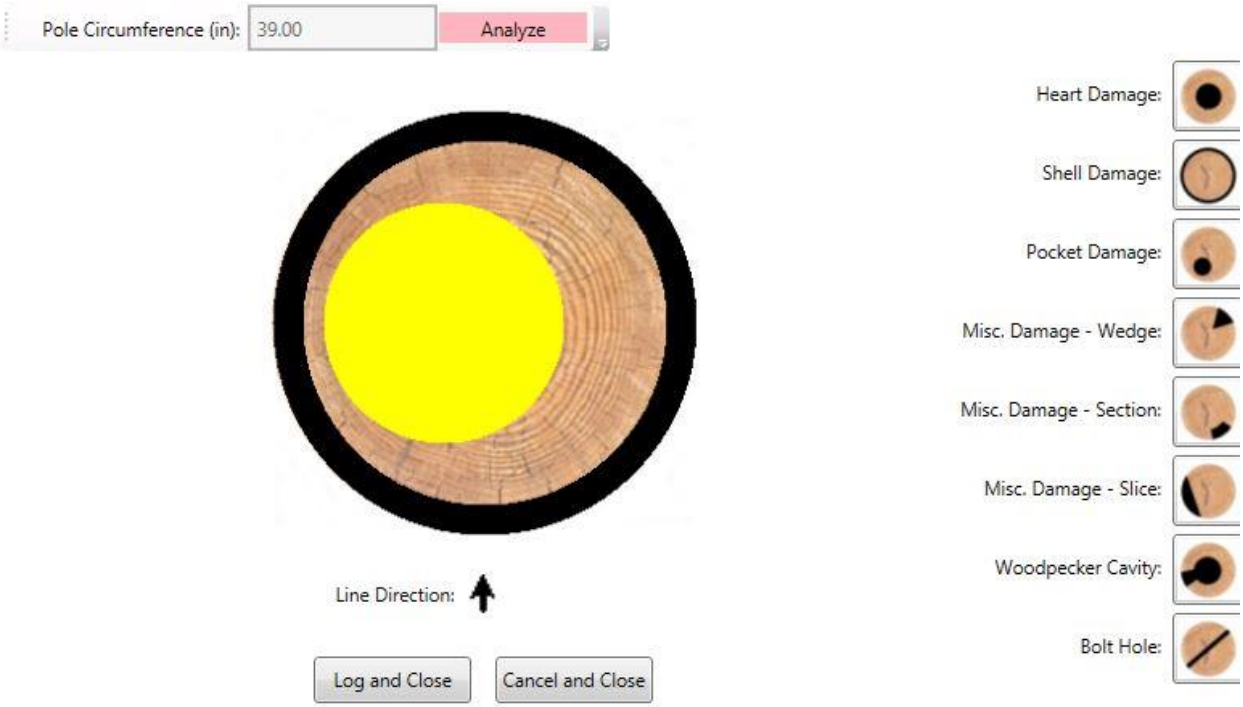



*Figure 45: Structure ID 26049 Height 0”*

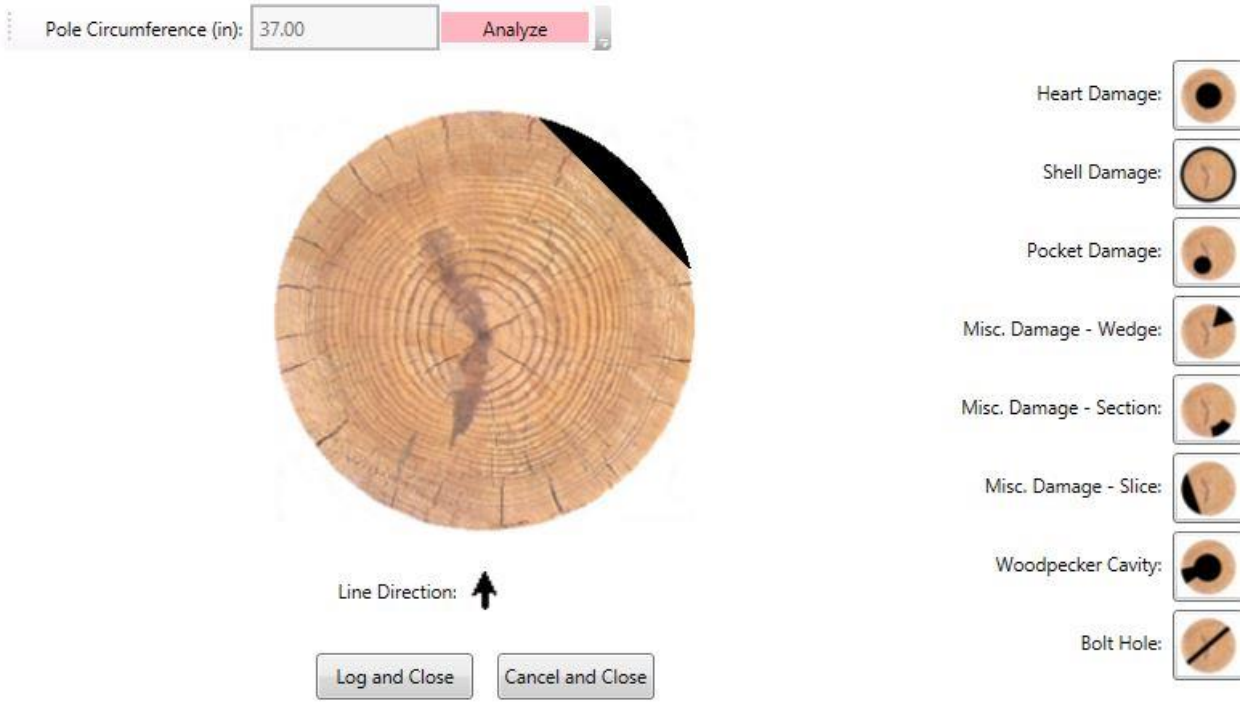



*Figure 46: Structure ID 28101 Height 6”*

*Figure 47: Structure ID 28864 – No D-Calc*

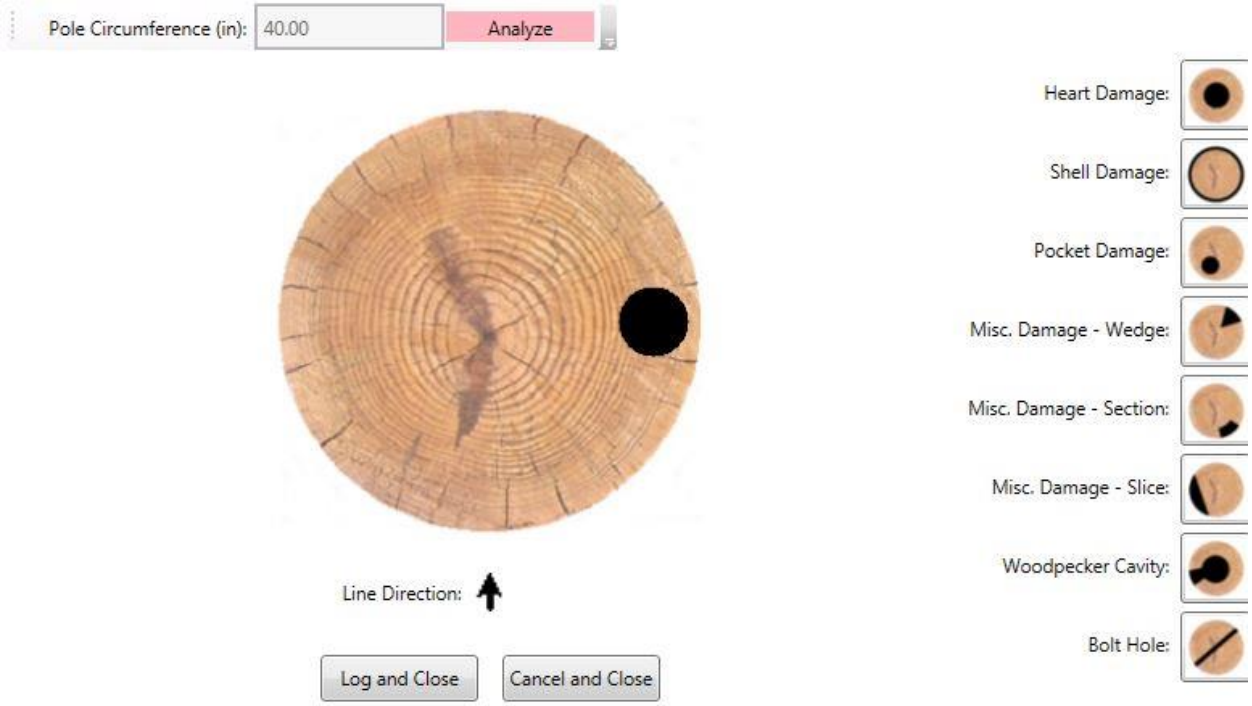



*Figure 48: Structure ID 28891 Height 0”*

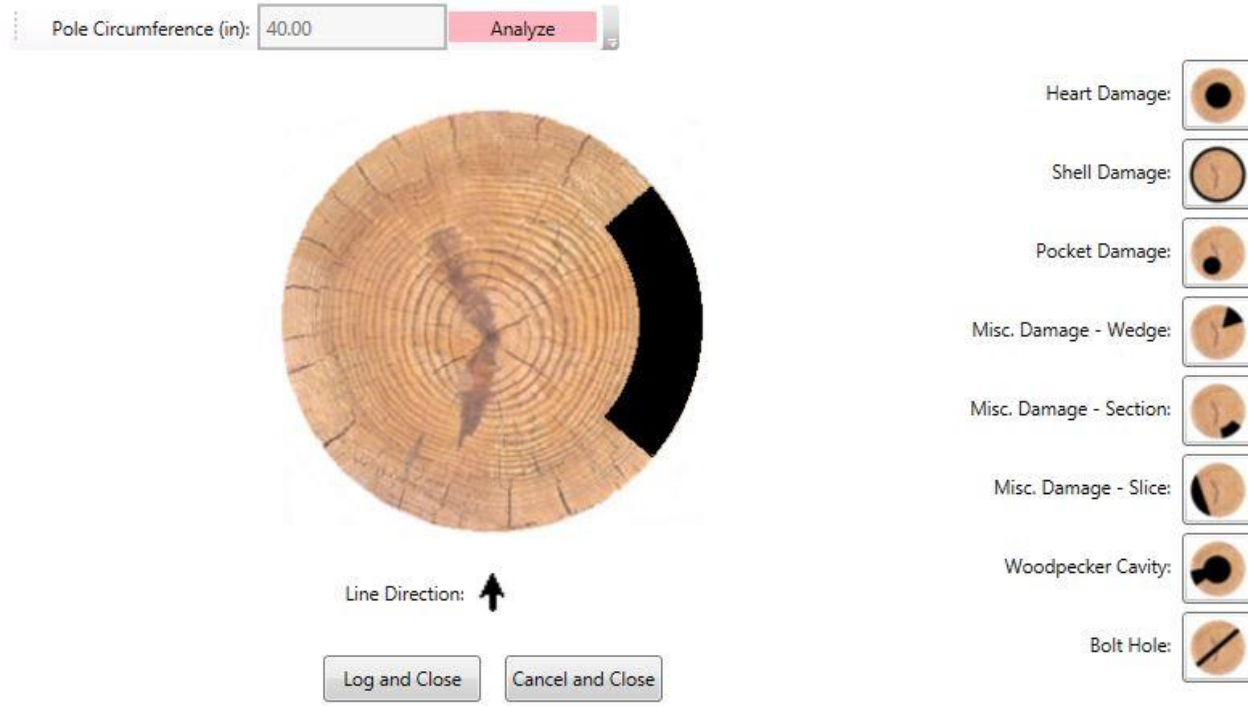



*Figure 49: Structure ID 28891 Height 6”*

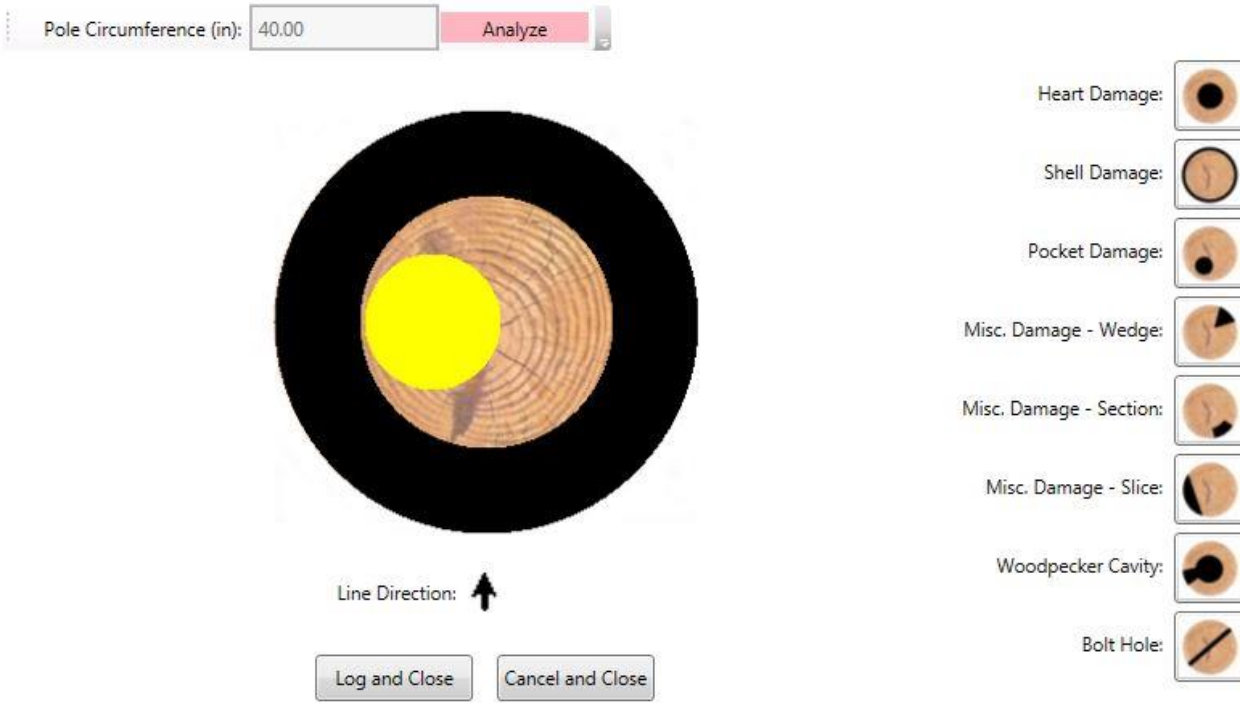



*Figure 50: Structure ID 28991 Height 0”*

*Figure 51: Structure ID 29751 – No D-Calc*

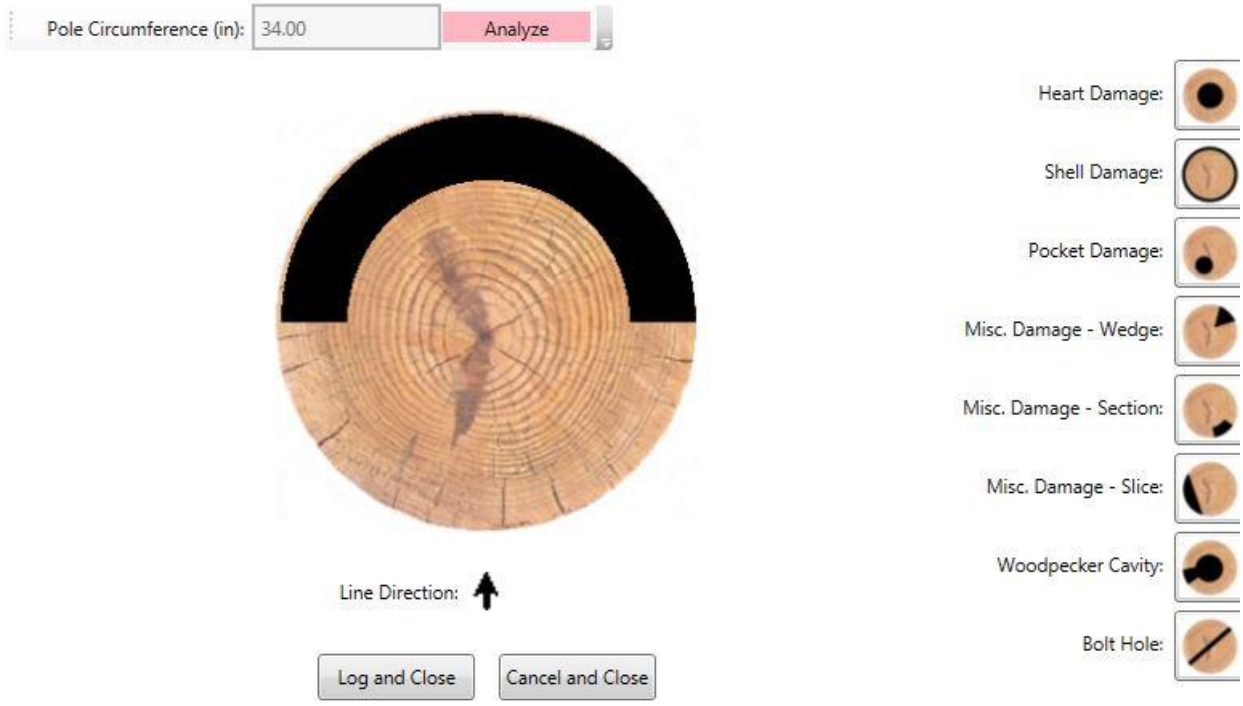



*Figure 52: Structure ID 29761 Height 0”*

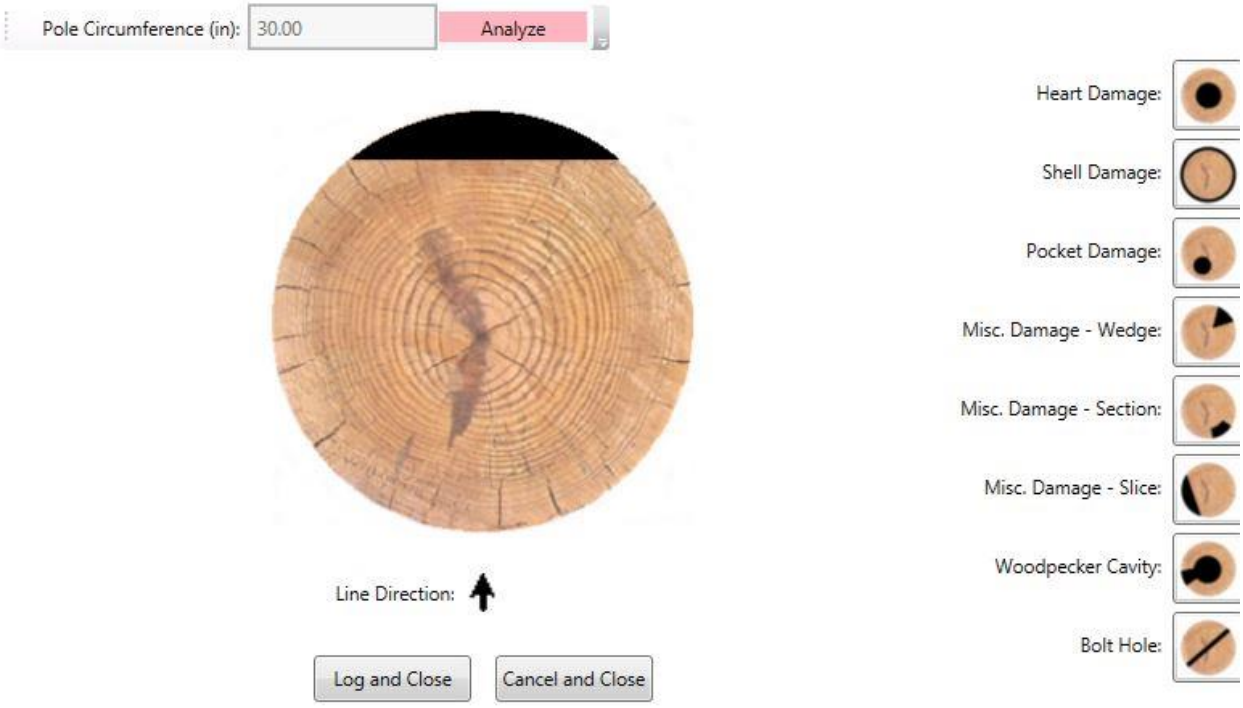



*Figure 53: Structure ID 30323 Height 0”*

*Figure 54: Structure ID 30469 – No D-Calc*

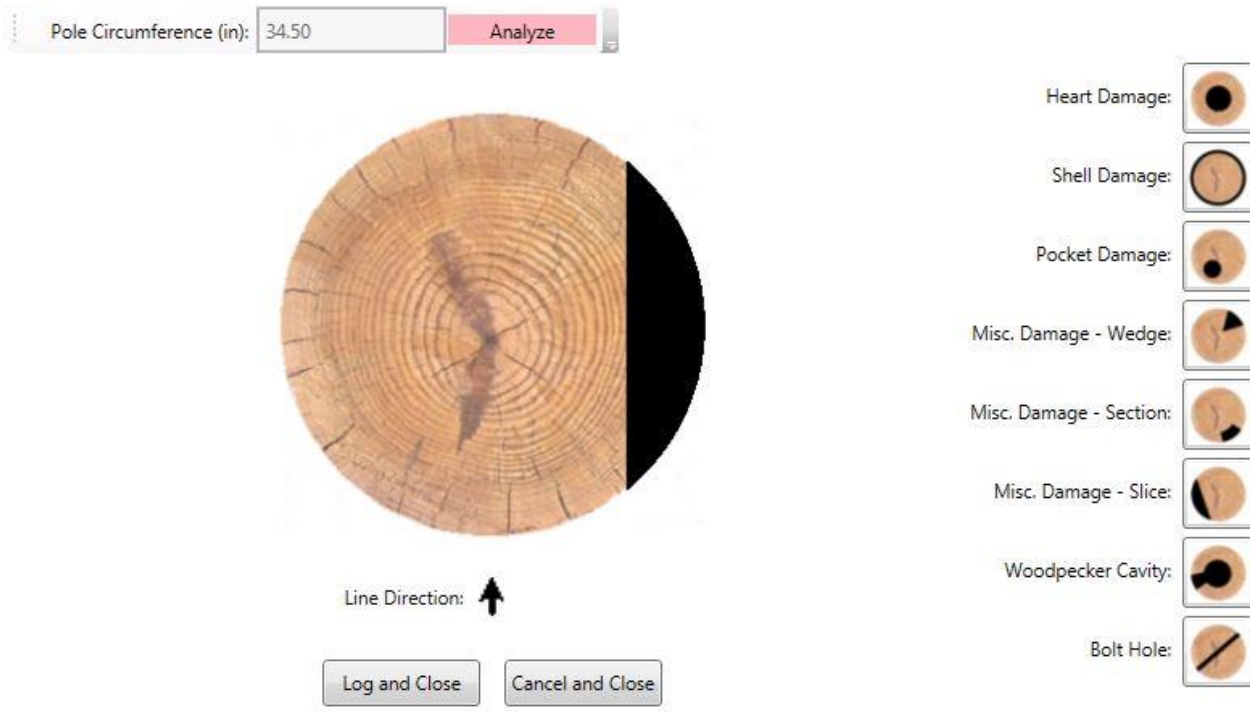



*Figure 55: Structure ID 30491 Height 12”*

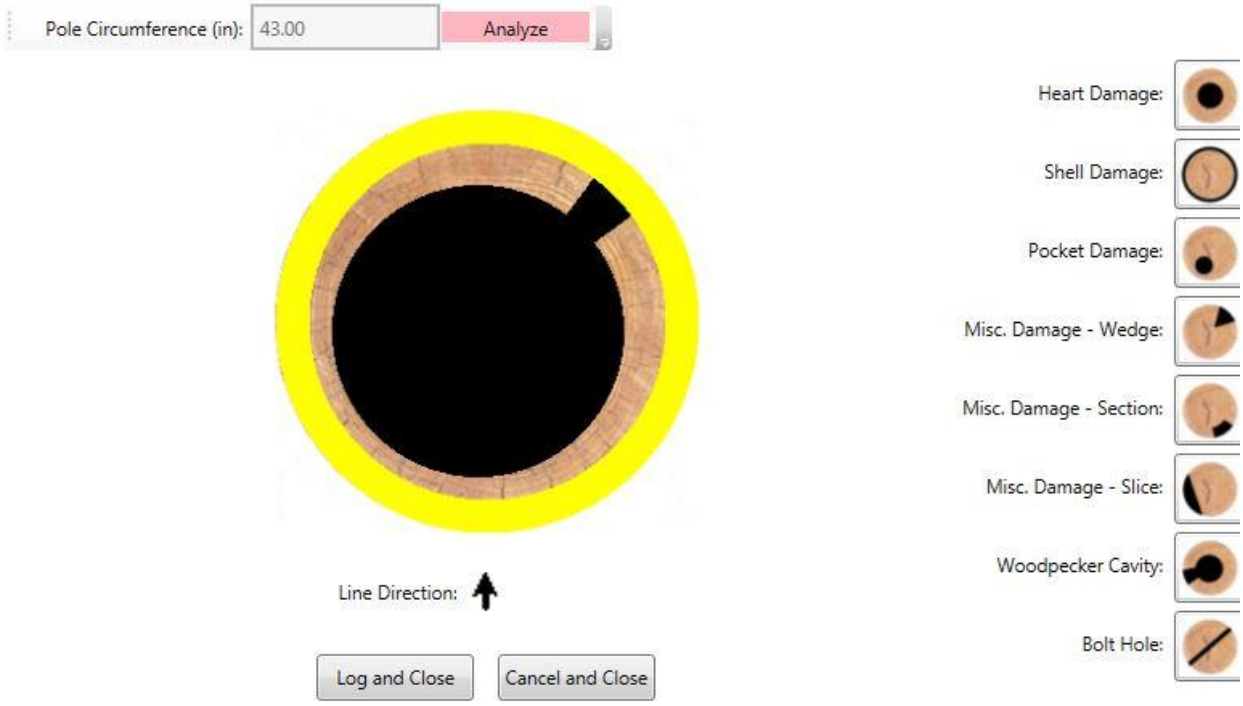



*Figure 56: Structure ID 30544 Height -6”*

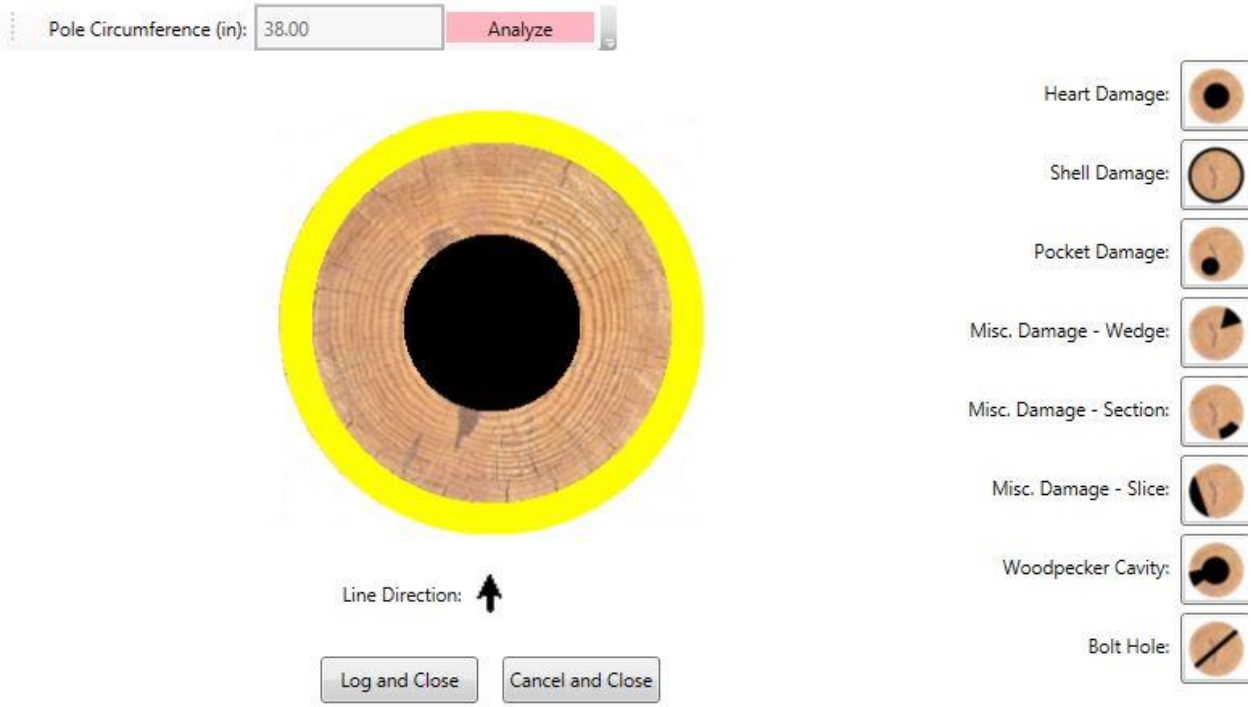



*Figure 57: Structure ID 45755 Height -12”*

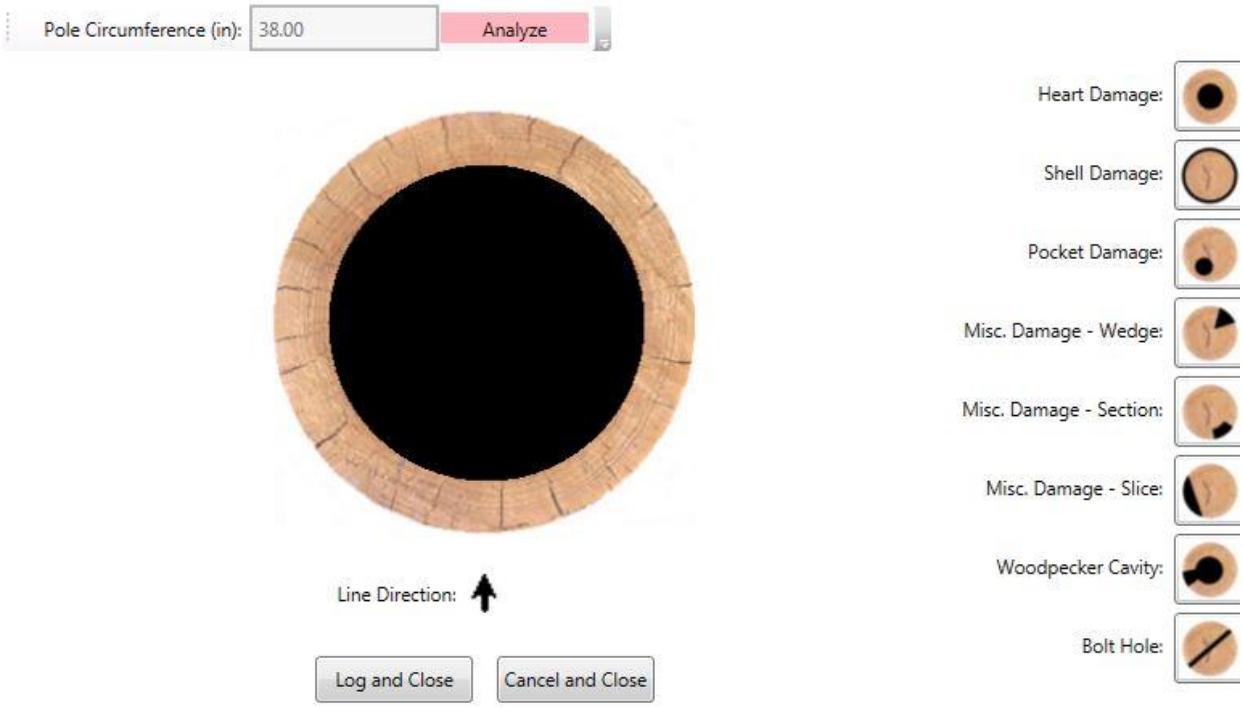



*Figure 58: Structure ID 45755 Height 0”*

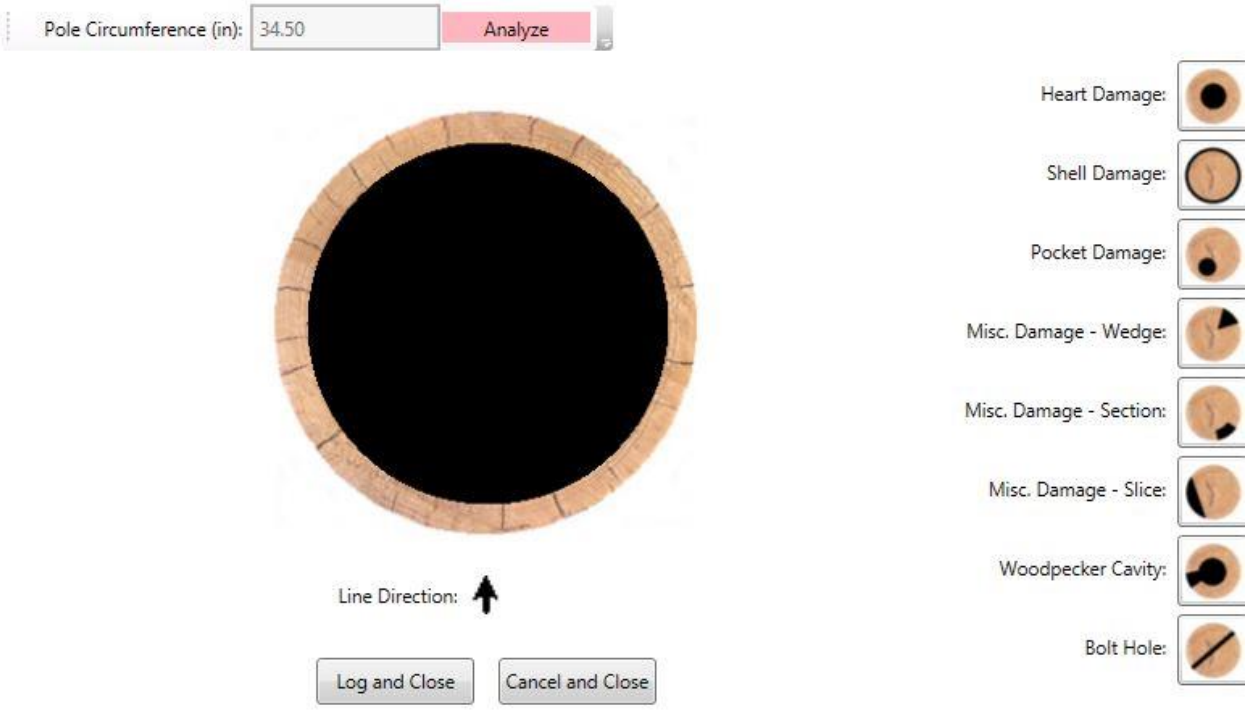



*Figure 59: Structure ID 45755 Height 0”*

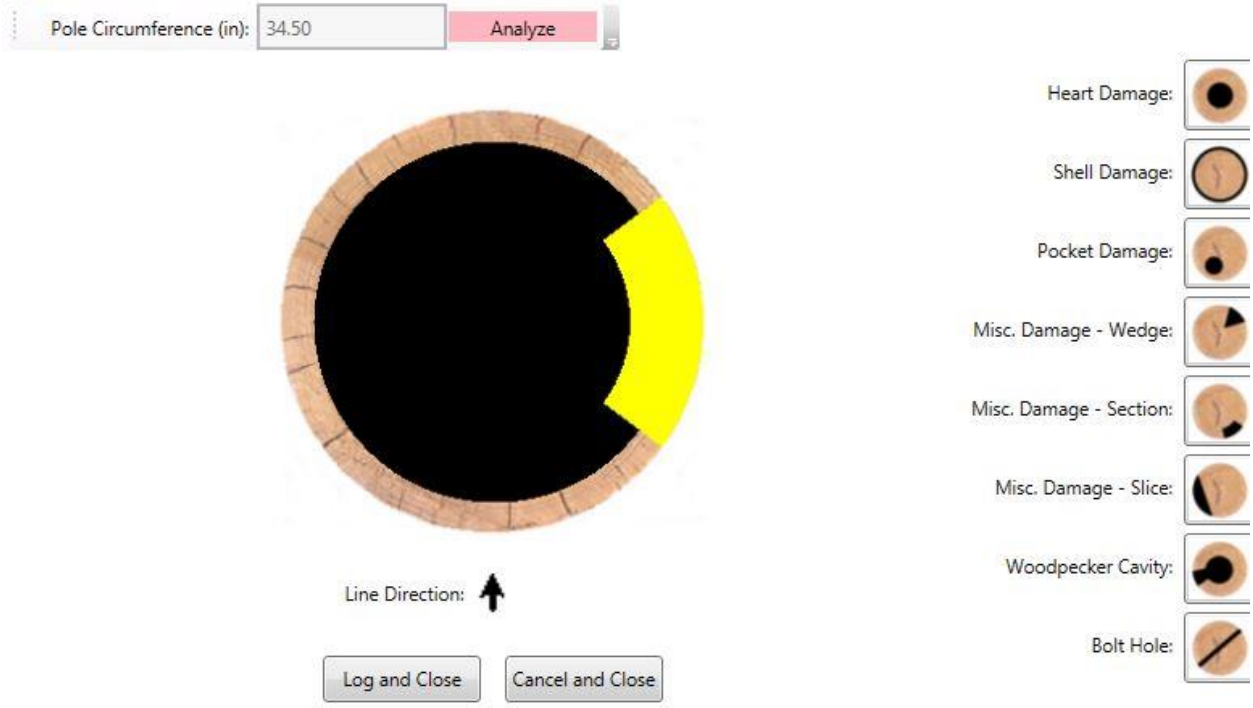



*Figure 60: Structure ID 45756 Height -12”*

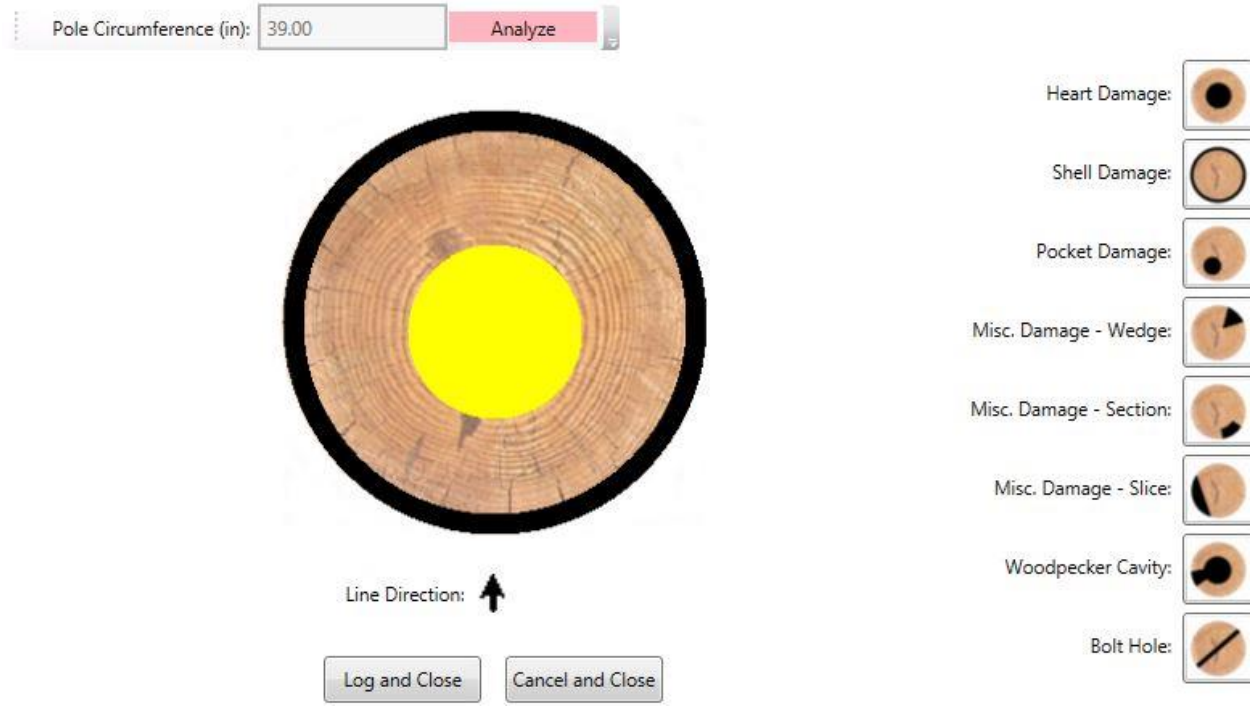



*Figure 61: Structure ID 56800 Height -16”*

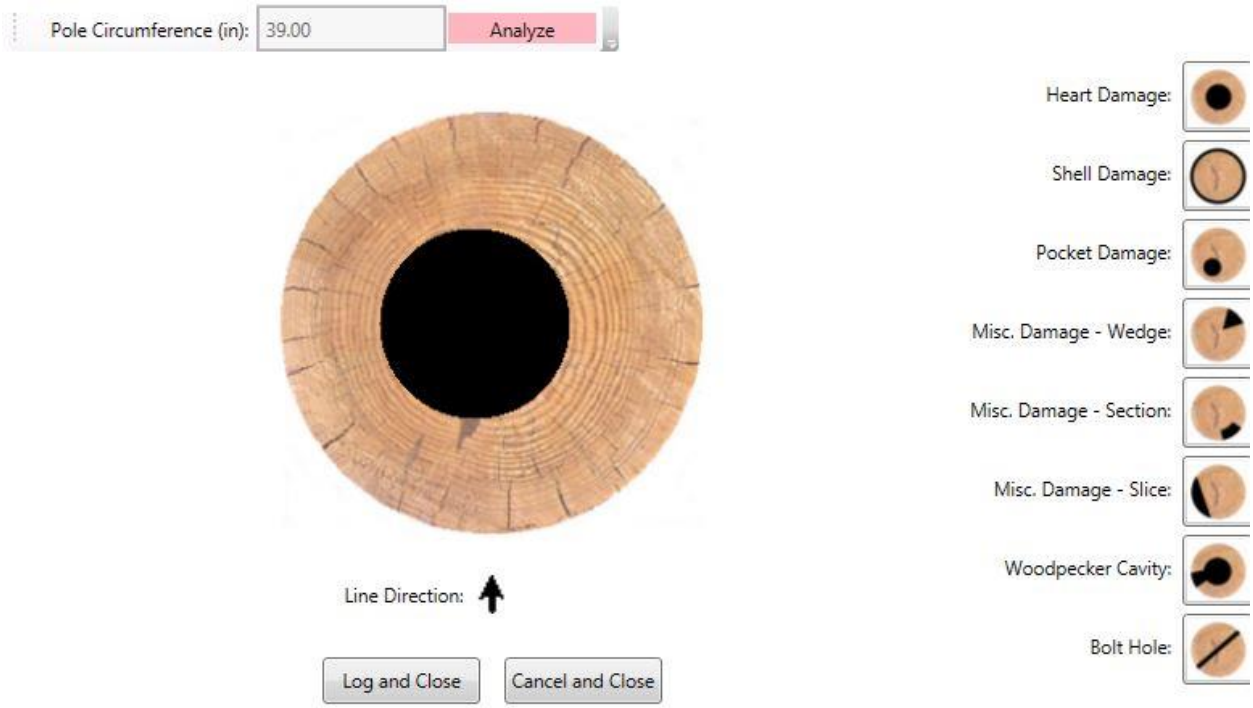



*Figure 62: Structure ID 56800 Height 0”*

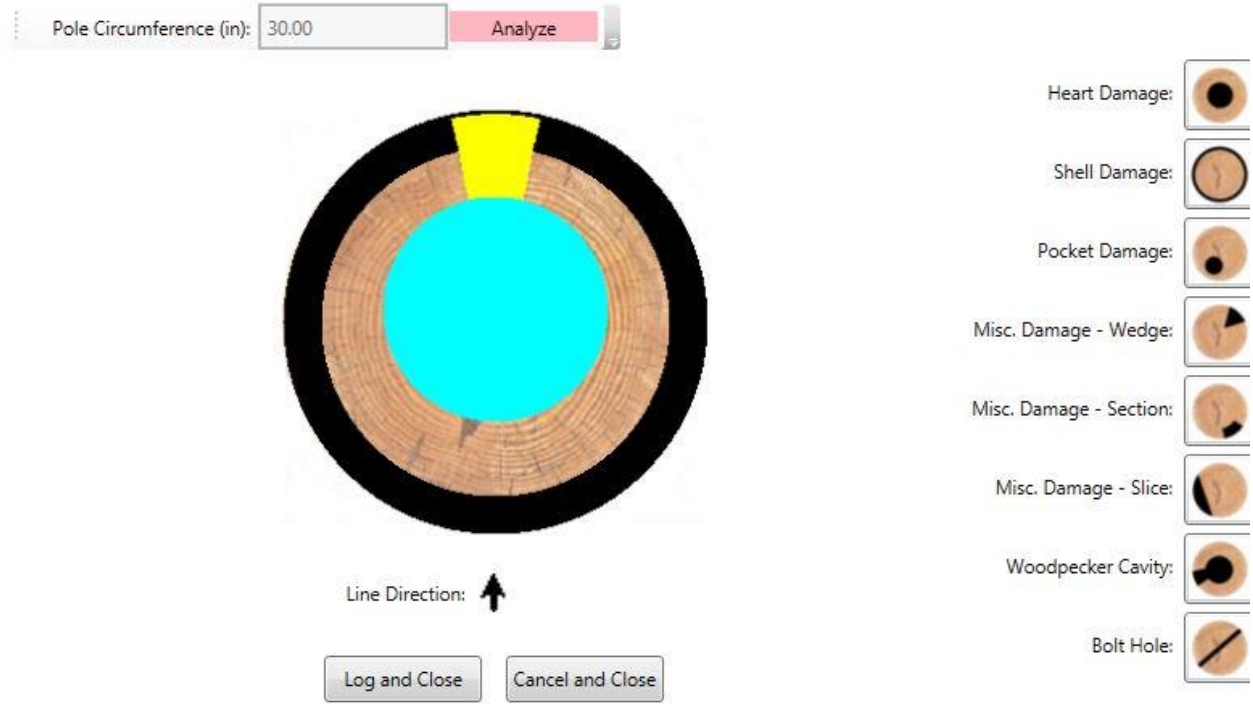



*Figure 63: Structure ID 56801 Height -6”*

*Figure 64: Structure ID 56851 – No D-Calc*

*Figure 65: Structure ID 56889 – No D-Calc*

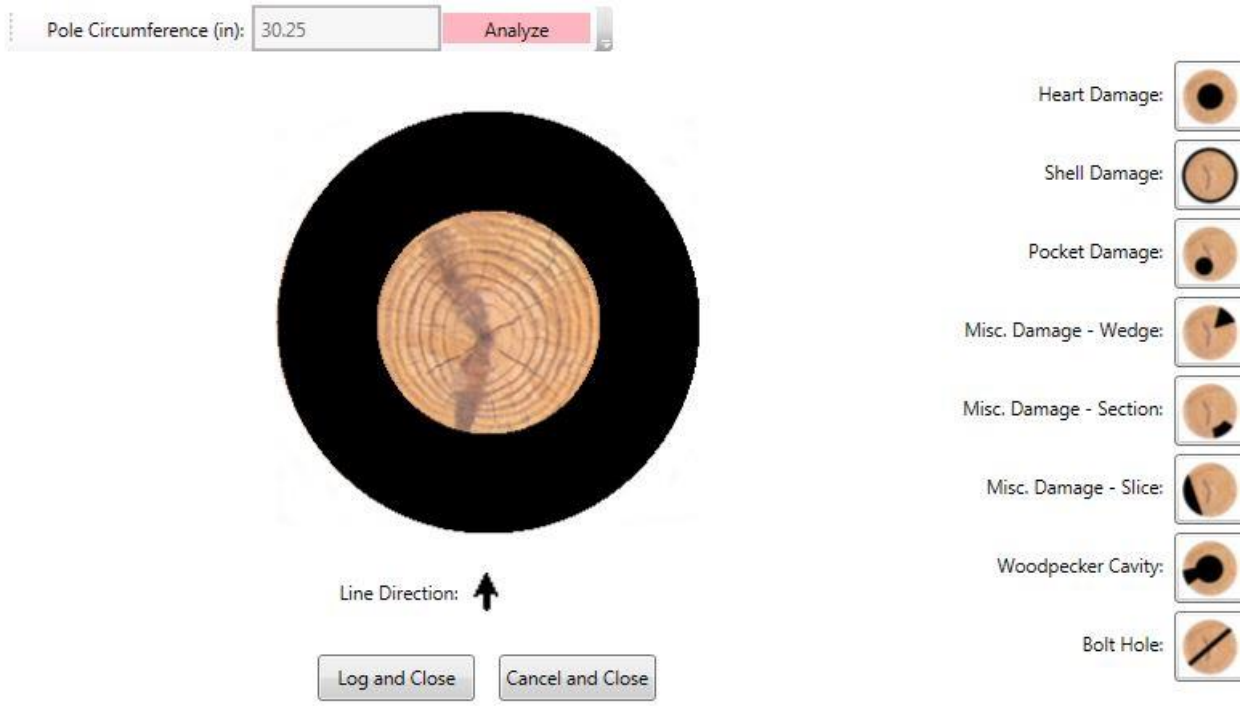



*Figure 66: Structure ID 64067 Height -16”*

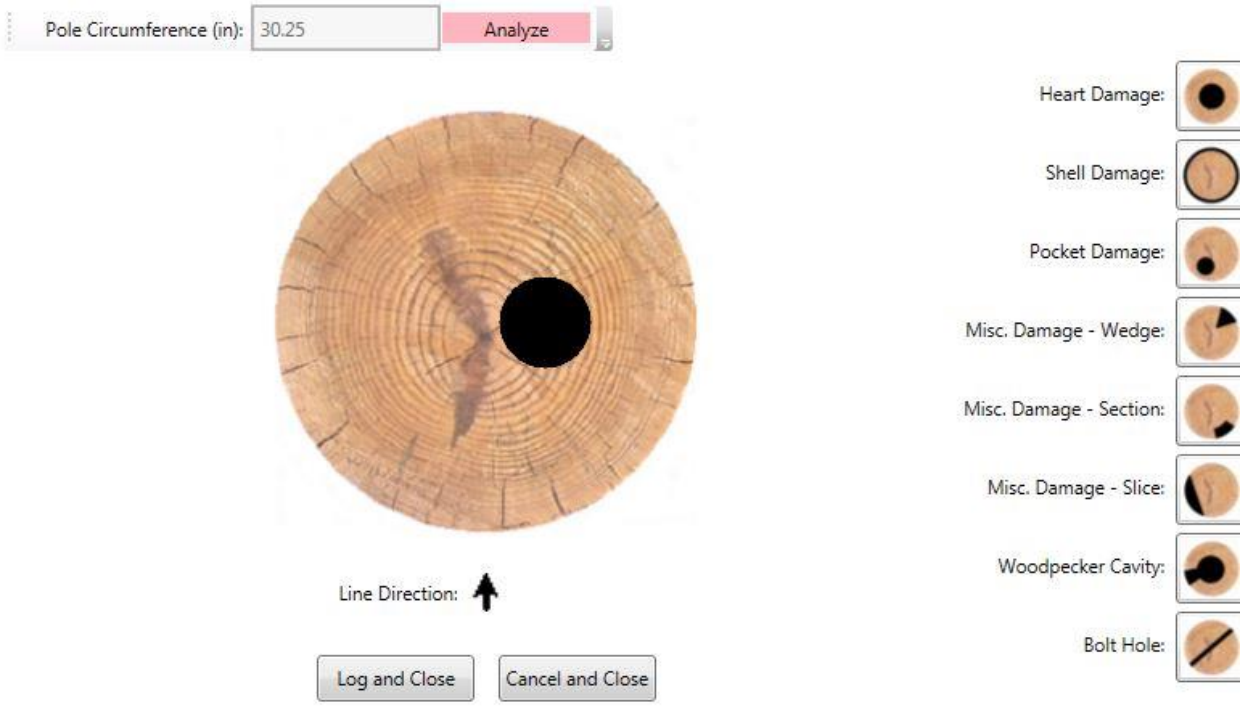



*Figure 67: Structure ID 64067 Height 0”*

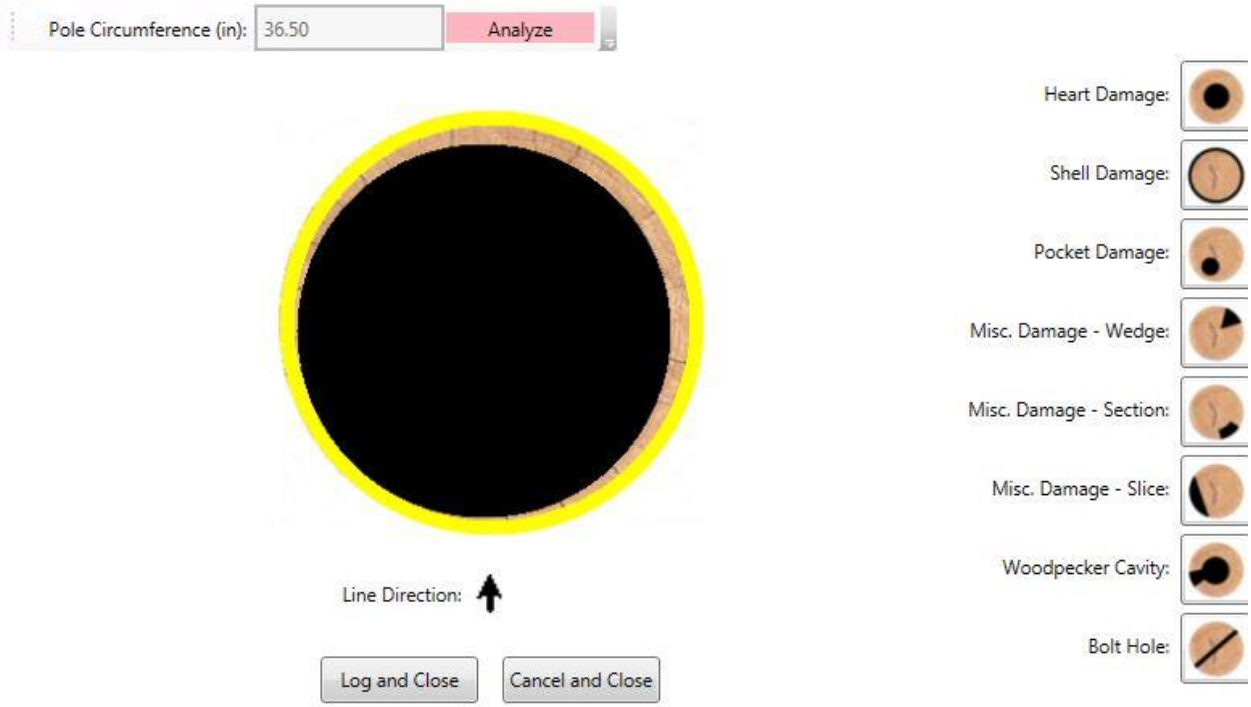



*Figure 68: Structure ID 64069 Height 0”*

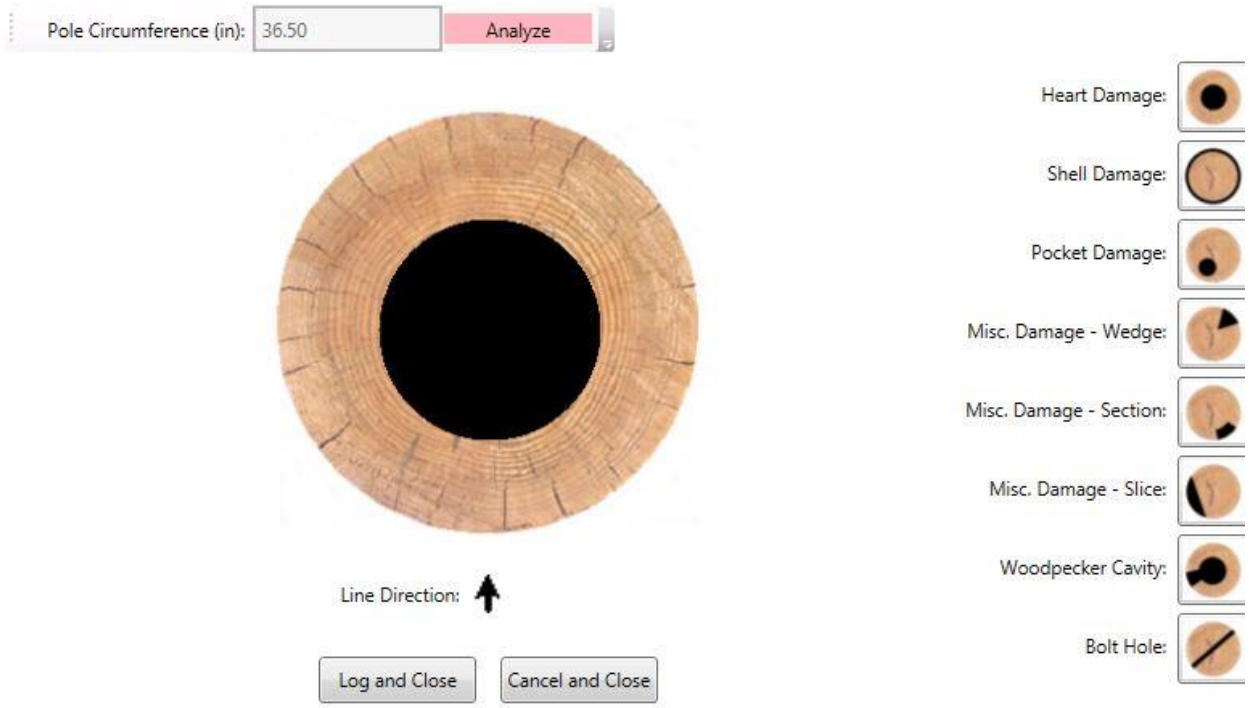



*Figure 69: Structure ID 64069 Height -16”*

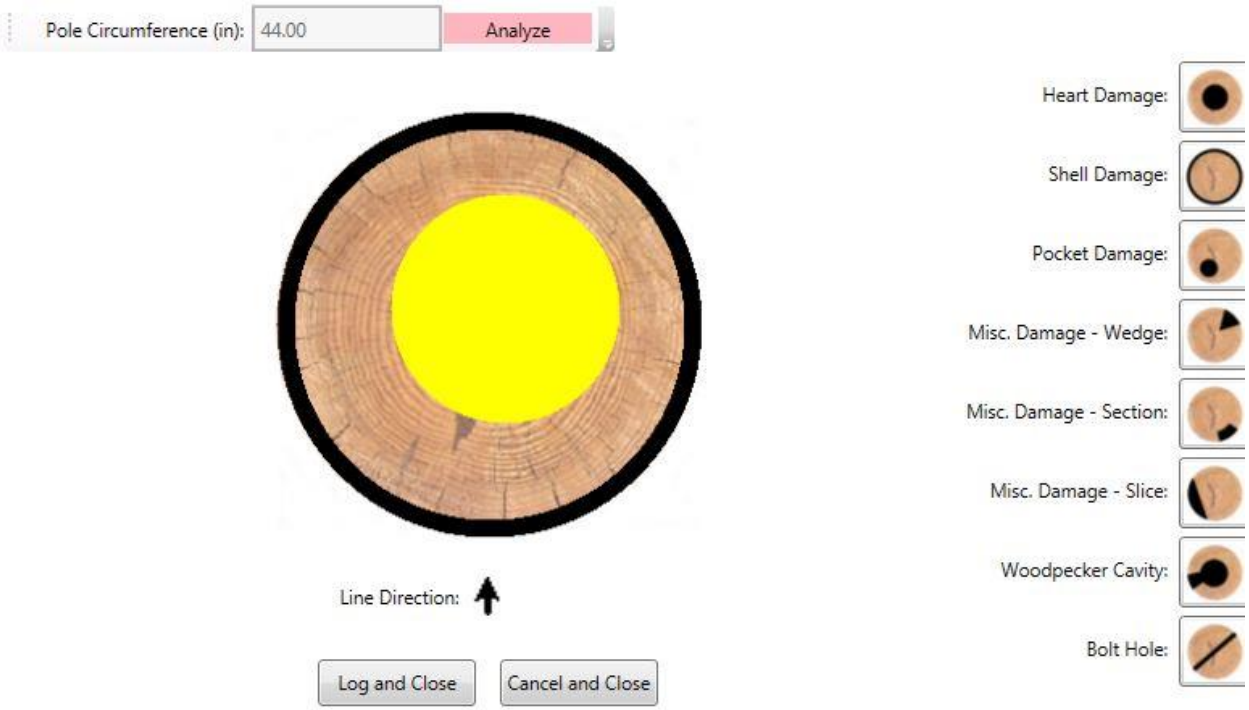



*Figure 70: Structure ID 64072 Height -16”*

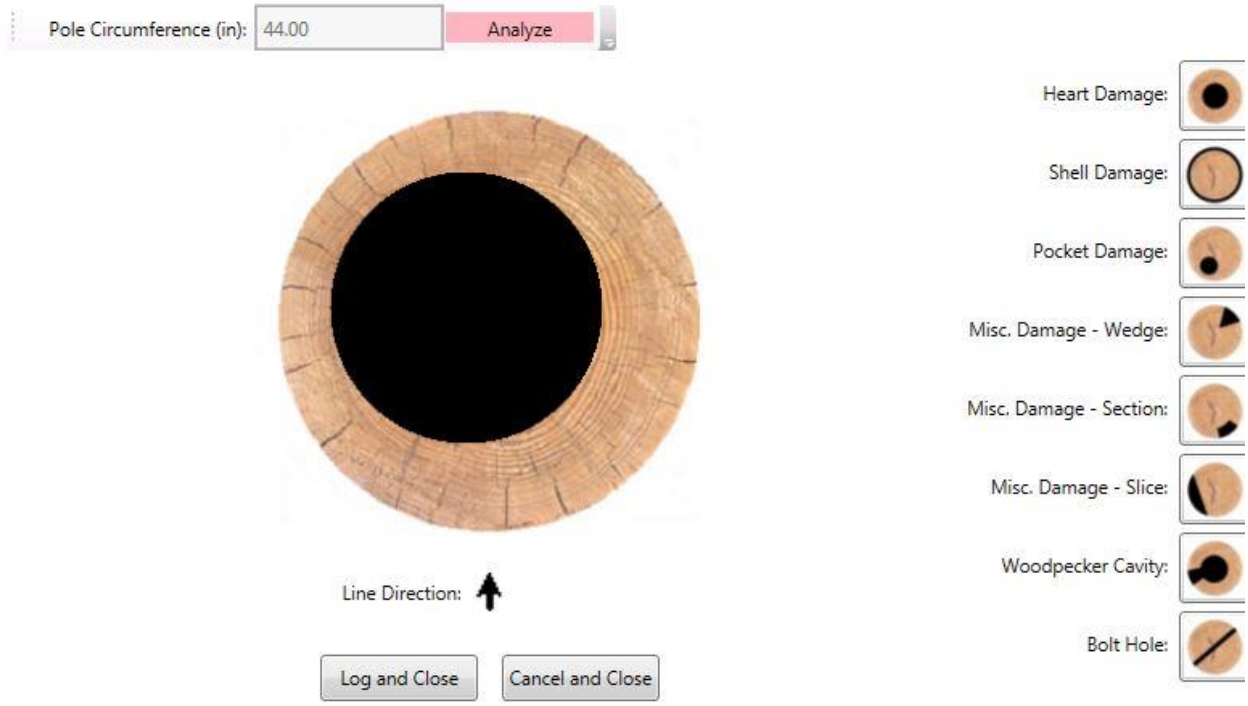



*Figure 71: Structure ID 64072 Height 0”*

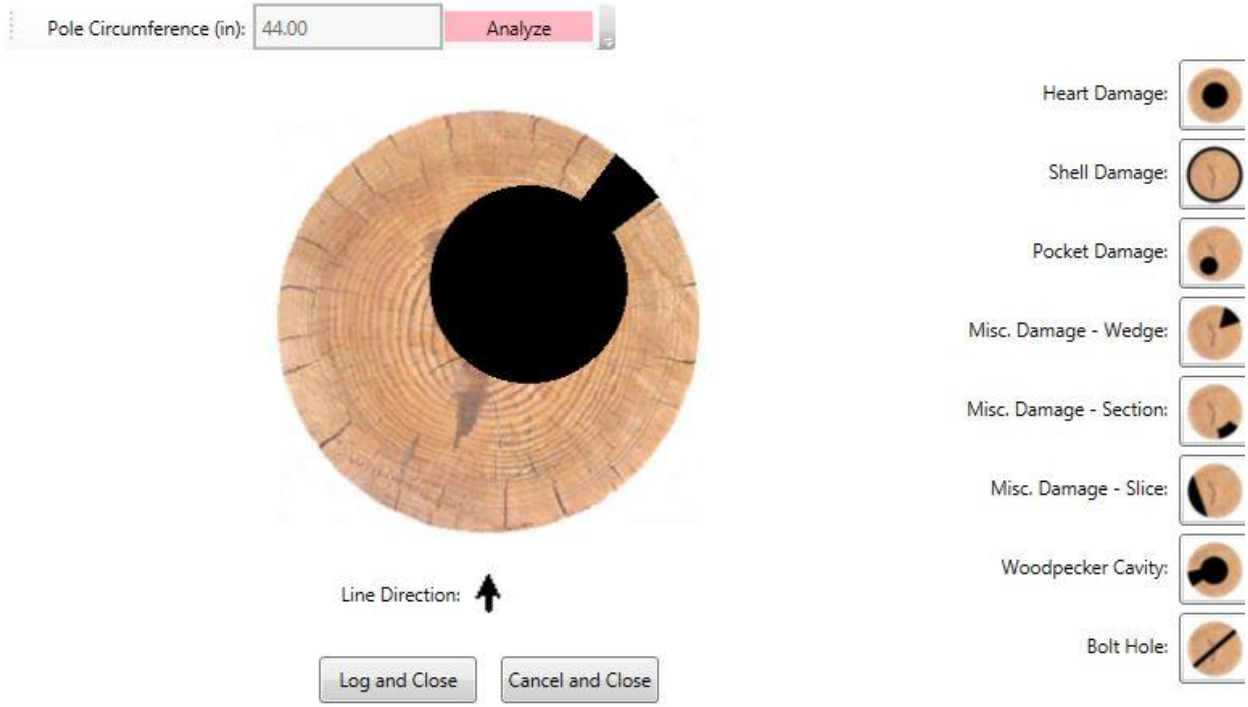



*Figure 72: Structure ID 64072 Height 24”*

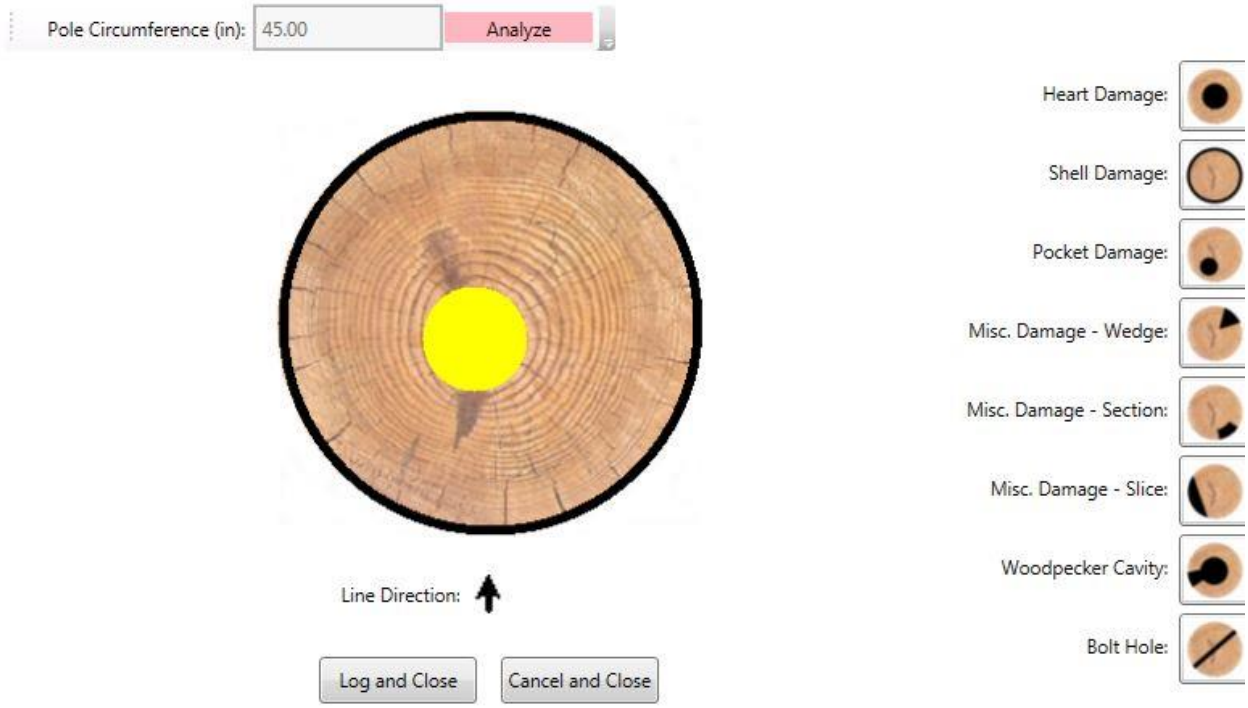



*Figure 73: Structure ID 68315 Height -16”*

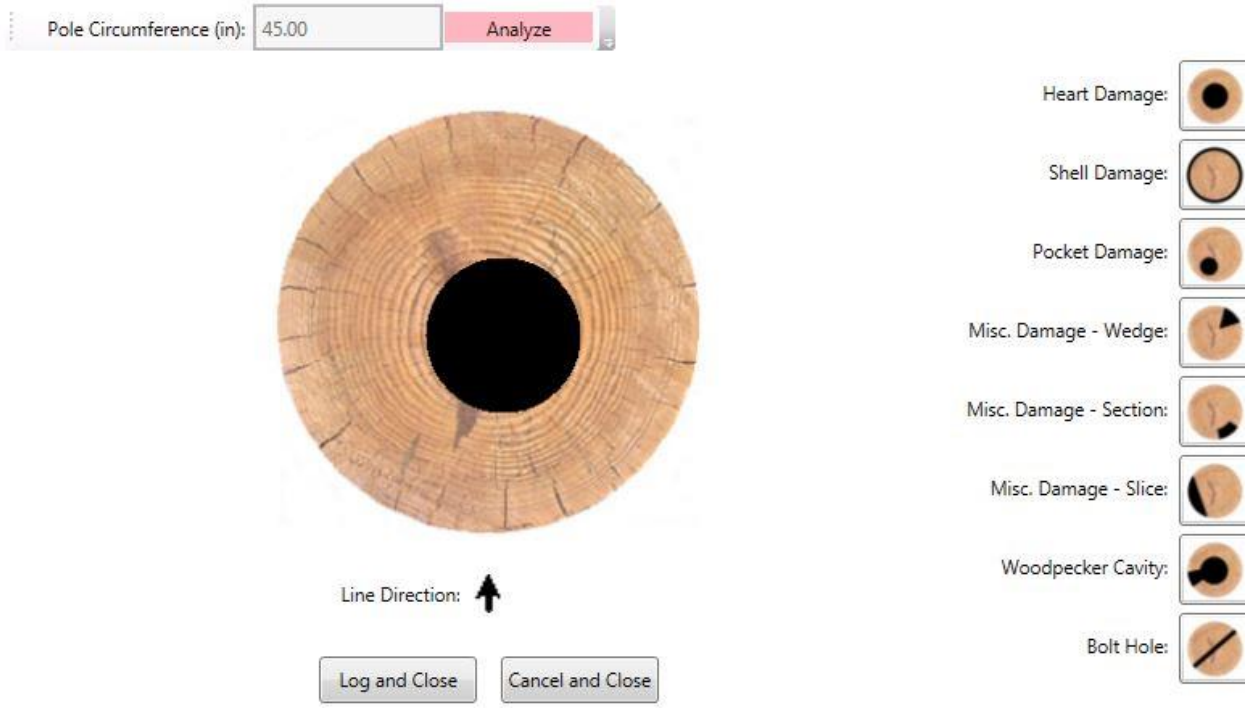



*Figure 74: Structure ID 68315 Height 0”*

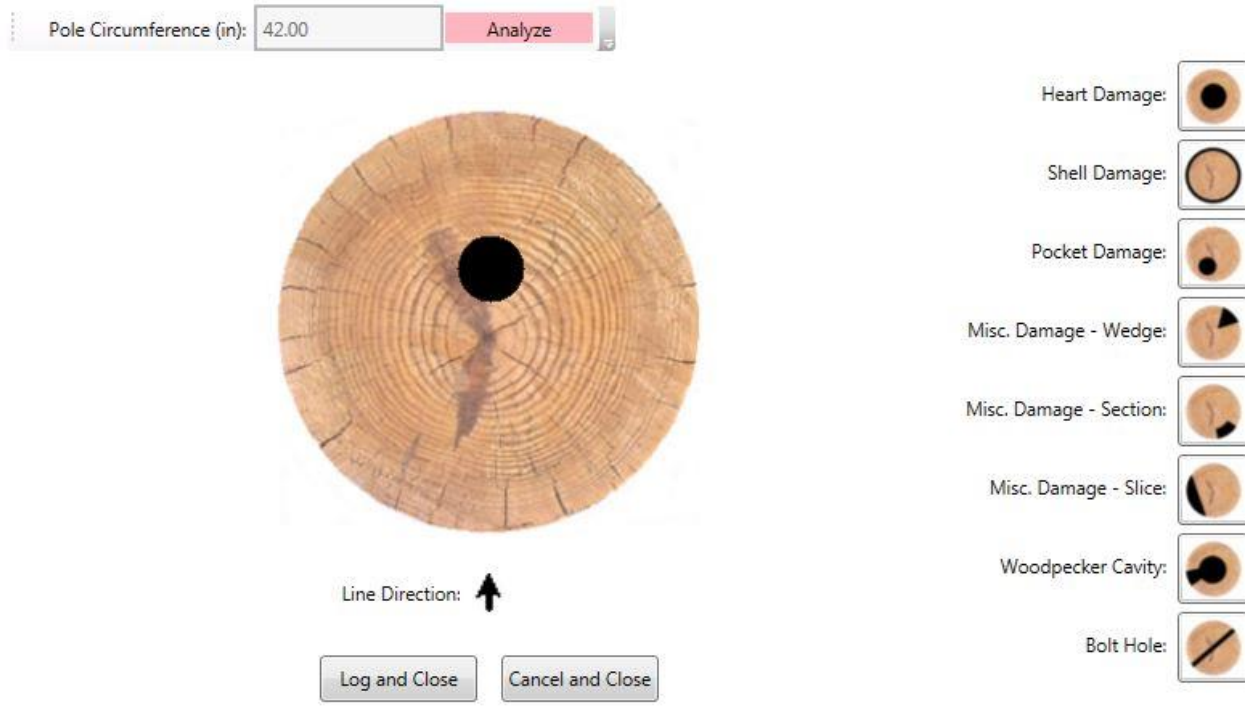



*Figure 75: Structure ID 68337 Height 54”*

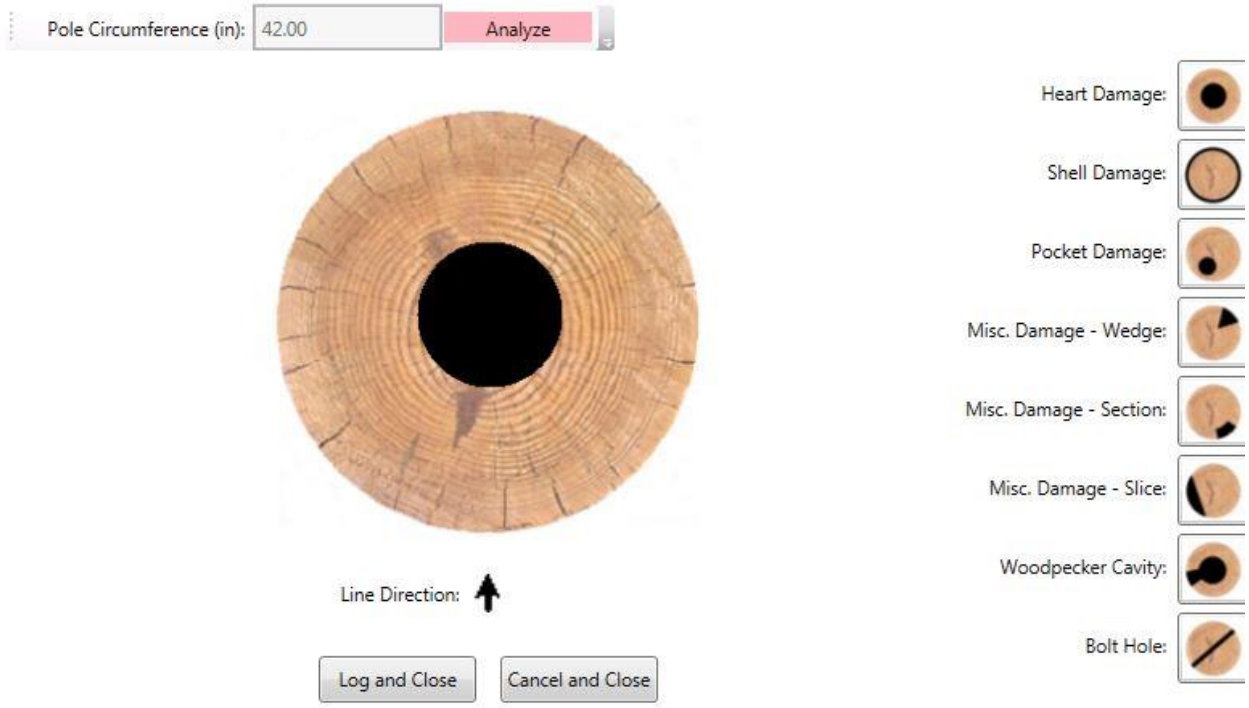



*Figure 76: Structure ID 68337 Height 48”*

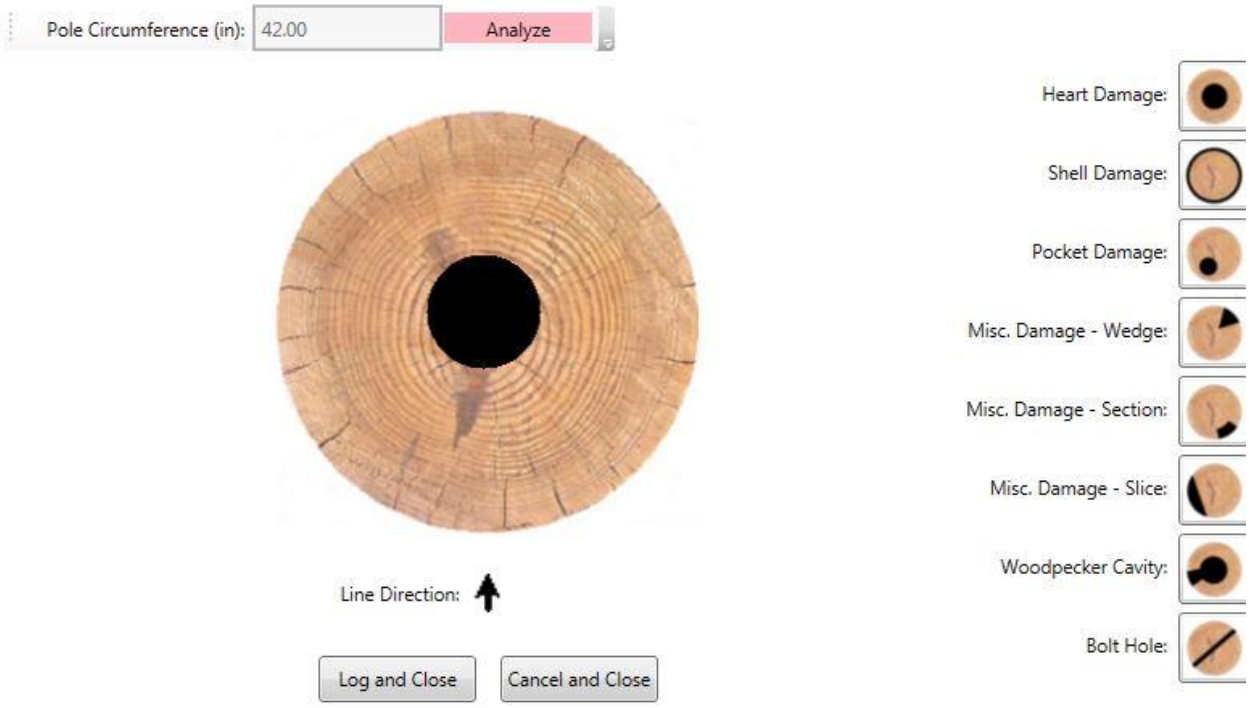



*Figure 77: Structure ID 68337 Height 0”*

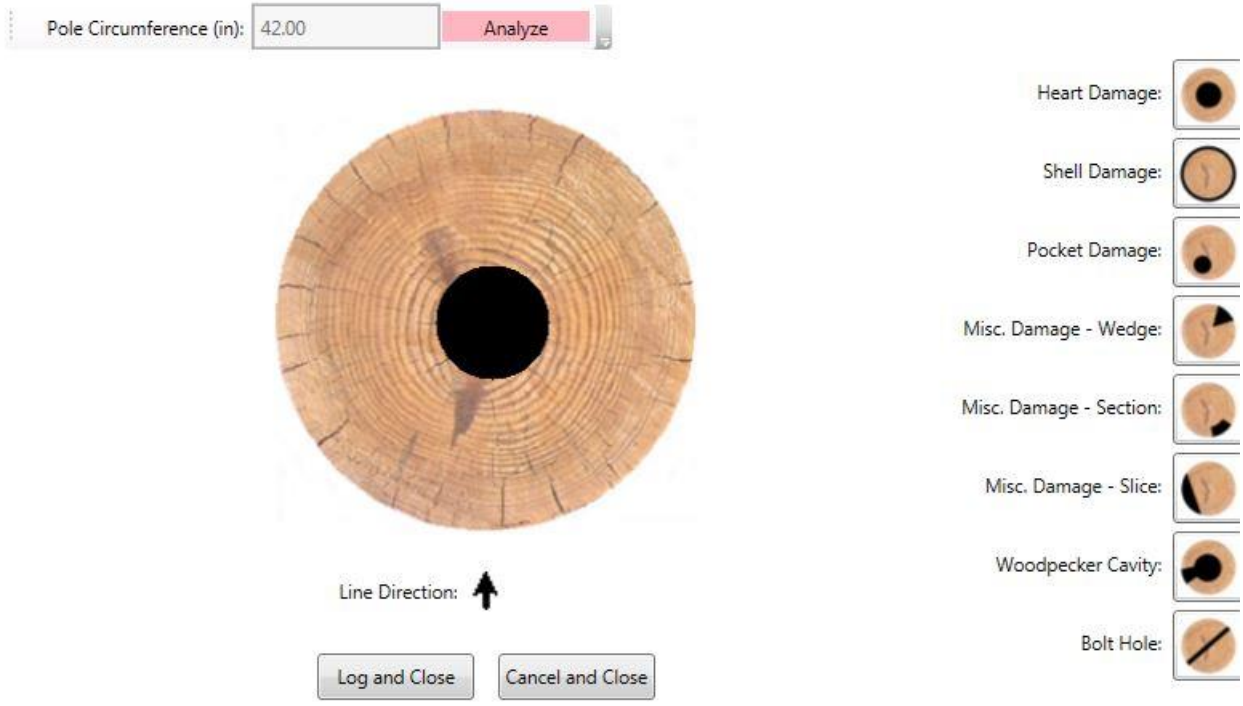



*Figure 78: Structure ID 68337 Height -16”*

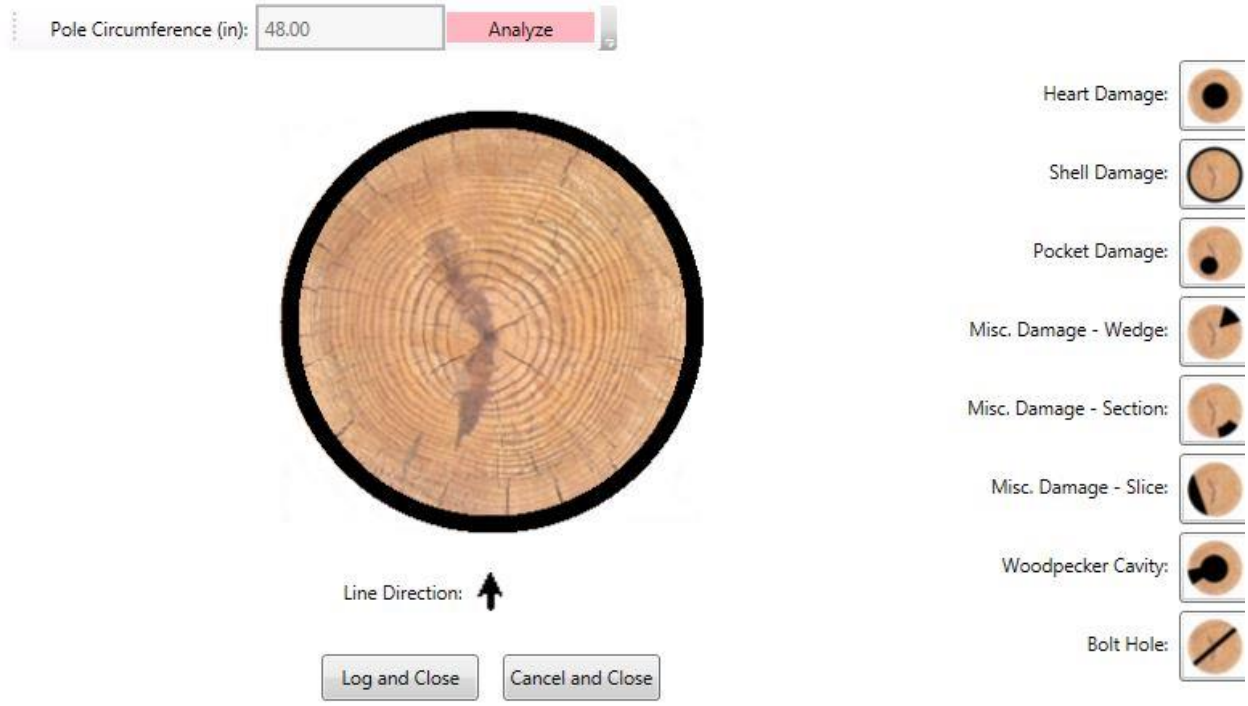



*Figure 79: Structure ID 80583 Height -16”*

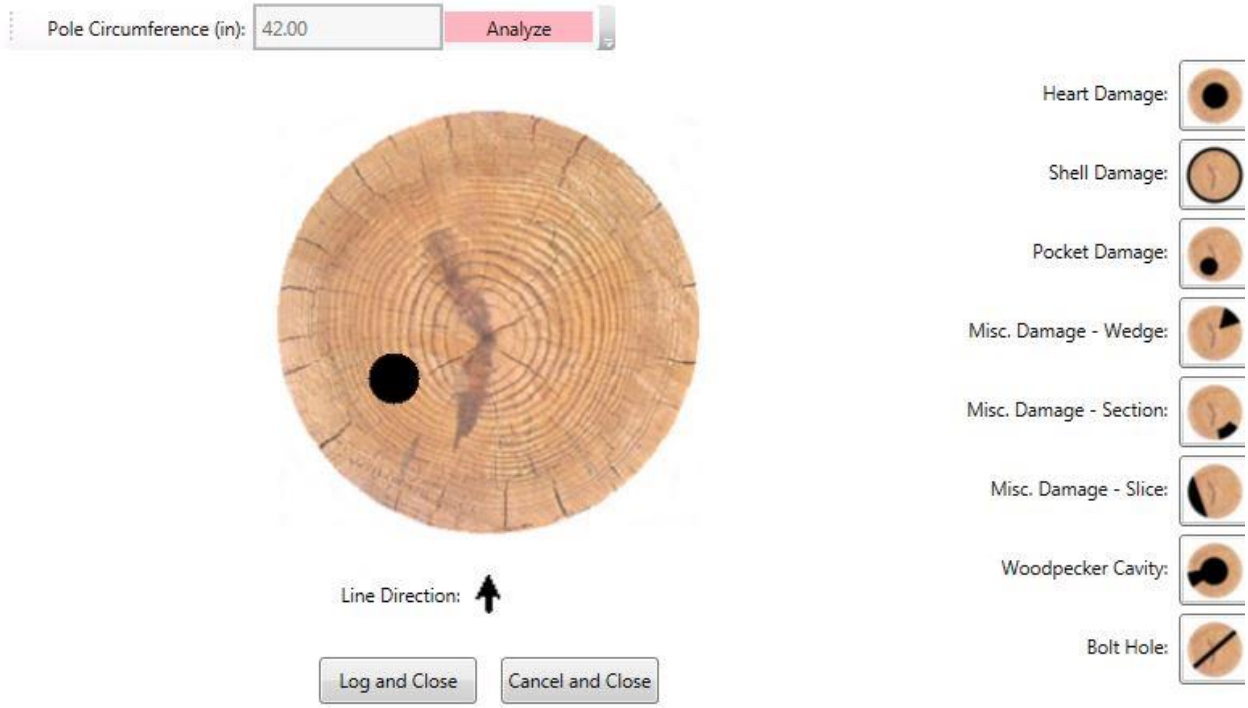



*Figure 80: Structure ID 80747 Height 0”*

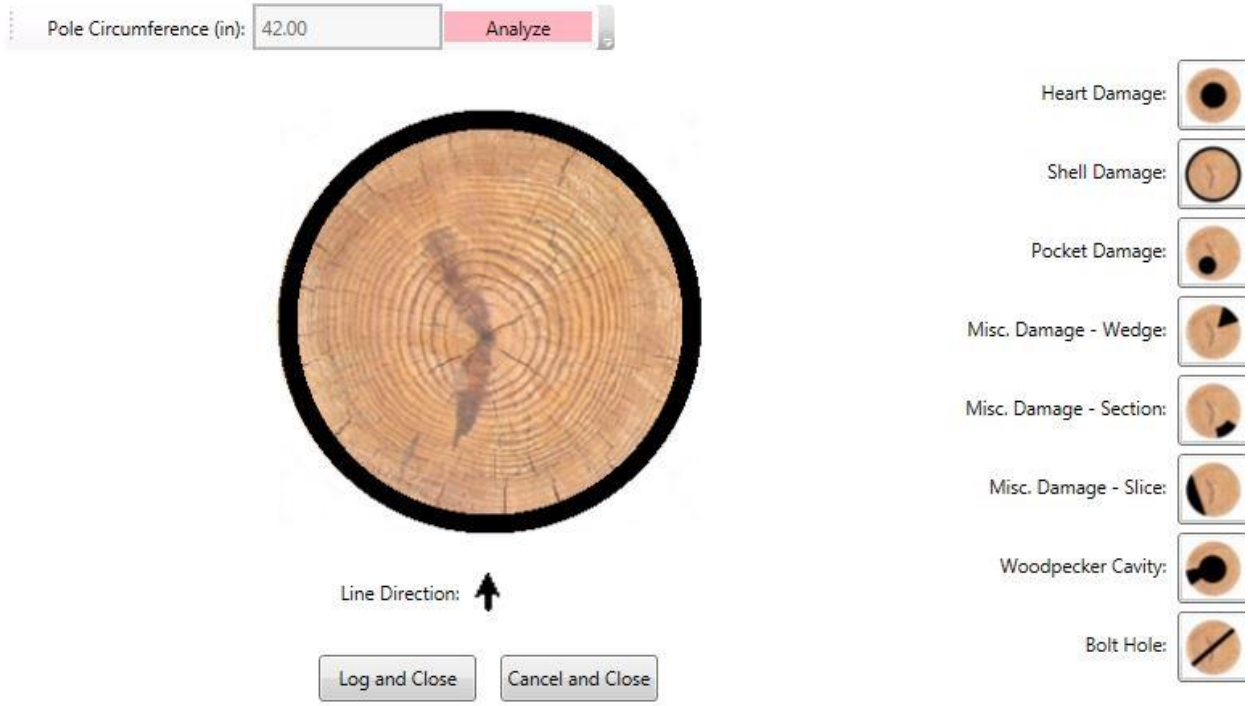



*Figure 81: Structure ID 80747 Height -16”*

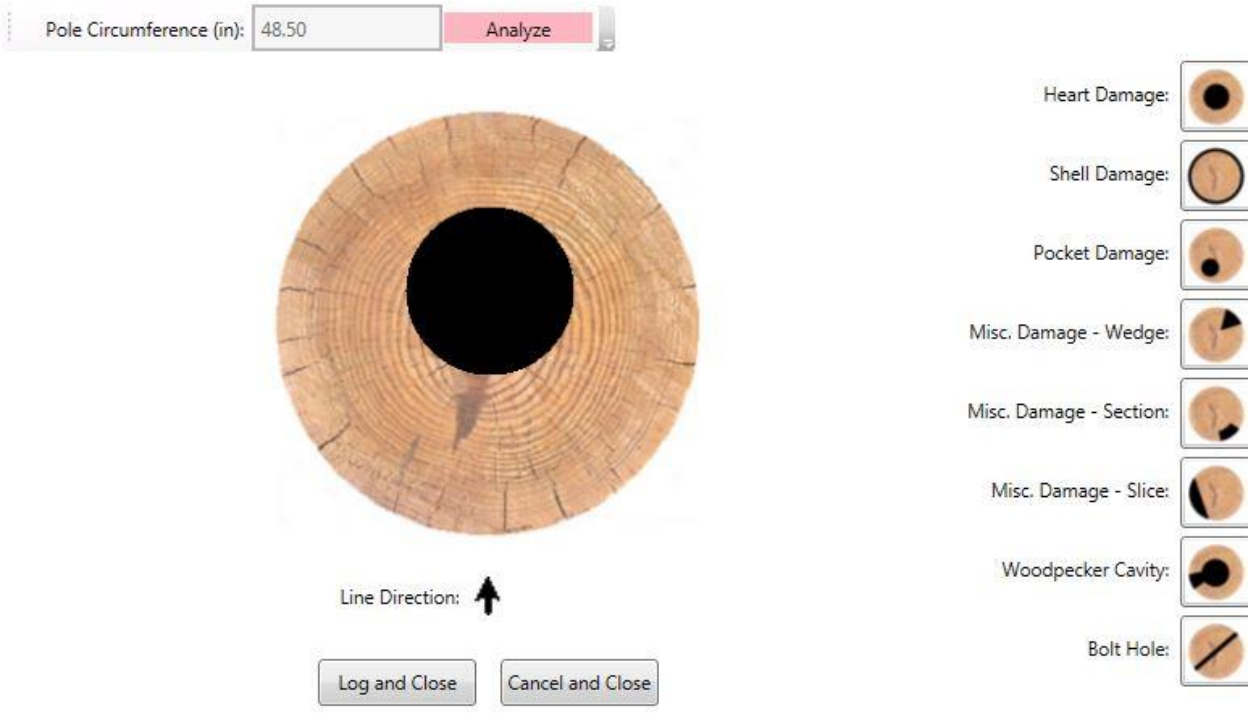



*Figure 82: Structure ID 80749 Height 0”*


*Figure 83: Structure ID 80749 Height -18”*

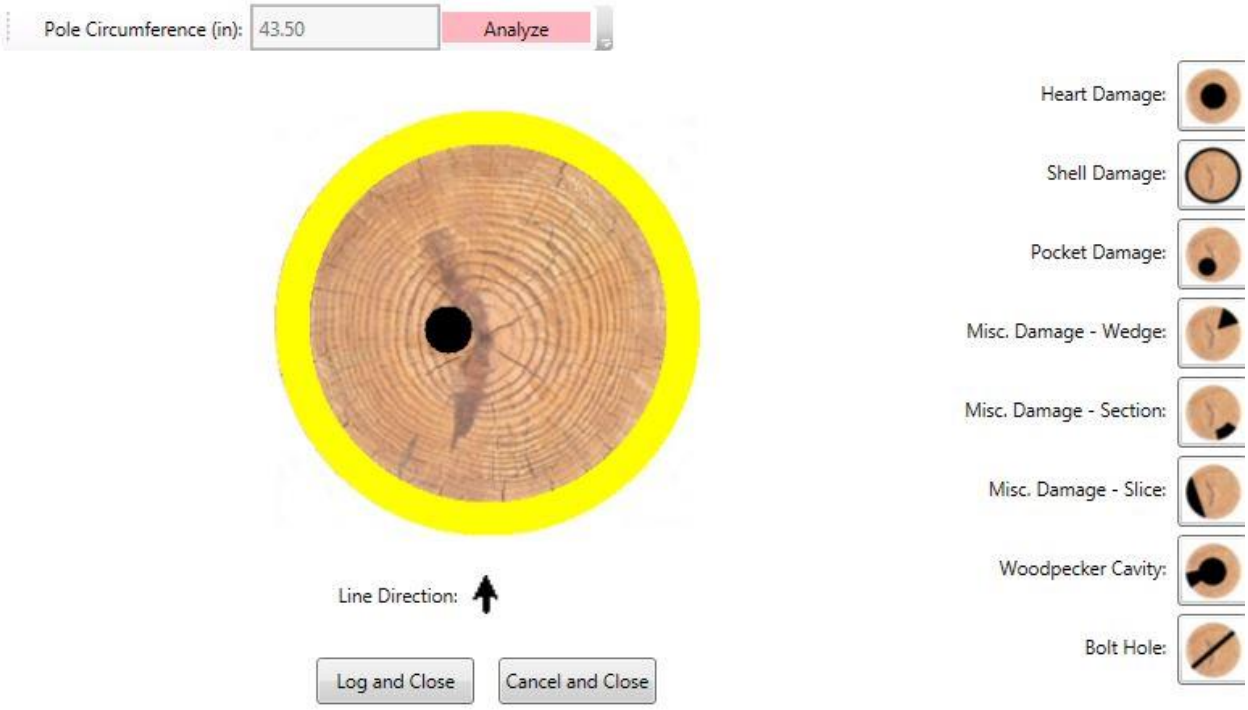



*Figure 84: Structure ID 80762 Height 0”*

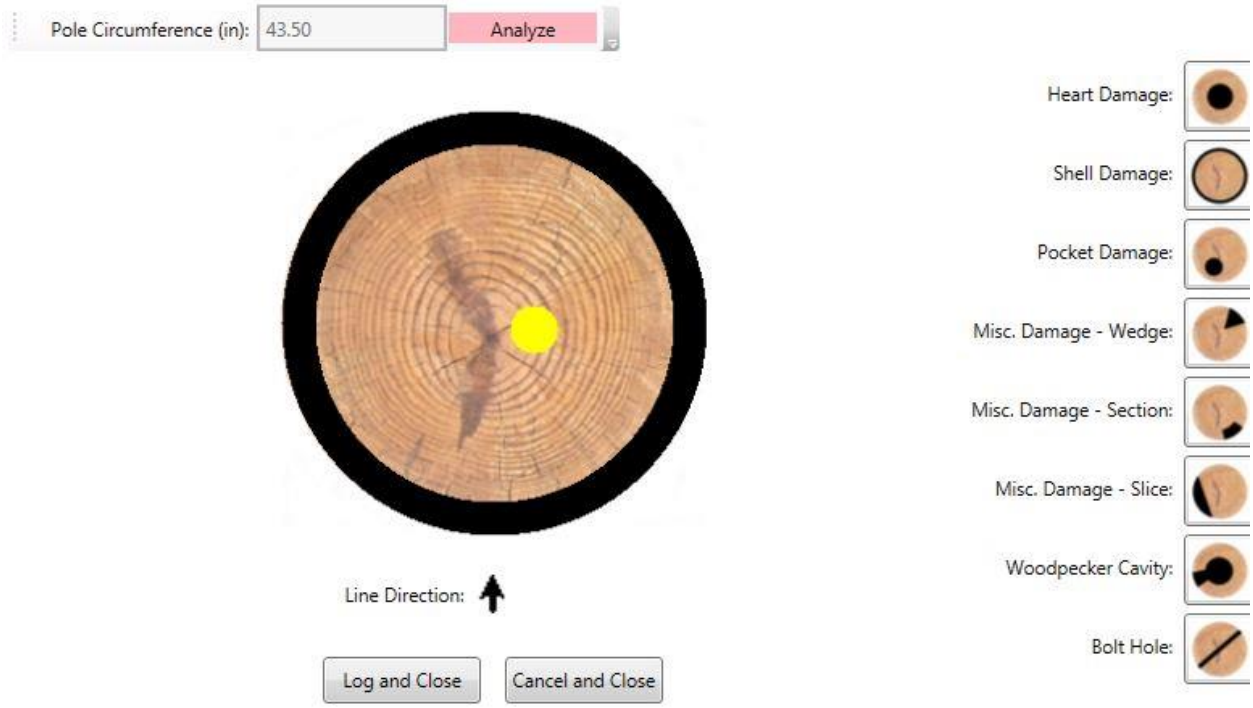



*Figure 85: Structure ID 80762 Height -18”*

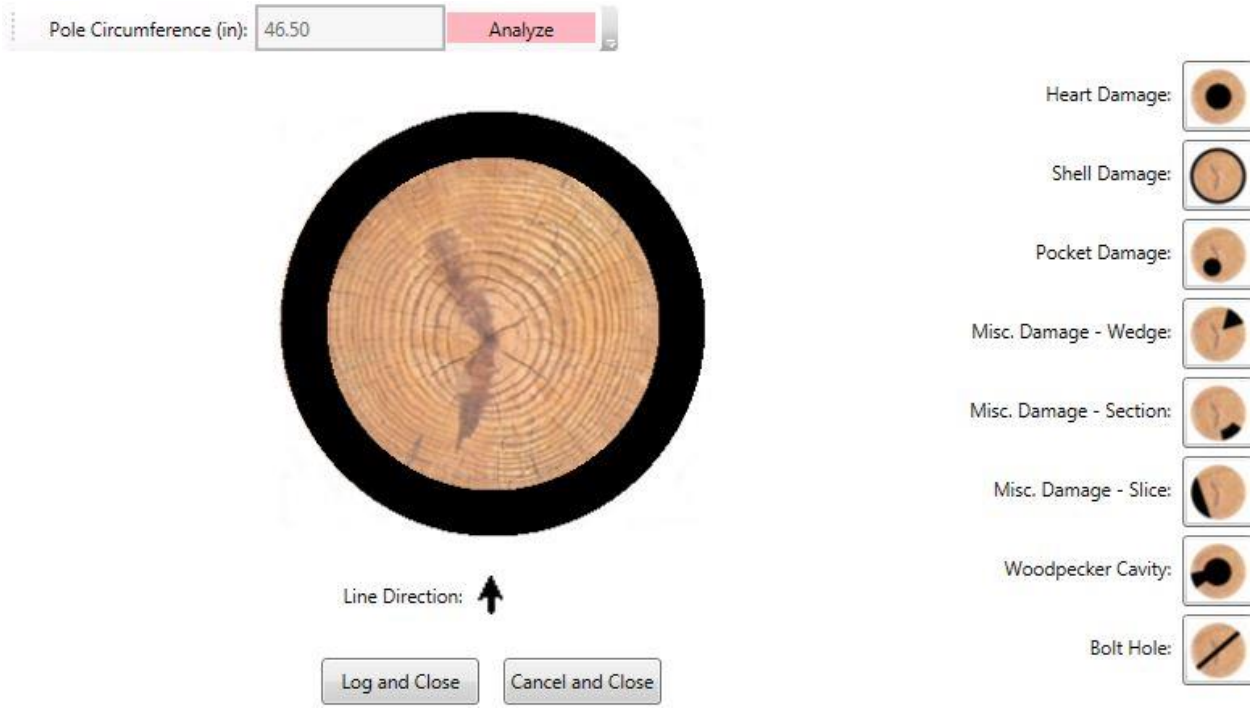



*Figure 86: Structure ID 80771 Height 0”*

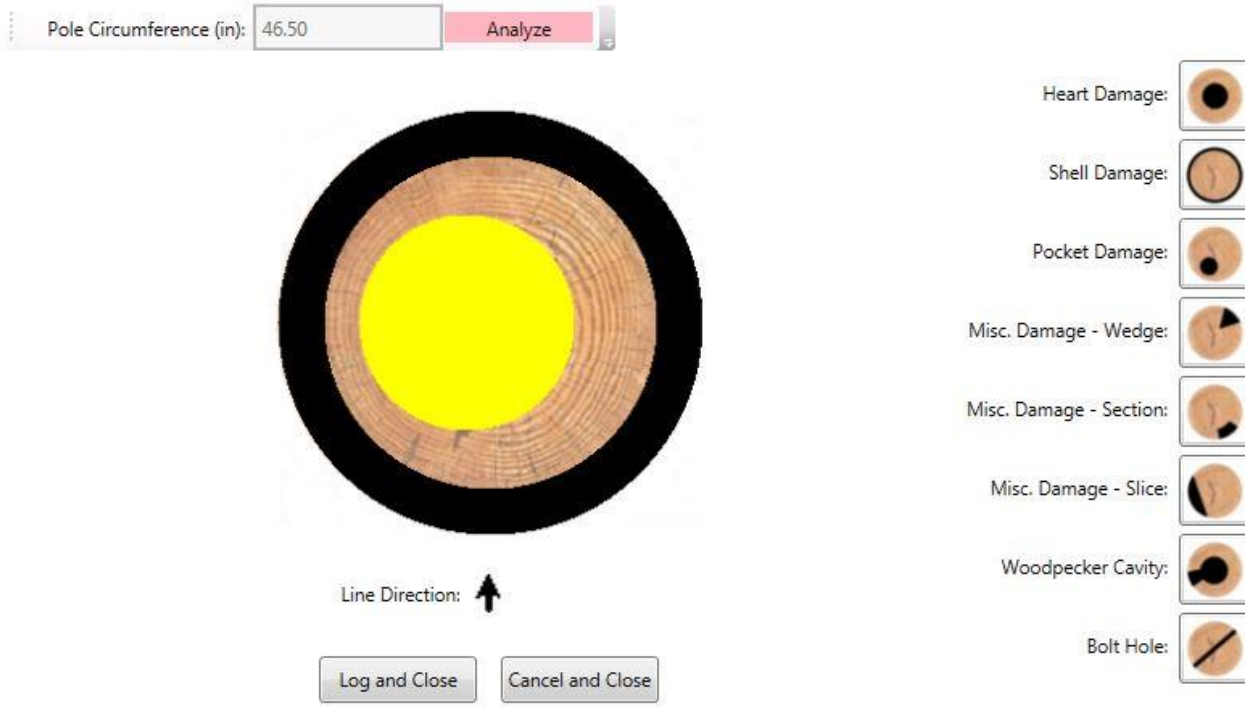



*Figure 87: Structure ID 80771 Height -18”*

*Figure 88: Structure ID 87517 – No D-Calc*

*Figure 89: Structure ID 87518 – No D-Calc*

## APPENDIX B - ANALYSIS OF RESULTS

Seven example line configurations with calculated loading compared to 25, 50, 75 and 100% remaining pole strengths is shown in Table 4-1.

**Table 4-1: Calculated loading compared to 25, 50, 75 and 100% remaining strengths**

| | Ruling Span (m) | Maximum Span (m) | CSA Rating (kPa) | Calculated Load at Groundline (kPa) | Comparison of Loading to Strength in % | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 25% | 50% | 70% | 100% |
| 1 Ph 4 ACSR 4 ACSR Neutral. | 83.8 | 88.4 | 26,000 | 7620 | 117% | 59% | 42% | 29% |
| 1 Ph 2 ACSR 4 ACSR Neutral. | 83.8 | 88.4 | 26,000 | 7830 | 120% | 60% | 43% | 30% |
| 1 Ph 2/0 ACSR 2 ACSR Neutral | 83.8 | 88.4 | 26,000 | 8440 | 130% | 65% | 46% | 32% |
| 3 Ph 2 ACSR 2 ACSR Neutral | 62.5 | 73.2 | 26,000 | 12160 | 187% | 94% | 67% | 47% |
| 3 Ph 2/0 ACSR 2 ACSR Neutral | 62.5 | 73.2 | 26,000 | 13250 | 204% | 102% | 73% | 51% |
| 3 Ph 477 AAC with 4/0 Neutral & Comm | 47.3 | 62.5 | 26,000 | 10230 | 157% | 79% | 56% | 39% |
| 3 Ph 477 AAC, Secondaries, transformer & communicaiton | 34.1 | 39.6 | 26,000 | 16520 | 254% | 127% | 91% | 64% |

The remaining pole strength and typical loading for each priority level group is shown in Table 4-2.

**Table 4-2: Remaining strength and typical loading**

| | Ruling Span (m) | Maximum Span (m) | CSA Rating (kPa) | High Priority Remaining Strength Range | | Medium Priority Remaining Strength Range | |
|---|---|---|---|---|---|---|---|
| | | | | Minimum | Maximum | Minimum | Maximum |
| 1 Ph 4 ACSR 4 ACSR Neutral. | 83.8 | 88.4 | 26,000 | 0% | 29% | 30% | 60% |
| 1 Ph 2 ACSR 4 ACSR Neutral. | 83.8 | 88.4 | 26,000 | 0% | 30% | 31% | 60% |
| 1 Ph 2/0 ACSR 2 ACSR Neutral | 83.8 | 88.4 | 26,000 | 0% | 32% | 33% | 60% |
| 3 Ph 2 ACSR 2 ACSR Neutral | 62.5 | 73.2 | 26,000 | 0% | 47% | 48% | 60% |
| 3 Ph 2/0 ACSR 2 ACSR Neutral | 62.5 | 73.2 | 26,000 | 0% | 51% | 52% | 60% |
| 3 Ph 477 AAC with 4/0 Neutral & Comm | 47.3 | 62.5 | 26,000 | 0% | 39% | 40% | 60% |
| 3 Ph 477 AAC, Secondaries, transformer & communicaiton | 34.1 | 39.6 | 26,000 | 0% | 64% | N/A | N/A |

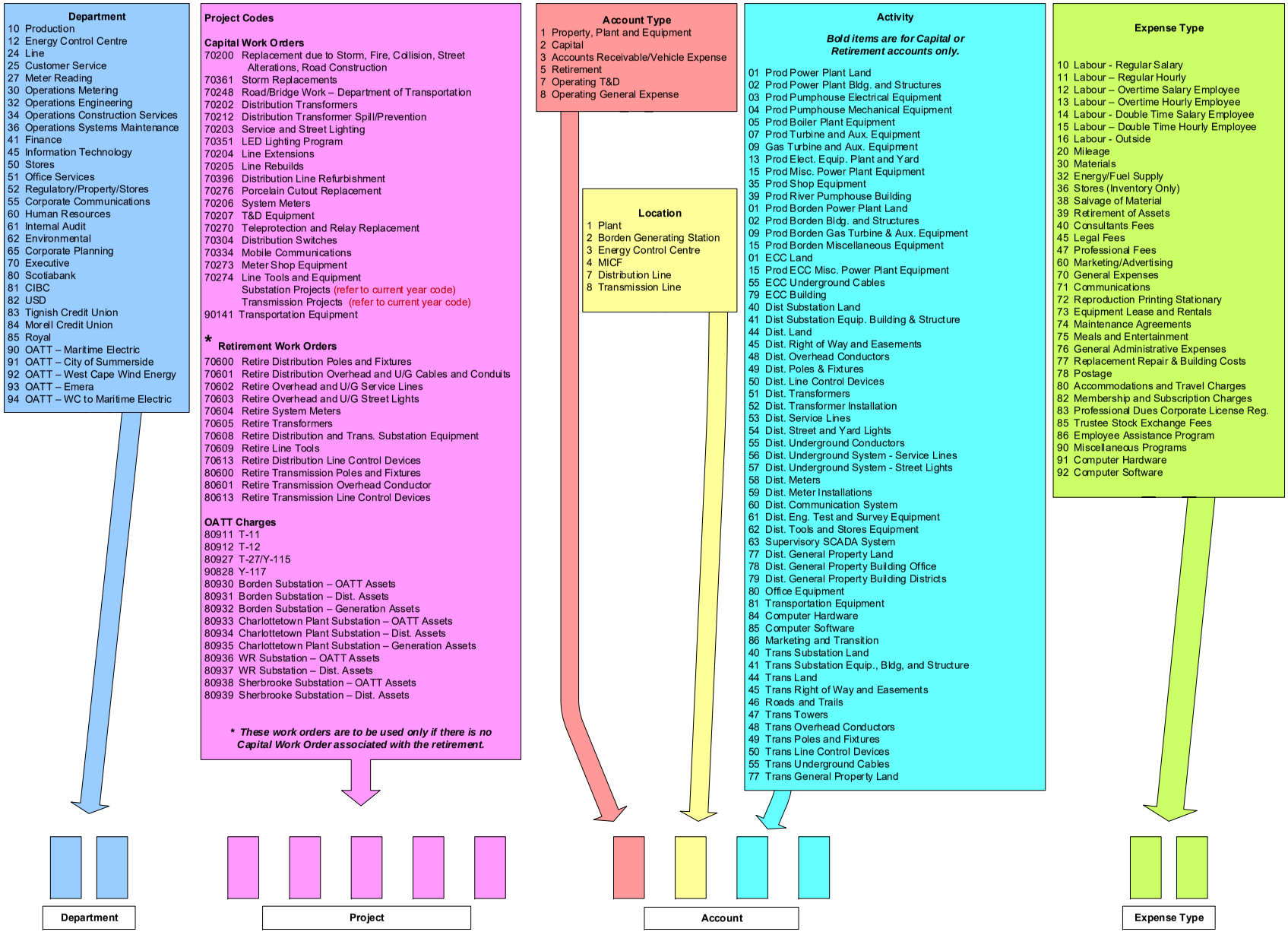
# APPENDIX C - POLE DATA

| Struct ID | Brand Year | Original Treatment | Class | Height (ft) | Pole Species *EC-cedar JP=Jack Pine RP=Red Pine WH=Western Hemlock* | Inspection Type *P=Partial Excavation SB=Sound Bore V=Visual* | Pole Setting S=Soil A=Asphalt | Ground Line Circumference (inches) | Net D-Calc RSM (%) | Recommended Action |
|---|---|---|---|---|---|---|---|---|---|---|
| 10387 | 1965 | Cedar | 4 | 35 | EC | P | S | 40.5 | 6.82 | Replace-High Priority |
| 12382 | 1985 | Penta | 4 | 40 | JP | SB | A | 37 | 76.63 | Maintain |
| 13192 | 1993 | Penta | 4 | 35 | JP | SB | A | 38 | 100 | Maintain |
| 13427 | 1967 | Cedar | 4 | 35 | EC | P | S | 36 | 10.81 | Replace-High Priority |
| 13585 | 1965 | Cedar | 4 | 35 | EC | P | S | 40 | 61.41 | Replace-Low Priority |
| 18394 | 1983 | Penta | 3 | 40 | RP | P | S | 40.5 | 100 | Maintain |
| 18576 | 1988 | CCA | 4 | 40 | JP | SB | A | 38 | 100 | Maintain |
| 18591 | 1985 | Penta | 4 | 40 | JP | SB | A | 37 | 64.53 | Replace-Low Priority |
| 18703 | 1977 | Penta | 4 | 40 | JP | SB | A | 41 | 83.18 | Maintain |
| 18857 | 1975 | Penta | 4 | 40 | JP | SB | A | 38 | 70.04 | Maintain |
| 20373 | 1975 | Cedar | 4 | 35 | EC | P | S | 37 | 53.55 | Replace-Medium Priority |
| 26043 | 1975 | Cedar | 4 | 45 | EC | P | S | 50 | 65.8 | Replace-Low Priority |
| 26049 | 1975 | Cedar | 4 | 45 | EC | P | S | 39 | 39.55 | Replace-High Priority |
| 28101 | 1988 | Penta | 4 | 40 | JP | SB | A | 37 | 93.06 | Maintain |
| 28864 | 1968 | Creosote | 4 | 35 | JP | P | S | 39 | 100 | Maintain |
| 28891 | 1968 | Penta | 4 | 40 | JP | SB | A | 40 | 74.32 | Maintain |
| 28991 | 1966 | Cedar | 4 | 35 | EC | SB | A | 40 | 13.07 | Replace-High Priority |
| 29751 | 1975 | Creosote | 4 | 35 | JP | P | S | 34.5 | 100 | Maintain |
| 29761 | 1975 | Penta | 4 | 35 | JP | P | S | 34 | 54.22 | Replace-High Priority |
| 30323 | | Penta | 4 | 35 | EC | V | A | 30 | 86.05 | Maintain |
| 30469 | 1983 | Penta | 3 | 40 | RP | P | S | 40 | 100 | Maintain |
| 30491 | 1968 | Cedar | 4 | 35 | JP | SB | A | 34.5 | 73.36 | Maintain |
| 30544 | 1965 | Cedar | 4 | 35 | EC | P | S | 43 | 30.47 | Replace-Medium Priority |
| 45755 | 1967 | Cedar | 4 | 35 | EC | P | S | 38 | 61.7 | Replace-Low Priority |
| 45756 | 1967 | Cedar | 4 | 35 | EC | P | S | 34.5 | 25.48 | Replace-High Priority |
| 56800 | | Penta | 4 | 35 | WH | P | S | 39 | 74.14 | Maintain |
| 56801 | 1965 | Cedar | 4 | 35 | EC | P | S | 30 | 38.21 | Replace-Medium Priority |
| 56851 | 1965 | Creosote | 4 | 45 | JP | P | S | 41.5 | 100 | Maintain |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 56889 | 1966 | Creosote | 4 | 50 | JP | P | S | 38 | 100 | Maintain |
| 64067 | 1975 | Cedar | 4 | 35 | EC | P | S | 30.25 | 16.01 | Replace-High Priority |
| 64069 | 1975 | Cedar | 4 | 35 | EC | P | S | 36.5 | 15.12 | Replace-High Priority |
| 64072 | 1975 | Cedar | 4 | 35 | EC | P | S | 44 | 67.65 | Replace-Low Priority |
| 68315 | 1967 | Cedar | 4 | 35 | EC | P | S | 45 | 90.62 | Maintain |
| 68337 | 1975 | Cedar | 4 | 40 | EC | P | S | 42 | 97.91 | Maintain |
| 80583 | 1975 | Cedar | 4 | 40 | EC | P | S | 48 | 81.62 | Maintain |
| 80747 | 1975 | Cedar | 4 | 40 | EC | P | S | 42 | 79.2 | Maintain |
| 80749 | 1975 | Cedar | 4 | 40 | EC | P | S | 48.5 | 72.34 | Maintain |
| 80762 | 1975 | Cedar | 4 | 30 | EC | P | S | 43.5 | 62.57 | Replace-Low Priority |
| 80771 | 1975 | Cedar | 4 | 35 | EC | P | S | 46.5 | 36.34 | Replace-Medium Priority |
| 80774 | 1987 | Creosote | 4 | | JP | | | | | Replace-Medium Priority |
| 87517 | 1965 | Cedar | 4 | 35 | EC | P | S | 43.75 | 100 | Maintain |
| 87518 | 1965 | Cedar | 4 | 35 | EC | P | S | 48.5 | 100 | Maintain |
| 110169 | 1975 | Cedar | 4 | 35 | EC | SB | S | 50 | 45.75 | Replace-Medium Priority |
| 110170 | 1975 | Cedar | 4 | 35 | EC | P | S | 43.5 | 100 | Maintain |
| 110171 | 1975 | Cedar | 4 | 35 | EC | P | S | 44 | 69.52 | Replace-Low Priority |
| 122023 | 1965 | Cedar | 4 | 35 | EC | P | S | 48 | 15.05 | Replace-High Priority |
| 122025 | 1965 | Cedar | 4 | 35 | EC | P | S | 39 | 82.6 | Maintain |
| 122028 | 1965 | Cedar | 5 | 35 | EC | P | S | 32 | 57.07 | Replace-Medium Priority |
| 123738 | 1975 | Cedar | 4 | 35 | EC | P | S | 38.5 | 31.45 | Replace-Medium Priority |
| 123739 | 1975 | Cedar | 4 | 35 | EC | P | S | 41 | 15.98 | Replace-High Priority |
| 124022 | 1974 | Cedar | 4 | 40 | EC | SB | S | 44 | 26.58 | Replace-High Priority |
| 124025 | 1975 | Cedar | 4 | 35 | EC | P | S | 47 | 51.1 | Replace-Medium Priority |
| 124864 | 1975 | Cedar | 4 | 35 | EC | P | S | 49 | 22.19 | Replace-High Priority |
| 124865 | 1975 | Cedar | 4 | 40 | EC | P | S | 45 | 49.41 | Replace-Medium Priority |
| 124866 | 1975 | Cedar | 4 | 40 | EC | P | S | 48 | 9.26 | Replace-High Priority |
| 146833 | 1975 | Cedar | 4 | 35 | EC | P | S | 36 | 40.36 | Replace-Medium Priority |
| 146836 | 1975 | Cedar | 4 | 35 | EC | P | S | 32.5 | 33.58 | Replace-Medium Priority |
| 146839 | 1975 | Cedar | 4 | 35 | EC | P | S | 36 | 10.59 | Replace-High Priority |

**Account Numbers - MASTER**

Issued: April 2018



| PROPERTY, PLANT AND EQUIPMENT ACCOUNTING | | |
|---|---|---|
| **PRODUCTION** | | |
| **Account Name** | **Section** | **Account Number** |
| Land | Charlottetown<br>Borden | 1101<br>1201 |
| Buildings and Structure | Charlottetown<br>Borden | 1102<br>1202 |
| Pumphouse – Mechanical Equipment | Charlottetown | 1103 |
| Pumphouse – Electrical Equipment | Charlottetown | 1104 |
| Steam Boilers and Auxiliary Equipment | Charlottetown | 1105 |
| Steam Turbine – Generators and Auxiliary Equipment | Charlottetown | 1107 |
| Gas Turbine – Generators and Auxiliary Equipment | Charlottetown | 1109 |
| Plant Electrical – Equipment | Charlottetown | 1113 |
| Power Plant – Miscellaneous Equipment | Charlottetown<br>Borden Plant<br>ECC | 1115<br>1215<br>1315 |
| Shop Tools and Equipment | | 1135 |
| River Pumphouse | | 1139 |
| Gas Turbine – Generators and Auxiliary Equipment | Borden | 1209 |
| Energy Control Centre | | 1379 |
| **TRANSMISSION AND DISTRIBUTION** | | |
| **Account Name** | **Section** | **Account Number** |
| Substation Land | Distribution<br>Transmission | 1740<br>1840 |
| Substation Equipment, Buildings and Structures | Distribution<br>Transmission | 1741<br>1841 |
| Transmission and Distribution Land | Distribution<br>Transmission | 1744<br>1844 |
| Road and Trails | | 1846 |
| Transmission Towers | | 1847 |
| Overhead Conductors | Distribution<br>Transmission | 1748<br>1848 |
| Poles and Fixtures | Distribution | 1749 |

| | | |
|---|---|---|
| | Transmission | 1849 |
| Line Control Devices | Distribution<br>Transmission | 1750<br>1850 |
| Line Transformers | Distribution | 1751 |
| Line Transformer Installation | Distribution | 1752 |
| Service Lines | Distribution | 1753 |
| Street and Yard Lighting | Distribution | 1754 |
| Underground System Cables and Conduits | Distribution | 1755 |
| Underground System Service Lines | Distribution | 1756 |
| Underground System Street Lighting Supply | Distribution | 1757 |
| Meters | Distribution | 1758 |
| Meter Installation | Distribution | 1759 |
| Communication Equipment | | 1760 |
| Engineering, Test and Survey Equipment | | 1761 |
| Tools and Stores Equipment | Distribution | 1762 |
| Supervisory and Control Equipment (SCADA) | | 1763 |
| General Property - Land | Distribution | 1777 |
| General Property - Office Buildings and Structures | Distribution | 1778 |
| General Property - Line Buildings and Structures | Distribution | 1779 |
| Office Equipment | | 1780 |
| Transportation Equipment | | 1781 |
| Office Leasehold Improvements | | 1783 |
| **INFORMATION TECHNOLOGY** | | |
| **Account Name** | **Section** | **Account Number** |
| Computer Hardware | | 1784 |
| Computer Software | | 1785 |

| **CAPITAL PROJECT CODES AND UNDISTRIBUTED GENERAL EXPENSE CAPTIAL** | | |
|---|---|---|
| **Account Name** | **Section** | **Account Number** |
| Undistributed General Expense - Capital | General Expense Capital | 2000 |
| Capital Project Codes in Progress | | 2000 |
| ▪ Project Code Content | | |
| ▪ Initiating the Project Code | | |
| ▪ Closing Out the Project Code | | |

| RETIREMENT ACCOUNTING | | |
|---|---|---|
| **Account Name** | **Section** | **Account Number** |
| Accumulated Depreciation or Retirement Reserves | | |
| Withdrawals of Retirements | | |
| Salvage | | |

| CURRENT ASSETS | | |
|---|---|---|
| **Account Name** | **Section** | **Account Number** |
| Cash | | 3000 |
| Accounts Receivable | | 3100 |
| Materials and Supplies | | 3200-3299 |
| Repayments | | 3300-3399 |
| Other Current Assets | | 3400-3499 |
| Deferred Charges | | 3500-3599 |
| Rights-of-Way and Easements | | 3580 |
| Accumulated Amortization - Rights-of-Way and Easements | | 3582 |
| Internally Developed Software | | 3585 |
| Accumulated Amortization - Internally Developed Software | | 3586 |
| Long Term Investments | | 3600-3699 |
| Accounts Receivable Job Orders | | 3700-3999 |

| LIABILITIES AND SHAREHOLDER EQUITY | | |
|---|---|---|
| **Account Name** | **Section** | **Account Number** |
| Funded Debt | | 4000 |
| Payroll - Deductions and Overheads | | 4200-4299 |
| Accounts Payable | | 4300-4399 |
| Accrued Liabilities | | 4400-4499 |
| Contribution for Services | | 4500-4519 |
| Future Site Removal and Restoration | | 4520 |
| Future Income Tax | | 4600 |
| Shareholders' Equity | | 4700-4710 |
| Retained Earnings | | 4720 |

| INCOME AND SURPLUS ACCOUNTING | | |
|---|---|---|
| **Account Name** | **Section** | **Account Number** |
| Accumulated Amortization - General | | 5000 - 5028 |
| Retirement Project Codes in Progress | | 5100-5999 |

| OPERATING REVENUE ACCOUNTING | | |
|---|---|---|
| **Account Name** | **Section** | **Account Number** |
| Electric Revenue Accounts | | 6000-6400 |
| Other Revenues | | 6500-6599 |

| OPERATING EXPENSE ACCOUNTING | | |
|---|---|---|
| **Account Name** | **Section** | **Account Number** |
| Operating Expense | | 7000 -7499 |
| Power Purchases | | 7000 -7009 |
| Dalhousie | | 7010-7019 |
| Point Lepreau | | 7020-7039 |
| Other | | 7040-7099 |
| Charlottetown Steam Plant | | 7100-7199 |
| Borden Gas Turbine Generating Plant | | 7200-7299 |
| Charlottetown Thermal Generating Station CT | | 7300-7349 |
| Production - Other | | 7350-7399 |
| Maritime Interconnection Facilities - Government-Owned | | 7400-7499 |
| OATT | | 7500-7599 |

| GENERAL EXPENSE ACCOUNTING | | |
|---|---|---|
| **Account Name** | **Section** | **Account Number** |
| Transmission and Distribution - Other | | 7900-7999 |
| General Expense | | |

| OTHER INCOME DEDUCTIONS ACCOUNTING | | |
|---|---|---|
| **Account Name** | **Section** | **Account Number** |
| Other Income Deductions | | 9000-9999 |

**Numerical Order (refer to Account Number Diagram)**

The third segment or "natural" account code is key to ensuring assets and expenses are properly recorded. The four digit natural account is as follows:

1st digit – Account Type
2nd digit – Location Code
3rd and 4th digits – Activity Type

Situations can arise when an Account Code can cover more than on activity. In these situations, consistence and judgment are applied.

The Property, Plant and Equipment (PPE) Accounts of each distinct class of operations shall be subdivided into the main divisions, Production, Transmission, Distribution and General Property. Maritime Electric follows the guidelines for accounting established by the Federal Energy regulatory Commission's (FERC's) Uniform System of Accounts. The Account structure is a 4-segment, 13 digit series as follows:

| | | |
|---|---|---|
| First 2 digits | = | Department Code |
| Next 5 digits | = | Project Code |
| Next 4 digits | = | Natural Account Number |
| Last 2 digits | = | Expense Type |

CONSTRUCTION ACCOUNTS

When a large construction project is under consideration and study, preliminary legal and engineering expenses will be incurred, these expenses shall be carried in a Capital Project Code in Progress until such time as they can be allocated to the appropriate accounts in the classification of Fixed Capital Accounts in the second part of this section.

Before the construction work is started, the management, accountants and construction engineers should agree upon the accounting methods or systems to provide a detailed cost of the construction to be undertaken, and they shall prepare a classification of construction accounts or Project Codes which will permit the detailed cost of the construction to be easily condensed or reclassified.

Transmission includes one or more transmission lines or main transformers or substations interconnecting Production plants, and transmitting energy to substations supplying cities, towns, rural areas and large power customers. The Fixed Capital record for Transmission should show the total cost of Transmission segregated into units and if so directed by management each unit will be divided as prescribed in the classification for Transmission lines.

Distribution includes all land, structures, conversion equipment, lines, line transformers, and other facilities employed between the primary source of supply (i.e. generating station, or transmission system, or point of receipt in the case of purchased power) and of delivery of customers, which are not includible in transmission system, whether or not such land, structures, and facilities are operated as part of a transmission system or as part of a distribution system.

General Property includes property or equipment not assignable to Production, Distribution, or Transmission.

# PRODUCTION

**Production** consists of one or more power plants supplying electrical energy to an interconnected system serving various areas. The Fixed Capital record will show the total cost of each producing plant and, when so directed by the management each plant will be segregated into the classification prescribed for power plants.

## POWER PLANT LAND

Includes the cost of land and land rights used in connection with steam-power, gas turbine or other internal combustion engine power generation. It shall not include the cost of buildings, structures or improvements other than as noted below.

Such items to be charged here include:

1. Survey in connection with acquisition of land.
2. Appraisals prior to closing title.
3. Examining and clearing title, insuring and registering in connection with the acquisition and defending against claims relating to the period prior to the acquisition.
4. Payments for obtaining consents or for abutting damages.
5. Conveyancers' and notaries' fees.
6. Fees, commissions and salaries to brokers, agents and others in connection with acquisition of the land.
7. Voiding leases upon purchase to secure possession of the land.
8. First cost of acquisition including mortgages and other liens assumed (but not subsequent interest thereon).
9. Filing satisfaction of mortgage.
10. Taxes accrued to the date of transfer of title.
11. Special assessments levied by public authorities for public improvements but not taxes levied to provide for maintenance of such improvements.
12. Grading the land except when directly occasioned by a building or structure.
13. Removing, relocating or reconstructing property of others, such as buildings, roads, power and communication lines, cemeteries, etc., in order to acquire quiet possession of land.
14. If on acquiring the land, buildings, structures or improvements are removed or wrecked without being used in the utility operation, the cost of removing or wrecking shall be charged to this account and any salvage credited to the account.

## POWER PLANT - BUILDINGS AND STRUCTURES

Includes the cost of all permanent buildings, structures and improvements and all appurtenant fixtures devoted to the generation operation.

The cost of specially provided foundations not intended to outlast the machinery or apparatus for which provided, and the cost of steel work and castings, etc., installed to form part or all of a base of an item of equipment shall be charged to the same account as the cost of the machinery, apparatus or equipment.

The cost of weather protective enclosures forming part of, or supplied as an integral part of a gas turbine generating units shall be charged to the same account as the cost of the machinery, apparatus or equipment.

The cost of weather protective enclosures forming part of, or supplied as an integral part of a gas turbine generating unit shall be charged to the same account as the cost of the generating unit.

Some of the items to be included in the accounts for buildings and structures are as follows:

1. Architects and engineers plans and specifications including supervision.
2. Ash pits (when located with the building).
3. Boilers, furnaces, piping, wiring, fixtures and machinery for heating, lighting, signaling, ventilating, and air conditioning systems, plumbing, vacuum cleaning system, incinerator and smoke pipe, flues, etc.
4. Bulkheads, including dredging, riprap fill, piling decking, concrete, fenders, etc., when exposed and subject to maintenance and replacement.
5. Chimneys.
6. Coal bins and bunkers.
7. Commissions and fees to brokers, agents, architects and others.
8. Conduit (not to be removed) with its contents.
9. Damages to abutting property during construction.
10. Docks and wharves.
11. Door checks and door stops.
12. Drainage and sewerage systems.
13. Elevators, cranes, hoists, etc., and the machinery for operating them.
14. Excavation, including shoring, bracing, bridging, refill, and disposal of excess excavated material, cofferdams around foundation, pumping water from cofferdam during construction, and test borings.
15. Fences and fence curbs (not including protective fences isolating items of equipment, which shall be charged to the appropriate equipment account).
16. Fire protection systems when forming a part of a structure.
17. Floor covering (permanently attached).
18. Foundations and piers for machinery, constructed as a permanent part of a building or other item listed herein.
19. Grading and clearing when directly occasioned by the building of a structure.
20. Intrasite communication system, pole, pole fixtures, wires and cables.
21. Landscaping, lawns, shrubbery, etc.
22. Leases, voiding upon purchase, to secure possession of structures.
23. Leased property, expenditures on.
24. Lighting fixtures and outside lighting system.
25. Initial painting.
26. Permanent paving, concrete, brick, flagstone, asphalt, etc., within the property lines.
27. Partitions, including movable.
28. Permits and privileges.
29. Platforms, railings and gratings when constructed as part of a structure.
30. Power boards for services to a building.

31. Refrigerating systems for general use.
32. Retaining walls except when identified with land.
33. Roadways, railroads, bridges, and trestles intrasite except railroads provided for in equipment accounts.
34. Roofs.
35. Scales, connected to and forming a part of a structure.
36. Screens.
37. Sidewalks, culverts, curbs and streets constructed by the utility on its property.
38. Sprinkling systems.
39. Sump pumps and pits.
40. Stacks - brick, steel, concrete or fiberglass, when set on foundation forming part of general foundation and steelwork of a building.
41. Steel inspection during construction.
42. Storage facilities constituting a part of a building.
43. Storm doors and windows.
44. Subways, areaways, and tunnels, directly connected to and forming part of a structure.
45. Tanks, constructed as part of a building or as a distinct structural unit.
46. Temporary heating during construction (net cost).
47. Temporary water connection during construction (net cost).
48. Temporary shanties and other facilities used during the construction (net cost).
49. Topographical maps.
50. Water front improvements.
51. Water meters and supply system for a building or for general company purposes.
52. Water supply piping, hydrants and wells.
53. Window shades and ventilators.
54. Yard drainage system.
55. Yard lighting system.
56. Yard surfacing, gravel, concrete, or oil (first cost only).

## PUMPHOUSE – MECHANICAL EQUIPMENT

Includes the cost installed of mechanical equipment located in a pumphouse, used for the purpose of supplying circulating water for condensing and cooling purposes, the pumphouse being remote from the plant building housing the generating machinery.

The cost of circulating water pumps, including motors, suction and discharge, valves and valve operators, water screens, screen wash pump, screen wash piping, valves and filters, and other mechanical equipment used in conjunction with this, and their installation are charged to this account.

## PUMPHOUSE – ELECTRICAL EQUIPMENT

Includes the cost of electrical equipment associated with the pumphouse which is remote from the plant and supplying circulating water to the plant for condensing and cooling purposes.

Includes the cost of overhead and underground power supply circuits, transformers, switchgear, cables, conduits, motor protection and control devices and the installation of this equipment. It does not include the main primary supply circuit breakers which are normally located in the plant.

## STEAM BOILERS AND AUXILIARY EQUIPMENT

Includes the cost installed of furnaces, boilers, and boiler apparatus and accessories, devoted to the production of steam for electric generation and for steam sales.

The specific items are:

1. Ash handling equipment, including hoppers, gates, cars, conveyors, hoists, sluicing equipment, including pumps and motors, sluicing water pipe and fittings, sluicing trenches and accessories, etc., except sluices which are a part of a building.
2. Boiler feed system, including feed water heaters, evaporator condensers, heater drain pumps, heater drainers, de-aerators, and vent condensers, boiler feed pumps, surge tanks, feed water regulators, feed water measuring equipment, and all associated drives.
3. Boiler plant cranes and hoists and associated drives.
4. Boilers and equipment, including boilers and baffles, economizers, superheaters, soot blowers, foundation and settings, water walls, arches, grates, insulation, slowdown system, drying out of new boilers, also associated motors or other power equipment.
5. Breeching and accessories, including breeching, dampers, soot spouts, hoppers and gates, cinder eliminators, breeching insulation, soot blowers and associated motors.
6. Coal handling and storage equipment, including coal towers, coal lorries, coal cars, locomotives and tracks when devoted principally to the transportation of coal, hoppers downtakes, unloading and hoisting equipment, skip hoists and conveyors, weighting equipment, magnetic separators, cable ways, housings and supports for coal handling equipment.
7. Draft equipment, including air preheaters and accessories induced and forced draft fans, air ducts, combustion control mechanisms, and associated motors or other power equipment.
8. Gas-burning equipment including holders, burner equipment and piping, control equipment, etc.
9. Instruments and devices, including all measuring, indicating and recording equipment for boiler plant services together with mounting and supports.
10. Lighting systems.
11. Oil-burning equipment, including tanks, heaters, pumps with drive burner equipment and piping, control equipment, etc.
12. Pulverized fuel equipment, including pulverizers, necessary motors, primary air fans, cyclones and ducts, dryers, pulverized fuel bins, pulverized fuel conveyors, and equipment, burners, burner piping priming equipment, air compressors, motors, etc.
13. Stacks, including foundations and supports, stack steel and ladders, stack brick work, stack concrete, stack lining, stack painting (first), when set on separate foundation independent of substructure or superstructure of building.
14. Station piping, including pipe, valves, fittings, separators, traps, desuperheaters, hangars, excavation, covering, etc., for station piping system, including all steam, condensate, boiler feed and water supply piping, etc., but not condensing water, plumbing, building heating, oil, gas, air piping.
15. Stoker or equivalent feeding equipment, including stokers and accessory motors, clinker grinders, fans and motors, etc.
16. Ventilating equipment.

17. Water purification equipment, including softeners, demineralizers and accessories, evaporators and accessories, heat exchangers, filters, tanks for filtered or softened water, pumps, motors, etc.
18. Water-supply systems, including pumps, motors, strainers, raw-water storage tanks, boiler wash pumps, intake and discharge pipes and tunnels not a part of a building.

## STEAM TURBINE – GENERATORS AND AUXILIARY EQUIPMENT

Includes the cost installed of main turbine-driven units and accessory equipment used in generating electricity by steam.

The specific items are:

1. Air cleaning and cooling apparatus, including blowers, drive equipment, air ducts not a part of building, louvers, pumps, hoods, etc.
2. Circulating pumps, including connections between condensers and intake and discharge wells and tunnels.
3. Condensers, including condensate pumps, air and vacuum pumps, ejectors, unloading valves and vacuum breakers, expansion devices, screens, etc.
4. Generator hydrogen gas piping system and hydrogen detrainment equipment.
5. Cooling system, including towers, pumps, tanks, and piping.
6. Cranes, hoists, etc., including items wholly identified with items listed herein.
7. Excitation system, when identified with main generating units.
8. Fire-extinguishing systems.
9. Foundations and settings, especially constructed for and not expected to outlast the apparatus for which provided.
10. Governors.
11. Lighting systems.
12. Lubricating systems, including gauges, filters, water separators, tanks, pumps, piping, motors, etc.
13. Mechanical meters, including gauges, recording instruments, sampling and testing equipment.
14. Piping-main exhaust, including connections between turbo-generator and condenser and between condenser and hot-well.
15. Piping-main steam, including connections from main throttle valve to turbine inlet.
16. Platforms, railings, steps, gratings, etc., appurtenant to apparatus listed herein.
17. Pressure oil systems, including accumulators, pumps, piping, motors, etc.
18. Steelwork, specially constructed for apparatus listed herein.
19. Throttle and inlet valve.
20. Tunnels, intake and discharge, for condenser system, when not a part of a structure, water screens, etc.
21. Turbo-generators-main, including turbine generator, field rheostats and electric connections for self-excited units.
22. Water screens, motors, etc.
23. Moisture separators for turbine steam.
24. Turbine lubricating oil (initial charge).

## GAS TURBINE – GENERATORS AND AUXILIARY EQUIPMENT

This account shall include the cost installed of main turbine-driven units and accessory equipment used in generating electricity by steam.

The specific items are:

1. Air cleaning and cooling apparatus including blowers, drive equipment, air ducts not a part of building, louvers, pumps, hoods, etc.
2. Circulating pumps, including connections between condensers and intake and discharge tunnels.
3. Condensers, including condensate pumps, air and vacuum pumps, ejectors, unloading valves and vacuum breakers, expansion devices, screens, etc.
4. Generator hydrogen, gas piping and detrainment equipment.
5. Cooling system, including towers, pumps, tanks, and piping.
6. Cranes, hoists, etc., including items wholly identified with items listed herein.
7. Excitation system, when identified with main generating units.
8. Fire-extinguishing systems.
9. Foundations and settings especially constructed for and not expected to outlast the apparatus for which provided.
10. Governors.
11. Lighting systems.
12. Lubricating systems, including gauges, filters, water separators, tanks, pumps, piping, motors, etc.
13. Mechanical meters, including gauges, recording instruments, sampling and testing equipment.
14. Piping - main exhaust, including connections between turbogenerator and condenser and between condenser and hotwell.
15. Piping - main steam including connections from main throttle valve to turbine inlet.
16. Platforms, railings, steps, gratings, etc., appurtenant to apparatus listed herein.
17. Pressure oil systems including accumulators, pumps, piping, motors, etc.
18. Steelwork, specially constructed for apparatus listed herein.
19. Throttle and inlet valve.
20. Tunnels, intake and discharge, for condenser system, when not a part of structure, water screens, etc.
21. Turbogenerators - main, including turbine and generator, field rheostats and electric connections for self-excited units.
22. Water screens, motors, etc.
23. Moisture separator for turbine steam.
24. Turbine lubricating oil (initial charge).

## PLANT ELECTRICAL - EQUIPMENT

Includes the cost installed of auxiliary generating apparatus, conversion equipment and equipment used primarily in connection with the control and switching of electric energy produced by generating equipment, and the protection of electric circuits and equipment. It does not include transformers and other equipment used for changing the voltage and frequencies of electricity for transmission or distribution.

The specific items are:

1. Auxiliary generators, including boards, compartments, switchgear and equipment, and connections to auxiliary power bus.
2. Exciters when driven separately from the main primemover, including its drive, rheostats, storage batteries and charging equipment, circuit breakers, panels and accessories, knife switches and accessories, surge arrestors, instrument shunts, conductors and conduit, special supports for conduit, generator field and exciter switch panels, exciter bus tie panels, generator and exciter rheostats, etc., special housing, protective screens, etc.
3. Generator main connections, including oil circuit breakers and accessories, disconnecting switches and accessories, operating mechanisms and interlocks, current transformers, potential transformers, protective relays, isolated panels and equipment, conductors, and conduit, special supports for generator main leads, grounding switch, etc., special housing, protective screens, etc.
4. Station buses including main, auxiliary, transfer, synchronizing and fault ground buses, including circuit breakers and accessories, disconnecting switches and accessories, operating mechanisms and interlocks, reactors and accessories, voltage regulators and accessories, compensators, resistors, starting transformers, current transformers, potential transformers, protective relays, storage batteries and charging equipment, isolated panels and equipment, conductors and conduit, special supports, special housings.
5. Concrete pads, general station grounding system, special fire-extinguishing system, and test equipment.
6. Station control system, including station switchboards with panel wiring, panels with instruments and control equipment only, panels with switching equipment mounted or mechanically connected, trucktype boards complete, cubicles, station supervisory control boards, generator and exciter signal stands, temperature recording devices, frequency-control equipment, master clocks, watt-hour meters and synchronoscope in the turbine room, station totalizing watt-meter, boiler-room load indicator equipment, storage batteries, panels and charging sets, instrument transformers for supervisor metering, conductors and conduit, special protective screens, doors, etc.

**NOTE:** When any item of equipment listed herein is used wholly to furnish power to equipment included in another account, its cost shall be included in such other account.

## POWER PLANT – MISCELLANEOUS EQUIPMENT

This account shall include the cost installed of miscellaneous equipment in and about the generating plants devoted to general station use and which is not included in foregoing accounts concerning power production accounts.

The specific items include:

1. Compressed air and vacuum cleaning systems, including tanks, compressors, exhausters, air filters, piping, etc.
2. Mobile cranes and hoisting equipment, including crane cars, crane rails, monorails, hoists, etc.
3. Fire extinguishing equipment for general station use.

4. Foundations and settings specially constructed for and not expected to outlast the apparatus for which provided.
5. Locomotive cranes not includible elsewhere.
6. Locomotives not includible elsewhere.
7. Marine equipment, including boats, barges, etc.
8. Miscellaneous belts, pulleys, countershafts, etc.
9. Miscellaneous equipment, including atmospheric and weather-indicating devices, intrasite communication equipment, laboratory equipment, signal systems, callophones, emergency whistles and sirens, fire alarms, insect-control equipment and other similar equipment.
10. Railway cars not includible elsewhere.
11. Refrigerating systems, including compressors, pumps, cooling coils, etc.
12. Station maintenance equipment, including lathes, shapers, planers, drill presses, hydraulic presses, grinders, etc., with motors, shafting, hangars, pulleys, etc.
13. Ventilating equipment, including items wholly identified with apparatus listed herein.

## SHOP TOOLS AND EQUIPMENT

This account shall include the cost of tools, implements and equipment used in the Production area in repair work and general plant shops. It also includes the cost of equipment for receiving, shipping, handling and storage of production materials and supplies such as hoists, lockers, scales, shelving, storage bins, hand trucks, wheelbarrows, machine tools, motor-driven tools, tool racks, vises, work benches, etc.

## RIVER PUMPHOUSE

Includes the cost of all permanent buildings, structures and improvements and all appurtenant fixtures devoted to the river pumphouse operation.

The cost of specially provided foundations not intended to outlast the machinery or apparatus for which provided, and the cost of steel work and castings, etc., installed to form part or all of a base of an item of equipment shall be charged to the same account as the cost of the machinery, apparatus or equipment.

Some of the items to be included in the accounts for buildings and structures are as follows:

1. Architects and engineers plans and specifications including supervision.
2. Piping, wiring, fixtures and machinery for heating, lighting, signaling, ventilating, and air conditioning systems, plumbing, vacuum cleaning system.
3. Bulkheads, including dredging, riprap fill, piling, decking, concrete, fenders, etc., when exposed and subject to maintenance and replacement.
4. Commissions and fees to brokers, agents, architects and others.
5. Conduit (not to be removed) with its contents.
6. Damages to abutting property during construction.
7. Docks and wharves.
8. Door checks and door stops.
9. Drainage and sewerage systems.
10. Elevators, cranes, hoists, etc., and the machinery for operating them.

11. Excavation, including shoring, bracing, bridging, refill, and disposal of excess excavated material, cofferdams around foundation, pumping water from cofferdam during construction, and test borings.
12. Fences and fence curbs (not including protective fences isolating items of equipment, which shall be charged to the appropriate equipment account).
13. Fire protection systems when forming a part of a structure.
14. Floor covering (permanently attached).
15. Foundations and piers for machinery, constructed as a permanent part of a building or other item listed herein.
16. Grading and clearing when directly occasioned by the building of a structure.
17. Intrasite communication system, poles, pole fixtures, wires and cables.
18. Landscaping, lawns, shrubbery, etc.
19. Leases, voiding upon purchase, to secure possession of structures.
20. Leased property, expenditures on.
21. Lighting fixtures and outside lighting system.
22. Initial painting.
23. Permanent paving, concrete, brick, flagstone, asphalt, etc., within the property lines.
24. Partitions, including movable.
25. Permits and privileges.
26. Platforms, railings and gratings when constructed as a part of a structure.
27. Power boards for services to a building.
28. Refrigerating systems for general use.
29. Retaining walls except when identified with land.
30. Roadways, railroads, bridges, and trestles intrasite except railroads provided for in equipment accounts.
31. Roofs.
32. Scales, connected to and forming a part of a structure.
33. Screens.
34. Sidewalks, culverts, curbs and streets constructed by the utility on its property.
35. Sprinkling systems.
36. Sump pumps and pits.
37. Stacks - brick, steel, concrete or fiberglass, when set on foundation forming part of general foundation and steelwork of a building.
38. Steel inspection during construction.
39. Storage facilities constituting a part of a building.
40. Storm doors and windows.
41. Subways, areaways, and tunnels, directly connected to and forming part of a structure.
42. Tanks, constructed as part of a building or as a distinct structural unit.
43. Temporary heating during construction (net cost).
44. Temporary water connection during construction (net cost).
45. Temporary shanties and other facilities used during the construction (net cost).
46. Topographical maps.
47. Tunnels, intake and discharge, when constructed as part of a structure, including sluice gates, and those constructed to house mains.
48. Vaults, constructed as part of building.
49. Water basins or reservoirs.

## GAS TURBINE – GENERATORS AND AUXILIARY EQUIPMENT - BORDEN

Includes the costs installed of gas turbine-driven units and accessory equipment used in generating electricity.

The specific items are:

1. Air cleaning and cooling apparatus, including blowers, fans, drive equipment, air ducts, louvers, pumps, hoods, etc.
2. Controls, including fuel controls, governoring equipment, excitation controls, batteries, voltage regulators, and all instrumentation necessary for automatic and manual operation of the unit.
3. Compressors, air receivers, filters, etc.
4. Generator hydrogen gas piping system and hydrogen detrainment equipment.
5. Cooling systems including pumps, tanks, and piping.
6. Cranes, hoists and trolleys associated with the equipment listed herein.
7. Excitation system.
8. Fire extinguishing systems.
9. Foundations and settings, specially constructed for and not expected to outlast the apparatus for which provided.
10. Governors.
11. Lighting systems.
12. Lubricating systems, including gauges, filters, water separator, tanks, pumps, piping, motors, etc.
13. Mechanical meters, including gauges, recording instruments, sampling and testing equipment.
14. Platforms, railings, steps, gratings, etc., appurtenant to apparatus listed herein.
15. Pressure oil systems, including accumulators, pumps, piping, motors, etc.
16. Steelwork, specially constructed for apparatus listed herein.
17. Turbine, including gas generator, power turbine, reduction gearing, couplings, generators, field rheostats and electric connections.
18. Housings supplied with and forming part of the unit, including turbine and generator weatherproof housing, control and switchgear housing.
19. Ducts, including air inlet and exhaust ducts, filters and silencing baffles.
20. Fences installed specifically for equipment concerned.
21. Lubricating oil, first fill.
22. Fuel system including pumps, piping, tanks, filters, etc., installed for the specific unit; fuel used for commissioning.
23. Electrical equipment up to and including the generator circuit breaker, including cables, conduits, instrument transformer control panels, circuit breakers, surge diverters, capacitors, grounding transformers, resistors and reactors, space heating system, unit auxiliary transformer, inverters, battery chargers, auxiliary panels and wiring, etc.

## ENERGY CONTROL CENTRE

This account includes the cost of the building in which the Energy Control Center is located. It also includes the cost of all fixtures permanently attached to and made a part of the building and which

cannot be removed without impairment to the building, as well as the cost of improvements of a permanent character.

## TRANSMISSION AND DISTRIBUTION

### SUBSTATION LAND

Includes the cost of all land devoted to distribution or transmission substations or switching operations outside of a generating plant property or land acquired solely for electric power generating purposes. It shall not include the cost of buildings, structures or improvements (other than public improvements noted in item (11) below).

The account shall include, when cost is assumed or paid by the Company, on its own behalf, the cost of:

1. Survey in connection with acquisition of the land.
2. Appraisals prior to closing title.
3. Examining and clearing title, insuring and registering the title in connection with the acquisition and defending against claims relating to the period prior to the acquisition.
4. Payments for obtaining consents or for abutting damages.
5. Conveyancers' and notaries' fees.
6. Fees, commissions and salaries to brokers, agents and others in connection with acquisition of the land.
7. Voiding leases upon purchase to secure possession of the land.
8. First cost of acquisition including mortgages and other liens assumed (but not subsequent interest thereon).
9. Filing satisfaction of mortgage.
10. Taxes accrued to the date of transfer to title.
11. Special assessments levied by public authorities for public improvements but not taxes levied to provide for the maintenance of such improvements.
12. Grading the land except when directly occasioned by a building or structure.
13. Removing, relocating or reconstructing property of others, such as buildings, roads, power and communication lines, cemeteries, etc., in order to acquire quiet possession of the land.
14. If on acquiring the land, buildings, structures or improvements are removed or wrecked without being used in the utility operations, the cost of removing or wrecking shall be charged to this account and any salvage credited to the account.

### SUBSTATION EQUIPMENT, BUILDINGS AND STRUCTURES

This account shall include the cost in place of all permanent buildings, structures, facilities and improvements to house, safeguard or support apparatus and equipment devoted to distribution or transmission substation or switching operations outside of a generating plant property or land acquired solely for electric power generating purposes.

Improvements include such items as roadways, fences, sidewalks, sewer and water systems, yard lighting, grading and landscape gardening, monuments and other permanent structures.

The account shall also include the installed cost of all distribution or transmission substation equipment including specially provided foundations. It will include such items as power transformers, converters, motor generators, regulators, switchgear, switching apparatus, etc., used primarily for changing electric power in either frequency of voltage or in controlling and measuring power and energy into or out of the distribution or transmission systems.

It will also include transformers installed in a distribution or transmission line to transform the voltage at a point between distribution or transmission systems of different operating voltage.

This account does not include distribution line transformers installed to step down the voltage from the utility's distribution system to the voltage at which it is used by the customer (normally 600 volts or less).

## TRANSMISSION AND DISTRIBUTION LAND

Charge to this account the cost of all land acquired and used primarily for the distribution or transmission of power and energy from one point to another outside of substation or generating plant land, including examination, searching and clearing title and registration of title, and other similar assignable costs as noted under "Substation Land" account (see 1740 and 1840).

## ROAD AND TRAILS

Charge to this account the cost of roads, trails, bridges used primarily as transmission facilities.

The specific items are:

1. Bridges including foundation piers, girders, trusses, flooring, etc.
2. Clearing land.
3. Roads including grading, surfacing, culverts, etc.
4. Structures constructed and maintained in connection with items included herein.
5. Trails including grading, surfacing, culverts, etc.

NOTE: The cost of temporary roads, bridges, etc., necessary during the period of construction but abandoned or dedicated to public use upon completion of the plant, shall be charged to the accounts appropriate for the construction.

## TRANSMISSION TOWERS

This account includes the installed cost of tower and associated fixtures used for supporting overhead transmission conductors, including:

1. Anchors, guys and braces
2. Brackets
3. Crossarms
4. Excavation, backfill and disposal of excavated material
5. Foundation
6. Guards
7. Insulator pins and suspension bolts
8. Ladders and steps

9. Railings
10. Towers
11. Warning lights

## OVERHEAD CONDUCTORS

Includes the cost of all overhead conductors used for the distribution or transmission of power and energy from one point to another, excluding service lines. It will cover all cables, conductors, and insulators installed above ground on towers or pole structures located outside of substation or generating plant structures.

## POLES AND FIXTURES

This account shall include the cost installed of distribution or transmission line poles of wood or other material together with appurtenant fixtures used for supporting the overhead conductors but excluding line support insulators. It includes the cost of pole structure, transformer platforms and supporting poles, and structures supporting other line devices, crossarms, insulator pins, braces, brackets, guys and other supports for holding the structures in position. It does not include any structures erected for substation or generating plant purposes.

## LINE CONTROL DEVICES

This account will include the cost installed of major electrical apparatus and devices installed on distribution or transmission line structures for the automatic control, protection or electrical measurement of these lines. It will include such devices as voltage regulators, reclosers, capacitor banks, non-revenue metering outfits, air breaks, automatic sectionalizing switches, etc., located outside of substation or generating plant structures.

## LINE TRANSFORMERS

This account shall include the landed purchase cost of overhead, padmounted, submersible, and vault-type distribution line transformers owned by the utility for use in transforming electricity to the voltage at which it is supplied and used by the customer whether or not such units are in service or held in stock. It will also include the cost of lightning arrestors if used in conjunction with the transformer, fuse cut-outs, housings, foundations, enclosures and all material used solely for the installation of the transformer but excluding transformer platforms and supporting poles.

When a transformer is permanently retired from service, the original cost thereof shall be credited to this account.

The records covering line transformers shall be kept that the utility can furnish the number of transformers of various capacities in service and those in reserve, and the location and the use of each transformer.

## LINE TRANSFORMER INSTALLATION

Charge to this account all labour, transportation and incidental expenses for the initial installation of any new transformer. This account will not include the cost of setting or removing an existing transformer relocated from one installation point to another.

## SERVICES LINES

Includes the cost installed of all overhead conductors, conduits, insulators, racks, clamps, ducts, supports, etc., leading from the last pole of the overhead distribution system to the point of connection with the customer's outlet or entrance installation.

## STREET AND YARD LIGHTING

Charge to this account the cost installed of all lamp posts, lighting fixtures and control devices operated and maintained for street, highway, yard and area lighting under contract entered into with a municipality, village or individuals. It will include street lighting transformers and equipment installed above ground, supports, suspension and control devices, overhead conduits, cables and conductors, if used exclusively for lighting service. The first installation of lamp bulbs should be charged to this account. This account does not include area lighting equipment installed on substation or generating plant property.

## UNDERGROUND SYSTEM CABLES AND CONDUITS

This account shall include the installed cost of all conduits, manholes, pullpits, duct banks, sewer connections, sewer traps and all material and apparatus necessary for the construction of a duct bank system to house underground cables and line control devices.

It shall also include the installed cost of all power cables, neutral wires, ground wires, grounding systems, terminators, splices, and lighting arrestors used in conjunction with primary and secondary distribution systems and all pole-mounted equipment necessary to facilitate the attachment of underground cables to the poles.

This account shall include the installed cost of all underground fusing, switching, sectionalizing, whether manual or automatic used in conjunction with an underground distribution system.

## UNDERGROUND SYSTEM SERVICE LINES

This account shall include the installed cost of all underground service cables, connectors, conduits, ducts, supports, etc., leading from the last pole of the overhead system, from the terminals of the transformer, or from a distribution bus system to the customer entrance installation.

## UNDERGROUND SYSTEM STREET LIGHTING SUPPLY

This account shall include the installed cost of all lamp posts, bases, lighting fixtures, control devices, fuses, fittings, underground conduits, cable and connectors used in conjunction with street and yard lighting where lighting supply originates underground.

## METERS

This account shall include the landed purchase cost of new meters, metering devices and appurtenances used in measuring power or energy delivered to a customer whether such equipment is actually in service or held in stock. It will also include the cost of the first Company and Government tests of the meter.

When a meter is permanently retired from service, the original cost thereof shall be credited to this account.

The records covering meters shall be so kept that the utility can provide information as to the number of meters of various capacities in service and in reserve as well as the location of each meter owned.

This account shall not include meters for recording output of a generating station, substation meters, etc. It includes only those meters used to record energy delivered to customers.

## METER INSTALLATION

Charge to this account the cost of initial installation of a new meter or metering device used for determination or measurement of power and energy delivered to a customer. It will not include the cost of setting or removing an existing meter relocated from one installation point to another.

## COMMUNICATION EQUIPMENT

Includes the cost installed of radio receivers, transmitters, terminal equipment, antenna, towers, associated motor generator sets, battery chargers and associated apparatus together with structures and improvements used exclusively for the purpose of operating a private radio communication system within the company. It will also include an overhead or underground multiplex, telephone lines and fibre-optic lines erected and operated by the utility as a component part of the system.

## ENGINEERING, TEST AND SURVEY EQUIPMENT

This account shall include the cost installed of engineering and laboratory equipment used for testing, measurement, laboratory and engineering purposes not specifically provided for or includible in other functional accounts. It will include such items as transits, levels, ammeters, voltmeters, rotating standards, testing panels, portable ammeters, voltmeters and watt meters, variacs, galvanometers, etc.

## DISTRIBUTION TOOLS AND STORES EQUIPMENT

This account shall include the cost of tools, implements and equipment used in repair work, general shops, line construction and garages, excluding generating plant shop tools and equipment. It also includes the cost of equipment for receiving, shipping, handling and storage of line materials and supplies such as chain falls, counters, cranes, hoists, lockers, scales, shelving, storage bins, hand trucks, wheelbarrows, etc.

## SUPERVISORY AND CONTROL EQUIPMENT (SCADA)

Includes the cost installed of supervisory, telemetering and remote controlled equipment both master units and remote terminal units, dedicated computers, terminal facilities, keyboards, screens, printers and associated equipment.

## GENERAL PROPERTY - LAND

Charge to this account the cost of all land acquired not assignable to any other account in this classification (i.e. plant, substation, T. & D.) Such costs include cost of survey, examination of title, registration of title fees, and other costs similar to those noted for "Substation Land".

## GENERAL PROPERTY – OFFICE BUILDINGS AND STRUCTURES

Charge to this account the cost of buildings, structures and improvements not assignable to any other buildings and structures account.

### GENERAL PROPERTY – LINE BUILDINGS AND STRUCTURES

Charge to this account the cost of buildings, structures, and improvements used in line operations and not assignable to any other buildings and structures account.

### OFFICE EQUIPMENT

This account shall include the cost of office furniture and equipment devoted to utility service and not permanently attached to buildings, such as desks, chairs, tables, moveable safes, filing cabinets, drafting tables, adding machines, billing and accounting machines, computers and photocopiers, etc. Small articles of slight value or short life should not be charged to this account but to the appropriate operating expense account.

### TRANSPORTATION EQUIPMENT

Includes the cost of equipment for general transportation purposes such as aircraft, automobiles, motor trucks, bicycles, snowmobiles, motor cycles, tractors, trailers and associated equipment such as battery chargers, gasoline and oil storage tanks and pumps. It will also include line construction digging equipment, winches, line bodies, aerial buckets and ladders, etc., which are mounted or attached as an integral part of the vehicle.

### OFFICE LEASEHOLD IMPROVEMENTS

The cost of substantial initial improvements (including repairs, rearrangements, additions, and betterments) made in the course of preparing for utility service property leased for a period of more than one year, and the cost of subsequent substantial additions, replacements, or betterments to such property, shall be charged to the utility plant account appropriate for the class of property leased. If the service life of the improvements is terminable by action of the lease, the cost, less net salvage, of the improvements shall be spread over the life of the lease. However, if the service life is not terminated by action of the lease but by depreciation proper, the cost of the improvements, less net salvage, shall be accounted for as depreciable plant.

If improvements made to property leased for a period of more than one year are of relatively minor cost, or if the lease is for a period of not more than one year, the cost of the improvements shall be charged to the account in which the rent is included either directly or by amortization thereof.

## INFORMATION TECHNOLOGY

### COMPUTER HARDWARE

This account shall include the cost of general-purpose computer hardware.

### COMPUTER SOFTWARE

This account shall include the cost of systems software and a right or license to use computer software.

## UNDISTRIBUTED GENERAL EXPENSE - CAPITAL

This account accumulates charges of a capital-related nature which are not readily assignable to any particular capital account number/Project Code.

At year-end, the accumulated costs are re-allocated to fixed assets on a predetermined proportionate allocation.

## CAPITAL PROJECT CODES IN PROGRESS

Project Code Content

Every Project Code must contain the following information: name and number of project; location of project; department or division having custodial responsibility; budget item number (this may be the same as the project number;) description of work to be performed; reason for work (justification); account numbers involved; and an estimate of costs, quantities, and description of materials and labor needed. The Project Code also must include a cost summary detailing direct costs (labor, materials and supplies, contract costs, and transportation); overheads (including construction, supervision, engineering, and administrative items); interest charged to construction; and customer contributions in aid of construction. Finally, the order must show the date and name of person(s) preparing the Project Code and the date and name of person(s) approving the Project Code. Any maps, engineering drawings, or other diagrams to be used by construction personnel should be attached to the order.

Initiating the Project Code

The Project Code in its initial stages is a mechanism for alerting those departments or individuals involved in the project. The drawings, for example, would have to be prepared by the engineering department, which, if the work is being done internally, would generate bills of material to be used in the actual performance of the job. The Project Code, through the engineering department, then would trigger action by the stores department to make the proper materials available. If they are not in stock, the purchasing department would have to be notified to order the required items. If the job were to be performed by an outside contractor, the purchasing department would have received the original Project Code and would have been asked to solicit bids for the work from outside vendors.

Closing Out the Project Code

As construction progresses, the Project Code will accumulate information relative to new materials and supplies used. This basic data is needed by the capital records accounting section in order to make proper entries in the temporary work in progress accounts. In the cost accounting analysis prior to the distribution of work in progress to permanent asset accounts, overhead items - including construction, supervision, engineering, and administrative costs, and interest during construction - and, where appropriate, tool expense should be accounted for.

Upon completion of the particular project or subtotaling of a blanket or standing Project Code, the accountant will analyze and distribute from the work in progress accounts to the appropriate plant accounts and update the continuing property records at year-end. Otherwise, incomplete Project Codes are carried forward to the subsequent year as carryovers. A comparison also must be made

between the estimated and actual costs with the proper explanation of variances which, in turn, serve as a check between budgeted and actual expenditures.

These instructions apply to both construction and retirement Project Codes. With retirement Project Codes, additional costs recorded will be costs of removal (including overheads) and salvage values, as well as the original costs of the assets retired.

This range of accounts is subdivided to identify the classifications complementary to the fixed asset accounts.

| | |
|---|---|
| 2000 | General Expense - Capital |
| 21XX | Plant |
| 27XX | Distribution |
| 28XX | Transmission |

The last two digits of the account number identifies the fixed asset to which the capital Project Code relates.

Each Project Code is coded with a suffix five-digit number to account separately for that particular Project Code.

By Retirement Accounting as treated under this heading is meant the accounting procedure to be followed in setting up Depreciation or Retirement Reserves; the removal from Fixed Capital accounts of property retired or abandoned; the procedure in recording the expenditures for retiring and replacing property; in determining the charges to made to the Depreciation or Retirement Reserves for property retired or abandoned; and the treating of salvage.

Accumulated Depreciation or Retirement Reserves

This account shall be credited with such amounts as are charged to Operating Expenses, appropriated from Retained Earnings, or both, as directed by management, to cover the value plus cost of dismantling less the salvage value of fixed capital retired from service.

Withdrawals of Retirements

To the end that the capital accounts shall at all times disclose the cost of property, the book value of retired property, whether replaced or not, must be deducted from (i.e. credited to) the account or accounts in this classification to which such cost was charged. When anything is worn out lost, sold, destroyed, abandoned, surrendered upon lapse of title, becomes permanently unserviceable, or is withdrawn or retired from service for any other reason, the amount at which such property stood charged in the capital account shall be credited to the appropriate capital account.

If the particular value is not separately recorded, it shall be taken to be the proportionate share of the said property recorded for the entire group in which the property is included, or if there is no record, the value of the property shall be estimated by the company engineers, and the recording entry of withdrawal shall state the fact of such estimation. Credits to Capital Account for property retired shall include such part of Capital General Expense as is equitably assignable to the item retired.

The value of any item retired, together with the cost of dismantling or removing from service, less any credits for salvage shall be charged to the Depreciation or Retirement Reserve.

The foregoing instructions do not apply to the retirement of minor parts, for which the charges are made directly to Operating expense accounts as directed by management.

Replacements Chargeable to Fixed Capital Accounts

Replacement expenditures shall include the cost of all labour, material and other expenses incurred in replacement of property that has been retired from service, and such expenditures shall be treated in a manner similar to those for new Capital Additions.

Salvage

Salvage, as termed in Retirement Accounting, means the value to the company of equipment or other material recovered in the process of dealing with withdrawals or retirement of property, which may be the amount realized from the sale of the equipment, or the estimated value to the company (if the nature of the equipment or material is similar to general stores stock normally used in the operations of the company).

Equipment or materials which are not sold, and cannot be used by the company, shall not be considered as salvage until disposed of.

(See also 2000 - 2999 Project Code System)