OpenBridgeML Specifications

Define Fundamental Units and how all unit conversions must convert to fundamental units

# Standard Units

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Name** | **Mass** | **Length** | **Time** | **Temperature** | **Angle** |
| mass | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| length | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 |
| time | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 |
| temperature | 0.0 | 0.0 | 0.0 | 1.0 | 0.0 |
| angle | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 |
| mass\_per\_length | 1.0 | -1.0 | 0.0 | 0.0 | 0.0 |
| length2 | 0.0 | 2.0 | 0.0 | 0.0 | 0.0 |
| length3 | 0.0 | 3.0 | 0.0 | 0.0 | 0.0 |
| length4 | 0.0 | 4.0 | 0.0 | 0.0 | 0.0 |
| pressure | 1.0 | -1.0 | -2.0 | 0.0 | 0.0 |
| unit\_weight | 1.0 | -3.0 | -3.0 | 0.0 | 0.0 |
| density | 1.0 | -3.0 | 0.0 | 0.0 | 0.0 |
| force | 1.0 | 1.0 | -2.0 | 0.0 | 0.0 |
| force\_per\_length | 1.0 | 0.0 | -2.0 | 0.0 | 0.0 |
| moment | 1.0 | 2.0 | -2.0 | 0.0 | 0.0 |
| thermal\_expansion | 0.0 | 0.0 | 0.0 | -1.0 | 0.0 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| mass | | | | |
| **name** | **prefix** | **conversionFactor** | **postfix** | **unitSystem** |
| kg | 0.0 | 1.0 | 0.0 | unitsSI |
| Mg | 0.0 | 1000.0 | 0.0 | unitsSI |
| g | 0.0 | 0.001 | 0.0 | unitsSI |
| MT | 0.0 | 1000.0 | 0.0 | unitsSI |
| slug | 0.0 | 14.5939029372 | 0.0 | unitsUS |
| lb | 0.0 | 0.45359237 | 0.0 | unitsUS |
| kslug | 0.0 | 14593.9029372 | 0.0 | unitsUS |
| 12slug | 0.0 | 175.126835246 | 0.0 | unitsUS |
| 12kslug | 0.0 | 175126.835246 | 0.0 | unitsUS |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| length | | | | |
| **name** | **prefix** | **conversionFactor** | **postfix** | **unitSystem** |
| m | 0.0 | 1.0 | 0.0 | unitsSI |
| mm | 0.0 | 0.001 | 0.0 | unitsSI |
| cm | 0.0 | 0.01 | 0.0 | unitsSI |
| km | 0.0 | 1000.0 | 0.0 | unitsSI |
| ft | 0.0 | 0.3048 | 0.0 | unitsUS |
| in | 0.0 | 0.0254 | 0.0 | unitsUS |
| mile | 0.0 | 1609.344 | 0.0 | unitsUS |
| yd | 0.0 | 0.9144 | 0.0 | unitsUS |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| time | | | | |
| **name** | **prefix** | **conversionFactor** | **postfix** | **unitSystem** |
| sec | 0.0 | 1.0 | 0.0 | unitsAll |
| min | 0.0 | 60.0 | 0.0 | unitsAll |
| hr | 0.0 | 3600.0 | 0.0 | unitsAll |
| day | 0.0 | 86400.0 | 0.0 | unitsAll |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| temperature | | | | |
| **name** | **prefix** | **conversionFactor** | **postfix** | **unitSystem** |
| C | 0.0 | 1.0 | 0.0 | unitsAll |
| F | -32.0 | 0.5555555555555 | 0.0 | unitsAll |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| angle | | | | |
| **name** | **prefix** | **conversionFactor** | **postfix** | **unitSystem** |
| rad | 0.0 | 1.0 | 0.0 | unitsAll |
| deg | 0.0 | 0.0174532925199 | 0.0 | unitsAll |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| mass\_per\_length | | | | |
| **name** | **prefix** | **conversionFactor** | **postfix** | **unitSystem** |
| kg/m | 0.0 | 1.0 | 0.0 | unitsSI |
| slug/ft | 0.0 | 0.0208854352115 | 0.0 | unitsUS |
| lb/ft | 0.0 | 1.48816394357 | 0.0 | unitsUS |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| length2 | | | | |
| **name** | **prefix** | **conversionFactor** | **postfix** | **unitSystem** |
| m^2 | 0.0 | 1.0 | 0.0 | unitsSI |
| mm^2 | 0.0 | 1.0e-06 | 0.0 | unitsSI |
| cm^2 | 0.0 | 1.0e-04 | 0.0 | unitsSI |
| km^2 | 0.0 | 1.0e+06 | 0.0 | unitsSI |
| ft^2 | 0.0 | 0.09290304 | 0.0 | unitsUS |
| in^2 | 0.0 | 0.00064516 | 0.0 | unitsUS |
| mile^2 | 0.0 | 2589988.11034 | 0.0 | unitsUS |
| yd^2 | 0.0 | 0.83612736 | 0.0 | unitsUS |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| length3 | | | | |
| **name** | **prefix** | **conversionFactor** | **postfix** | **unitSystem** |
| m^3 | 0.0 | 1.0 | 0.0 | unitsSI |
| mm^3 | 0.0 | 1.0e-09 | 0.0 | unitsSI |
| cm^3 | 0.0 | 1.0e-06 | 0.0 | unitsSI |
| km^3 | 0.0 | 1.0e+09 | 0.0 | unitsSI |
| ft^3 | 0.0 | 0.028316846592 | 0.0 | unitsUS |
| in^3 | 0.0 | 0.000016387064 | 0.0 | unitsUS |
| mile^3 | 0.0 | 4168181825.44 | 0.0 | unitsUS |
| yd^3 | 0.0 | 0.764554857984 | 0.0 | unitsUS |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| length4 | | | | |
| **name** | **prefix** | **conversionFactor** | **postfix** | **unitSystem** |
| m^4 | 0.0 | 1.0 | 0.0 | unitsSI |
| mm^4 | 0.0 | 1.0e-12 | 0.0 | unitsSI |
| cm^4 | 0.0 | 1.0e-08 | 0.0 | unitsSI |
| km^4 | 0.0 | 1.0e+12 | 0.0 | unitsSI |
| ft^4 | 0.0 | 8.63097484124e-03 | 0.0 | unitsUS |
| in^4 | 0.0 | 4.162314256e-07 | 0.0 | unitsUS |
| mile^4 | 0.0 | 6.70803841168e12 | 0.0 | unitsUS |
| yd^4 | 0.0 | 0.699108962141 | 0.0 | unitsUS |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| pressure | | | | |
| **name** | **prefix** | **conversionFactor** | **postfix** | **unitSystem** |
| Pa | 0.0 | 1.0 | 0.0 | unitsSI |
| kPa | 0.0 | 1.0e+03 | 0.0 | unitsSI |
| MPa | 0.0 | 1.0e+06 | 0.0 | unitsSI |
| psi | 0.0 | 6.89475729317e+03 | 0.0 | unitsUS |
| psf | 0.0 | 4.78802589803e+01 | 0.0 | unitsUS |
| ksi | 0.0 | 6.89475729317e+06 | 0.0 | unitsUS |
| ksf | 0.0 | 4.78802589803e+04 | 0.0 | unitsUS |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| unit\_weight | | | | |
| **name** | **prefix** | **conversionFactor** | **postfix** | **unitSystem** |
| N/m^3 | 0.0 | 1.0 | 0.0 | unitsSI |
| pci | 0.0 | 271447.137526 | 0.0 | unitsUS |
| pcf | 0.0 | 157.087463846 | 0.0 | unitsUS |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| density | | | | |
| **name** | **prefix** | **conversionFactor** | **postfix** | **unitSystem** |
| kg/m^3 | 0.0 | 1.0 | 0.0 | unitsSI |
| slug/ft^3 | 0.0 | 515.378818393 | 0.0 | unitsUS |
| lb/ft^3 | 0.0 | 16.018463374 | 0.0 | unitsUS |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| force | | | | |
| **name** | **prefix** | **conversionFactor** | **postfix** | **unitSystem** |
| N | 0.0 | 1.0 | 0.0 | unitsSI |
| kN | 0.0 | 1.0e+03 | 0.0 | unitsSI |
| lbf | 0.0 | 4.44822161525 | 0.0 | unitsUS |
| kip | 0.0 | 4448.22161525 | 0.0 | unitsUS |
| ton | 0.0 | 8896.44323052 | 0.0 | unitsUS |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| force\_per\_length | | | | |
| **name** | **prefix** | **conversionFactor** | **postfix** | **unitSystem** |
| N/m | 0.0 | 1.0 | 0.0 | unitsSI |
| N/mm | 0.0 | 1.0e+03 | 0.0 | unitsSI |
| lbf/ft | 0.0 | 14.5939029372 | 0.0 | unitsUS |
| lbf/in | 0.0 | 175.126835246 | 0.0 | unitsUS |
| kip/ft | 0.0 | 14593.9029372 | 0.0 | unitsUS |
| kip/in | 0.0 | 175126.835246 | 0.0 | unitsUS |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| moment | | | | |
| **name** | **prefix** | **conversionFactor** | **postfix** | **unitSystem** |
| N-m | 0.0 | 1.0 | 0.0 | unitsSI |
| N-mm | 0.0 | 1.0e+03 | 0.0 | unitsSI |
| kN-m | 0.0 | 1.0e+03 | 0.0 | unitsSI |
| lbf-ft | 0.0 | 1.35581794833 | 0.0 | unitsUS |
| lbf-in | 0.0 | 0.112984829028 | 0.0 | unitsUS |
| kip-ft | 0.0 | 1355.81794833 | 0.0 | unitsUS |
| kip-in | 0.0 | 112.984829028 | 0.0 | unitsUS |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| thermal\_expansion | | | | |
| **name** | **prefix** | **conversionFactor** | **postfix** | **unitSystem** |
| 1/C | 0.0 | 1.0 | 0.0 | unitsSI |
| 1/F | 0.0 | 0.555555555555555555 | 0.0 | unitsUS |

# Extended Physical Units

Can’t have dimensionality that is defined in the Standard Units

# Extended Units of Measure

Can’t have name that is defined in the Standard Units

Conversion factors must convert to fundamental units