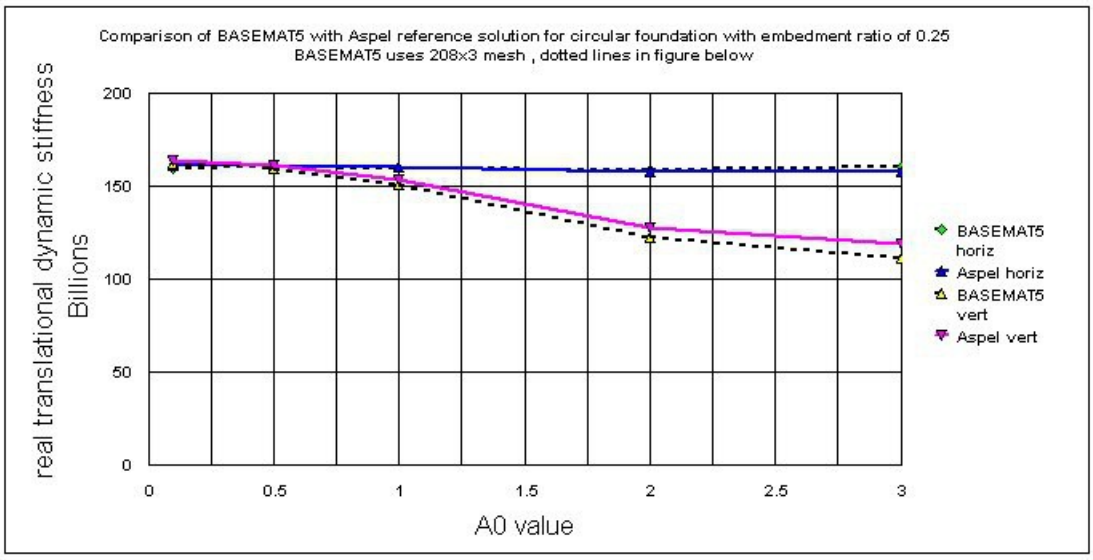
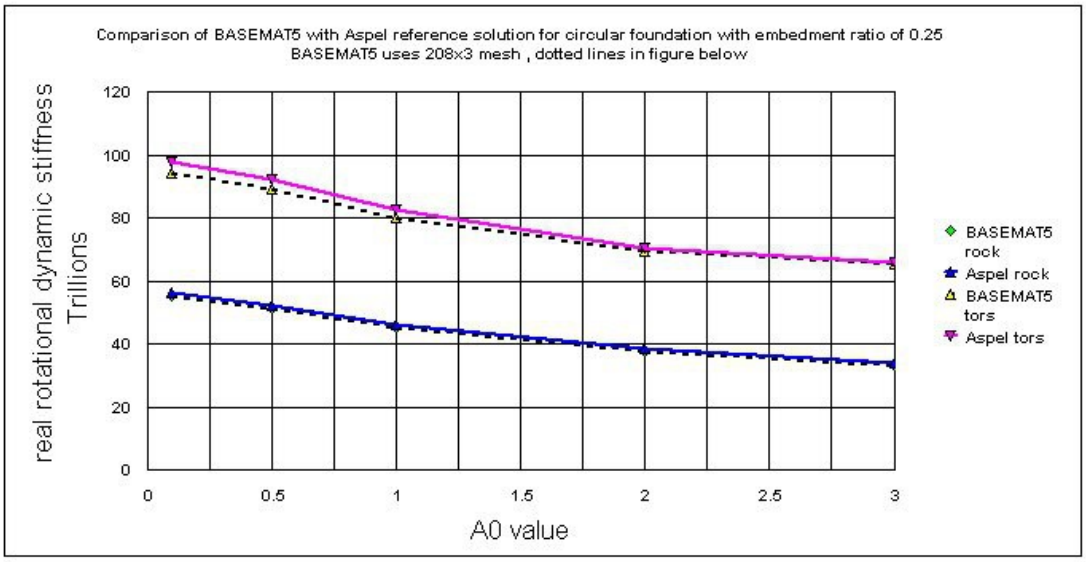
**Verification material for BASEMAT - Embedded Foundations**

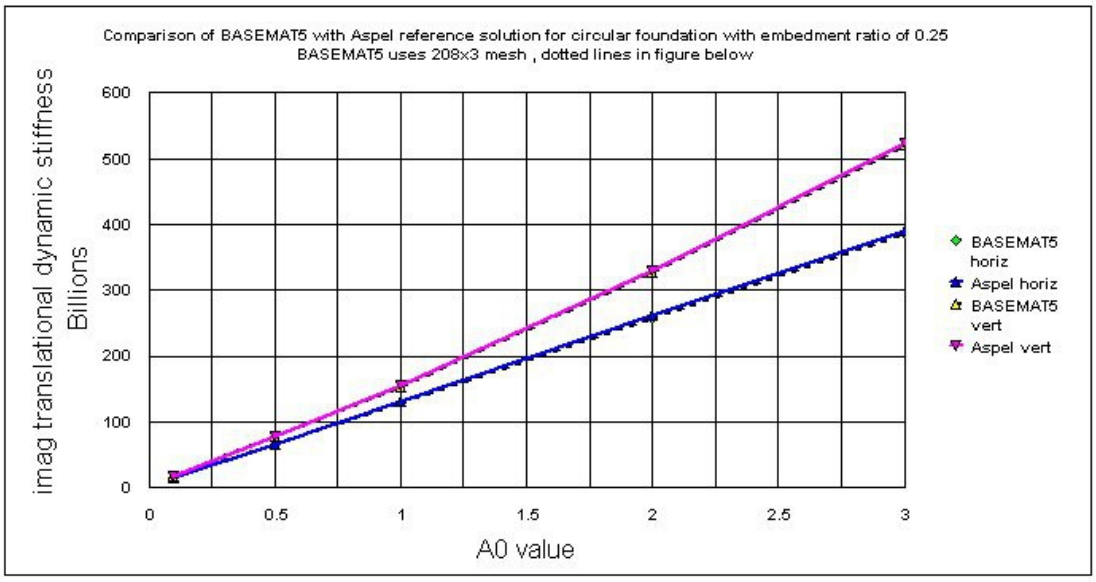
The dynamic stiffness results for BASEMAT obtained for a 20m radius circular foundation embedded in a uniform half-space with shear wave velocity 800 m/sec, density 2000 kg/m³, poisson's ratio of 0.25, shear wave material damping of 1% and compression wave material damping of 0.5% are compared with results given by Aspel in Appendix I of his 1979 PhD thesis "Dynamic Green's functions for layered media and applications to boundary-value problems". The comparison is carried out at three embedment ratios: 0.25, 0.5 and 1.0, corresponding to embedment depths of 5m, 10m and 20m respectively, up to a dimensionless frequency A0 of 3.

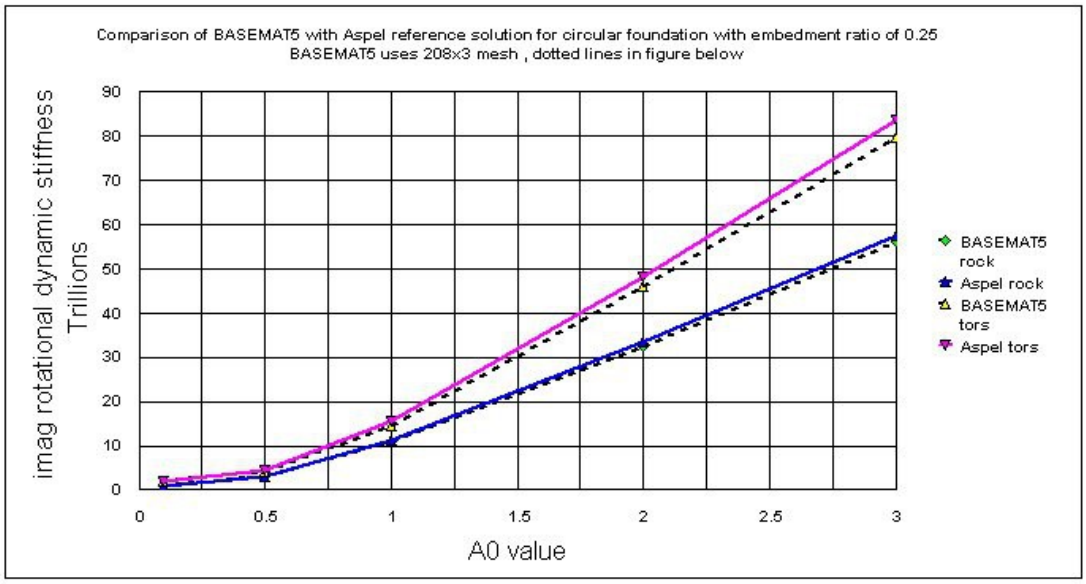
The circular shape is approximated using 208 equal square subregions. For the embedment ratio cases of 0.25 and 0.5, a stack of three parallel sub-meshes is used, one 208 subregion sub-mesh at the bottom of the soil volume that is later to be excavated, one at the top of the soil volume, and one at the half depth of the soil volume. For the deeper embedment ratio case of 1.0, a stack of five equally spaced parallel sub-meshes is used.

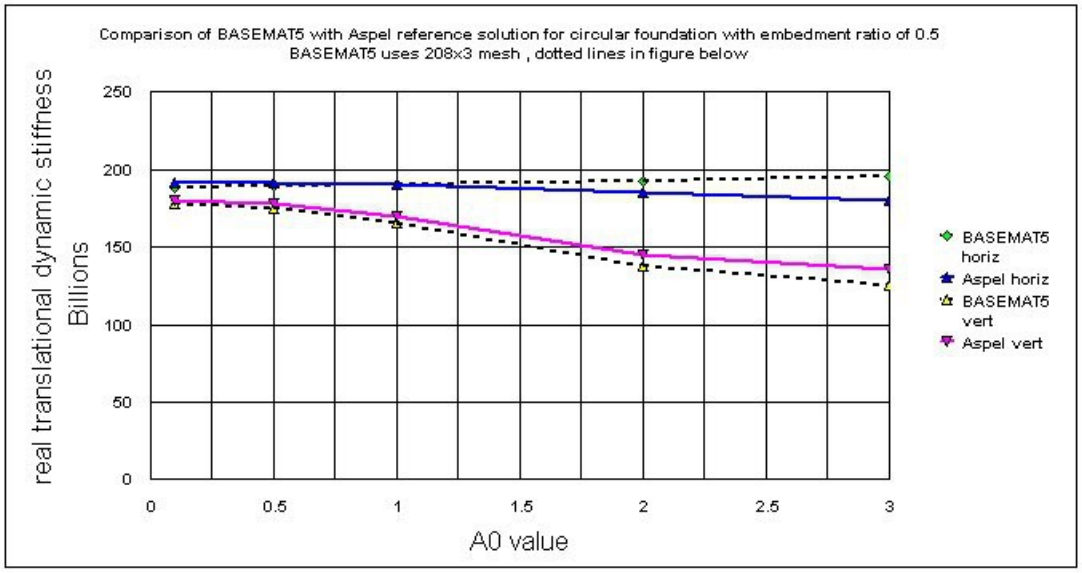
The dynamic stiffness graph results are given in billions and trillions. These correspond to a US convention used in the graph plotting software where a billion = 1.E9 and a trillion = 1.E12.

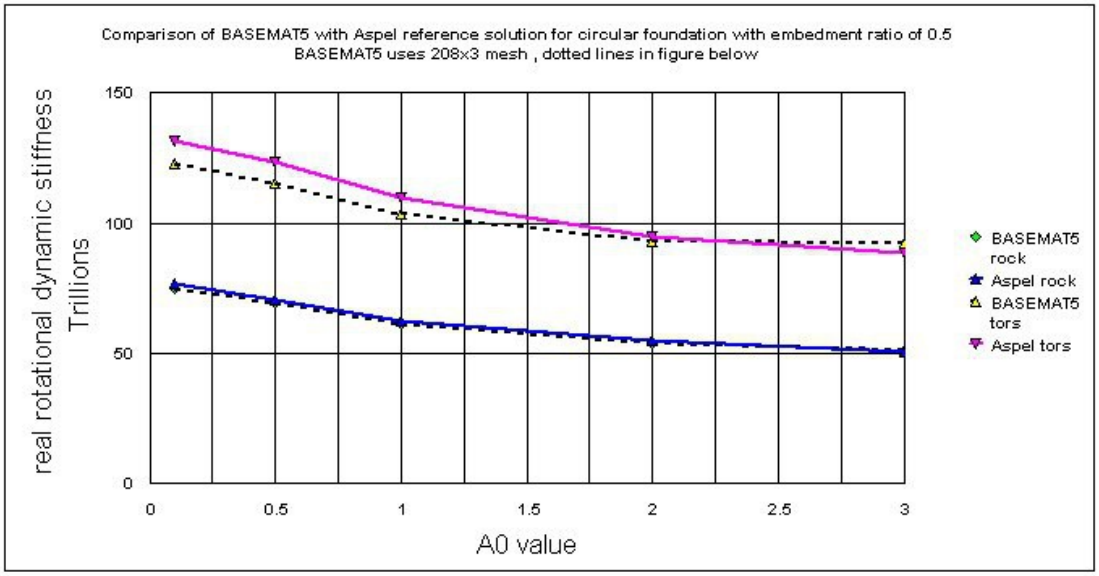


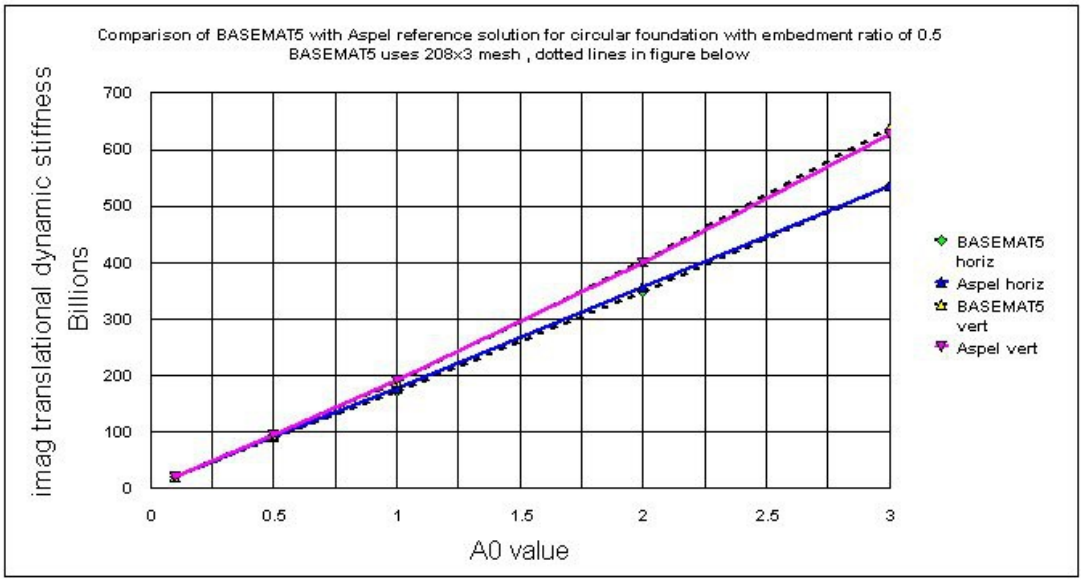

Comparison of BASEMAT5 with Aspel reference solution for circular foundation with embedment ratio of 0.25
BASEMAT5 uses 208x3 mesh , dotted lines in figure below
real rotational dynamic stiffness
Trillions
120
100
80
60
40
20
0
0
0.5
1
1.5
2
2.5
3
A0 value
BASEMAT5 rock
Aspel rock
BASEMAT5 tors
Aspel tors

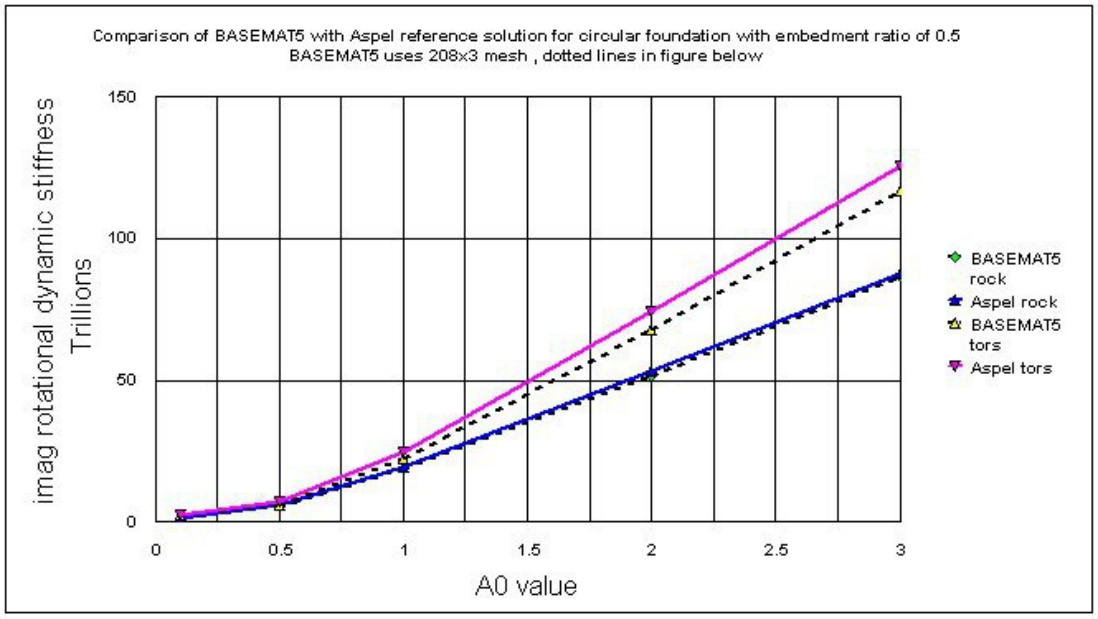

Comparison of BASEMAT5 with Aspel reference solution for circular foundation with embedment ratio of 0.25
BASEMAT5 uses 208x3 mesh , dotted lines in figure below
imag translational dynamic stiffness
Billions
600
500
400
300
200
100
0
0
0.5
1
1.5
2
2.5
3
A0 value
BASEMAT5 horiz
Aspel horiz
BASEMAT5 vert
Aspel vert

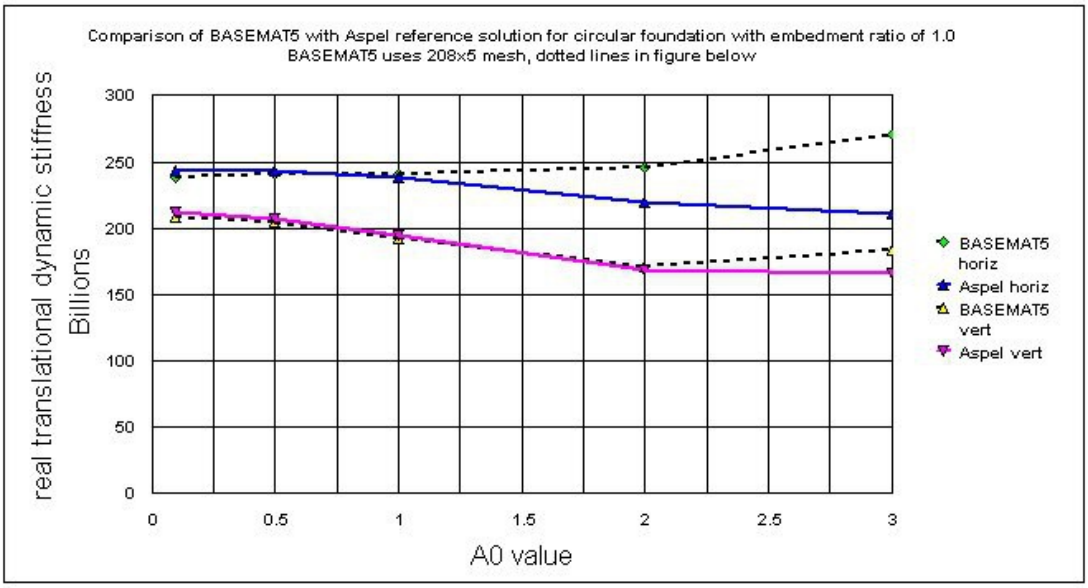

Comparison of BASEMAT5 with Aspel reference solution for circular foundation with embedment ratio of 0.25
BASEMAT5 uses 208x3 mesh , dotted lines in figure below
imag rotational dynamic stiffness
Trillions
90
80
70
60
50
40
30
20
10
0
0
0.5
1
1.5
2
2.5
3
A0 value
BASEMAT5 rock
Aspel rock
BASEMAT5 tors
Aspel tors

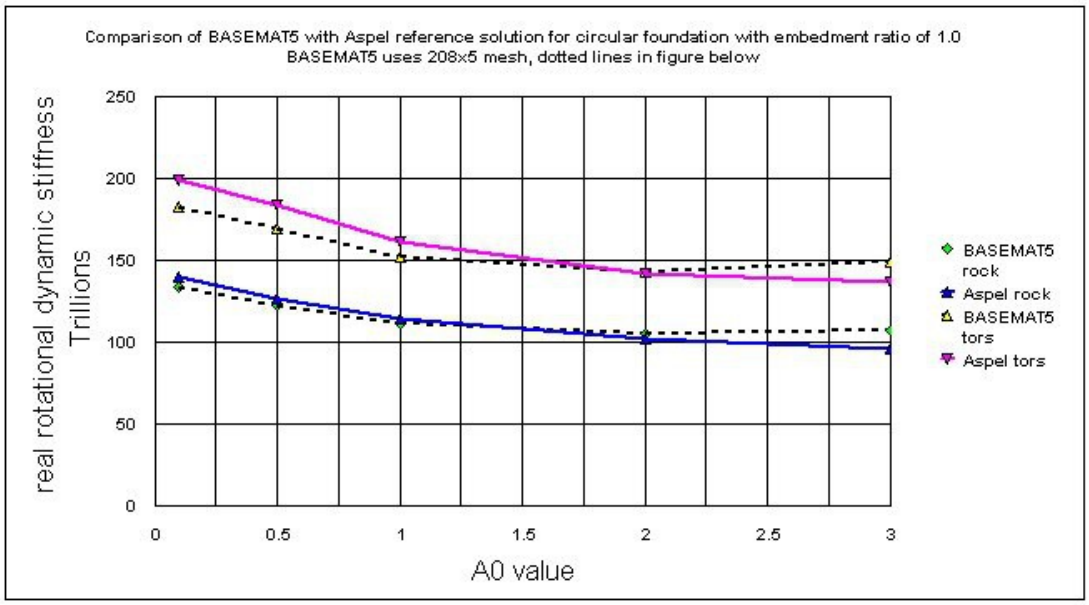

Comparison of BASEMAT5 with Aspel reference solution for circular foundation with embedment ratio of 0.5
BASEMAT5 uses 208x3 mesh , dotted lines in figure below
real translational dynamic stiffness
Billions
250
200
150
100
50
0
0
0.5
1
1.5
2
2.5
3
A0 value
BASEMAT5 horiz
Aspel horiz
BASEMAT5 vert
Aspel vert

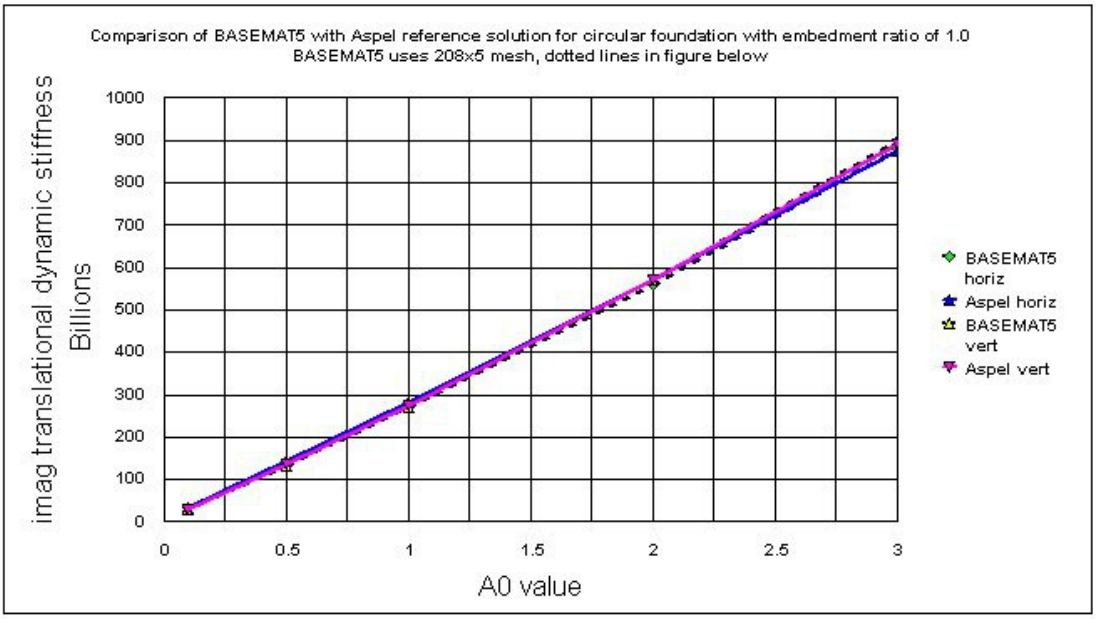

Comparison of BASEMAT5 with Aspel reference solution for circular foundation with embedment ratio of 0.5
BASEMAT5 uses 208x3 mesh , dotted lines in figure below
real rotational dynamic stiffness
Trillions
150
100
50
0
0
0.5
1
1.5
2
2.5
3
A0 value
BASEMAT5 rock
Aspel rock
BASEMAT5 tors
Aspel tors

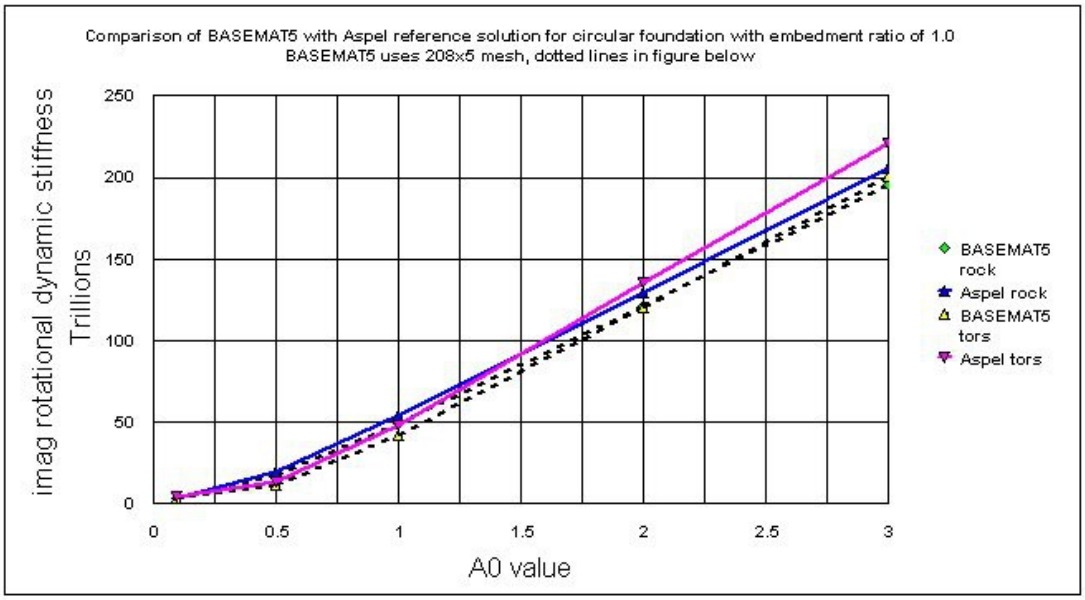

Comparison of BASEMAT5 with Aspel reference solution for circular foundation with embedment ratio of 0.5
BASEMAT5 uses 208x3 mesh , dotted lines in figure below
imag translational dynamic stiffness
Billions
700
600
500
400
300
200
100
0
0
0.5
1
1.5
2
2.5
3
A0 value
BASEMAT5 horiz
Aspel horiz
BASEMAT5 vert
Aspel vert


Comparison of BASEMAT5 with Aspel reference solution for circular foundation with embedment ratio of 0.5
BASEMAT5 uses 208x3 mesh , dotted lines in figure below
imag rotational dynamic stiffness
Trillions
150
100
50
0
0
0.5
1
1.5
2
2.5
3
A0 value
BASEMAT5 rock
Aspel rock
BASEMAT5 tors
Aspel tors


Comparison of BASEMAT5 with Aspel reference solution for circular foundation with embedment ratio of 1.0
BASEMAT5 uses 208x5 mesh, dotted lines in figure below
real translational dynamic stiffness
Billions
300
250
200
150
100
50
0
0
0.5
1
1.5
2
2.5
3
A0 value
BASEMAT5 horiz
Aspel horiz
BASEMAT5 vert
Aspel vert


Comparison of BASEMAT5 with Aspel reference solution for circular foundation with embedment ratio of 1.0
BASEMAT5 uses 208x5 mesh, dotted lines in figure below
real rotational dynamic stiffness
Trillions
250
200
150
100
50
0
0
0.5
1
1.5
2
2.5
3
A0 value
BASEMAT5 rock
Aspel rock
BASEMAT5 tors
Aspel tors


Comparison of BASEMAT5 with Aspel reference solution for circular foundation with embedment ratio of 1.0
BASEMAT5 uses 208x5 mesh, dotted lines in figure below
imag translational dynamic stiffness
Billions
1000
900
800
700
600
500
400
300
200
100
0
0
0.5
1
1.5
2
2.5
3
A0 value
BASEMAT5 horiz
Aspel horiz
BASEMAT5 vert
Aspel vert


Comparison of BASEMAT5 with Aspel reference solution for circular foundation with embedment ratio of 1.0
BASEMAT5 uses 208x5 mesh, dotted lines in figure below
imag rotational dynamic stiffness
Trillions
250
200
150
100
50
0
0
0.5
1
1.5
2
2.5
3
A0 value
BASEMAT5 rock
Aspel rock
BASEMAT5 tors
Aspel tors