RTFN - 22 102230 CUP

| | |
|---|---|
| Project Name: | Res. Treatment Fac. North |
| Project Number: | S303237 |
| Date: | 6/20/2022 |
| Project Engineer: | RWD |

# BOUSSINESQ LIVE LOAD ANALYSIS - FIRE TRUCK / LARGE SERVICE VEHICLE

*Calculation Notes:* *Outrigger inputs per BCRA. Axle loading unknown; inputs taken from SGH MC-3500 structural evaluation.*

## LOAD INPUTS

| | | |
|---|---|---|
| Load - Axle A: | 24000 | *lbs* |
| Load - Axle B: | 24000 | *lbs* |
| Axle Spacing: | 4.3 | *ft* |
| Wheel Spacing (on axle): | 8.0 | *ft* |
| Average Tire Pressure: | 110.0 | *psi* |
| Mult. Presence: | 1.0 | *dim* |
| *Impact Factor* | *1.02* | *dim* |
| Outrigger Type: | Rectangular | *dim* |
| Dim A: | 24 | *in* |
| Dim B: | 24 | *in* |
| Max Outrigger Load: | 45000 | *lbs* |

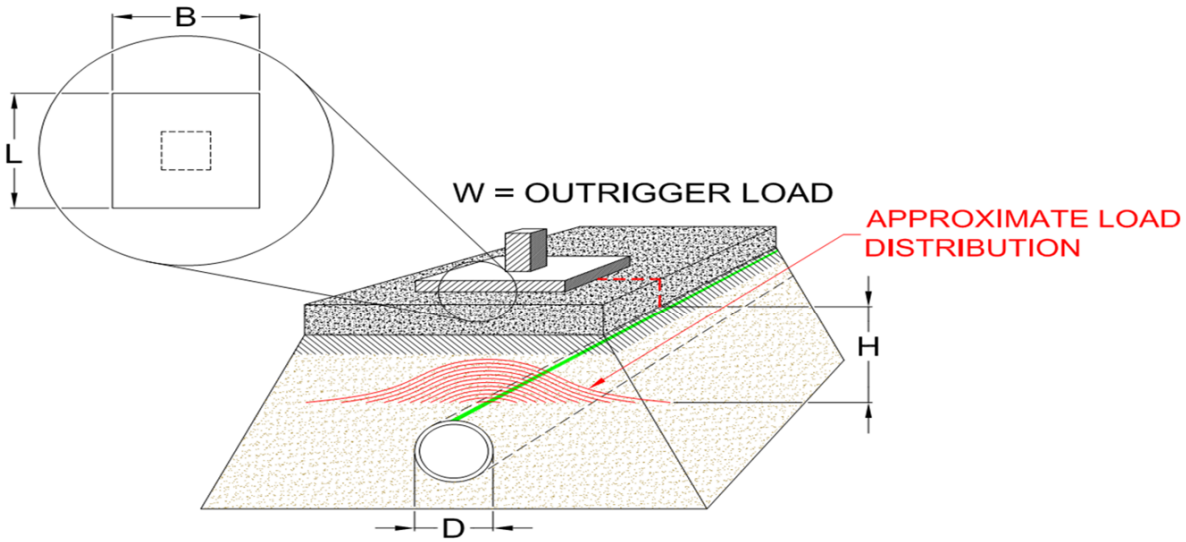
☐ Triple Axle Mode

## PRODUCT INPUTS

| | | |
|---|---|---|
| Product: | Chamber | *dim* |
| Size: | MC-3500 | *dim* |
| Cover: | 90 | *in* |

## PAVEMENT INPUTS

| | | |
|---|---|---|
| Pavement: | Flexible | *dim* |




## Results:

| | Total Pressure | |
|---|---|---|
| **Peak Wheel Pressure (psi):** | **1.73** | **7.98** |
| **Outrigger Pressure (psi):** | **2.18** | **8.43** |

**Wheel Load is OK up to 2 months**

**Outrigger Load is OK up to 2 months**

**Chamber Results**

| Min. (psi) | Max (psi) | Duration |
|---|---|---|
| 0.0 | 6.7 | Long-Term |
| 6.7 | 12.0 | 2 months |
| 12.0 | 13.9 | 1 week |
| 13.9 | 20.7 | 8 hours |
| 20.7 | | Not acceptable |

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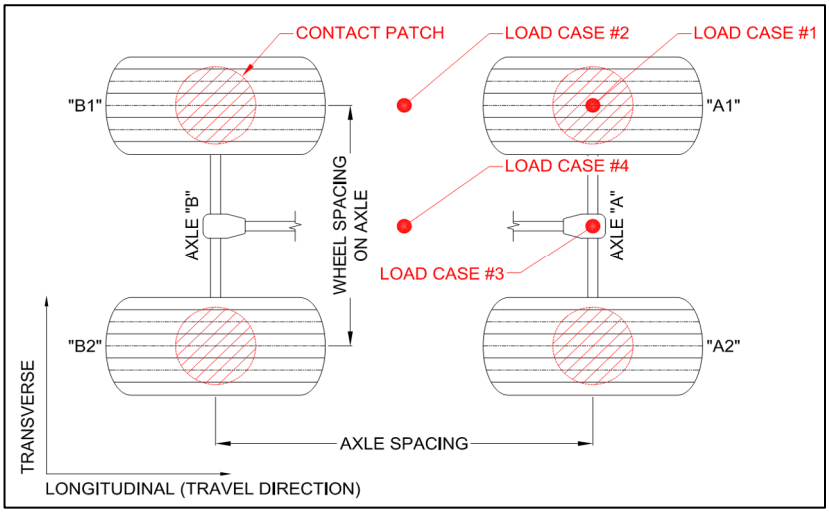
# Calculations:

## PRODUCT OFFSET & ANGLE COMPUTATIONS - WHEEL LOADS

Axle Spacing A-B: 4.3 *ft*

Wheel Spacing: 8.0 *ft*




| | AXLE LOADS - LOAD CASES | | | |
|---|---|---|---|---|
| | **1** | **2** | **3** | **4** |
| | *Total Offset, X (in)* | | | |
| **Wheel A1** | 0.0 | 26.0 | 48.0 | 54.6 |
| **Wheel A2** | 96.0 | 99.5 | 48.0 | 54.6 |
| **Wheel B1** | 52.0 | 26.0 | 70.7 | 54.6 |
| **Wheel B2** | 109.2 | 99.5 | 70.7 | 54.6 |
| | *Relative Product Angle - Pipe Parallel (deg)* | | | |
| **Wheel A1** | 0.0 | 0.0 | 90.0 | 61.6 |
| **Wheel A2** | 90.0 | 74.9 | 90.0 | 61.6 |
| **Wheel B1** | 0.0 | 0.0 | 42.7 | 61.6 |
| **Wheel B2** | 61.6 | 74.9 | 42.7 | 61.6 |
| | *Relative Product Angle - Pipe Transverse (deg)* | | | |
| **Wheel A1** | 90.0 | 90.0 | 0.0 | 28.4 |
| **Wheel A2** | 0.0 | 15.1 | 0.0 | 28.4 |
| **Wheel B1** | 90.0 | 90.0 | 47.3 | 28.4 |
| **Wheel B2** | 28.4 | 15.1 | 47.3 | 28.4 |

| **OUTRIGGER LOAD** | | |
|---|---|---|
| **Offset (in):** | 0.0 | *Outrigger loads are assumed to be spaced out such that interaction of multiple load does not occur. Therefore, the only outrigger load case is directly below the load (X=0). Wheel loads are assumed to be negligible when outriggers are loaded* |
| **Relative Product Angle (deg):** | 0.0 | |

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## FLEXIBLE PAVEMENT BOUSSINESQ COMPUTATIONS

| | | | | | |
|---|---|---|---|---|---|
| Cover, H = | 90 | *in* | Product: | Chamber | *dim* |
| [A] Wheel Radius, $r_A$ = | 6.0 | *in* | Size: | MC-3500 | *dim* |
| [B] Wheel Radius, $r_B$ = | 6.0 | *in* | Target Width: | 77 | *in* |
| Outrigger Type: | Rectangular | *dim* | [A] Wheel Load, $P_{WA}$ = | 12248 | *lbs* |
| Dim A: | 24 | *in* | [B] Wheel Load, $P_{WB}$ = | 12248 | *lbs* |
| Dim B: | 24 | *in* | Outrigger Load, $P_O$ = | 45000 | *lbs* |

$$r_A = \sqrt{\frac{P_{WA}}{p_{tire}\pi}}$$

$$P_{WA} = \left(\frac{P_{XA}}{2}\right) * IM * MP$$

| | AXLE - LOAD CASE | | | |
|---|---|---|---|---|
| | **1** | **2** | **3** | **4** |
| | *Normalized Depth Factor - H/r* | | | |
| **All Wheels** | 15.118 | | | |
| | *Normalized Offset Factor - X/r* | | | |
| **Wheel A1** | 0.000 | 4.364 | 8.063 | 9.168 |
| **Wheel A2** | 16.126 | 16.706 | 8.063 | 9.168 |
| **Wheel B1** | 8.728 | 4.364 | 11.882 | 9.168 |
| **Wheel B2** | 18.336 | 16.706 | 11.882 | 9.168 |

**Notes**

*Boussinesq Coefficent for each wheel/outrigger and load case (below) are selected from* ***Appendix A*** *using the normalized factors above.*

| | AXLE LOAD - LOAD CASE | | | |
|---|---|---|---|---|
| | **1** | **2** | **3** | **4** |
| | *Average Boussinesq Coefficient, C - Pipe Parallel (dim)* | | | |
| **Wheel A1** | 0.010 | 0.007 | 0.004 | 0.003 |
| **Wheel A2** | 0.000 | 0.000 | 0.004 | 0.003 |
| **Wheel B1** | 0.001 | 0.007 | 0.000 | 0.003 |
| **Wheel B2** | 0.000 | 0.000 | 0.000 | 0.003 |
| **Pressure:** | **1.21** | **1.48** | **1.01** | **1.22** |
| | *Average Boussinesq Coefficient, C - Pipe Transverse (dim)* | | | |
| **Wheel A1** | 0.010 | 0.008 | 0.002 | 0.002 |
| **Wheel A2** | 0.000 | 0.000 | 0.002 | 0.002 |
| **Wheel B1** | 0.004 | 0.008 | 0.000 | 0.002 |
| **Wheel B2** | 0.000 | 0.000 | 0.000 | 0.002 |
| **Pressure:** | **1.49** | **1.73** | **0.54** | **0.67** |

**Max Wheel Pressure:** **1.73**

$$p = \frac{CP}{\pi r^2}$$

*Where:*
- *P = Wheel Load*
- *C = Avg. Bousssinesq Coefficient*

| OUTRIGGER LOAD | | |
|---|---|---|
| Average Boussinesq Coefficient, C = | 0.028 | *Rectangular Outrigger. Boussinesq coefficient deteremined using Rectangular load approximation. Solution requies superposition of multiple, intermediate loads. Refer to App. B for an example* |
| **Outrigger Pressure:** | **2.18** | |