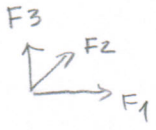
okAgenda

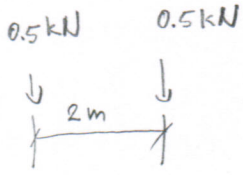
Subject: INCIDENT 18434 / TEST 13281
Subtask: VERIFICATION OF HORIZONTAL MOVING LOADS
Prepared by: ok Date: 5/8/2015
Sheet No. 1 of



CASE A

VERTICAL

VEHICLE ELEVATION



VEHICLE AXLE

EXPECTED REACTIONS:

$F1 = F2 = 0$

$F3 = 1kN$

$M1 = (1.5m)(0.5kN) = 0.75\,kN\text{-}m$ ... consider just 1 wheel (reduction of response severity not allowed)

$M2 = (20m)(1kN) = 20\,kN\text{-}m$

CENTIFOGAL

CENTRIFOGAL LOADS

$$F_c = -c\,\frac{V_c^2}{g}\,\frac{W}{R} = (-1)\,\frac{(20m/s)^2}{(9.80665\,\frac{m}{s^2})}\,\frac{(1kN)}{(100m)} = -0.4079\,kN$$

EXPECTED REACTIONS:

$F2 = 0.4079\,kN$

$M1 = (0.4079\,kN)(10m) = 4.079\,kN\text{-}m$

M1 FOR LOADS ACTING AT MID THICKNESS OF DECK $= (0.4079kN)(9.85m) = 4.0178\,kN\text{-}m$

BRAKING

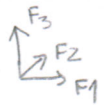
FACTOR FOR AXLE LOADS = 0.25

EXPECTED REACTIONS:

$F_1 = (0.25)(1\,kN) = 0.25\,kN$

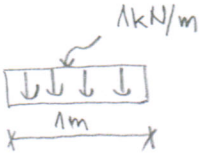
$M_2 = (0.25\,kN)(10m) = 2.5\,kN$

M_2 FOR LOADS ACTING AT MIDTHICKNESS OF DECK $= (0.25\,kN)(9.85m) = 2.4625\,kN\text{-}m$

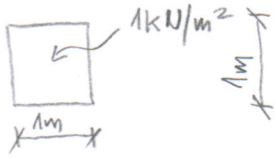


CASE B

VERTICAL



VEHICLE ELEVATION



VEHICLE PLAN

EXPECTED REACTIONS:

$F1 = F2 = 0$

$F3 = 1kN$

$M1 = (1kN)(1m) = 1kN\text{-}m$

$M2 = (1kN)(19.5m) = 19.5kN\text{-}m$

CENTRIFUGAL

EXPECTED REACTIONS:

SAME AS FOR CASE A

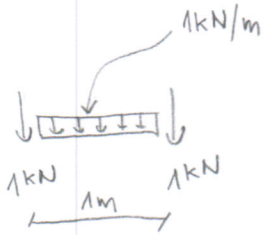
BRAKING

EXPECTED REACTIONS:

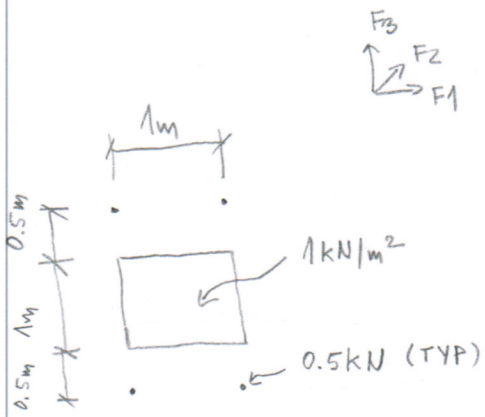
SAME AS FOR CASE A

CASE C

VERTICAL



VEHICLE ELEVATION



VEHICLE PLAN

NOTE:

VEHICLE LOADS (AXLE AND UNIFORM) ARE APPLIED 2m ABOVE THE DECK.

EXPECTED REACTIONS:

$F1 = F2 = 0$

$F3 = 3\,kN$

$M1 = \underbrace{(1.5m)(1kN)}_{\text{Axle}} + \underbrace{(1m)(1kN)}_{\text{uniform at the edge of lane}} = 2.5\,kN\text{-}m$

$M2 = (3kN)(19.5m) = 58.5\,kN\text{-}m$

CENTRIFUGAL

USE SIMILAR CALCULATION AS FOR CASE A

EXPECTED REACTIONS:

$F2 = (3)(0.4079\,kN) = 1.2237\,kN$

$M1 = (1.2237\,kN)(10\,m + 2\,m) = 14.6844\,kN\text{-}m$

↑ vehicle cg is 2 m above the deck (note that the 2m distance is only considered when there are sufficient vertical loads to prevent overturning, which is not the case for the present model)

$M_1' = (1.2237\,kN)(10\,m - 0.15\,m) =$
$= 12.053\,kN - m$

BRAKING

USE SIMILAR CALCULATION AS FOR CASE A

FACTOR FOR UNIFORM AND AXLE LOADS = 0.5

EXPECTED REACTIONS:

$F1 = (0.5)(3\,kN) = 1.5\,kN$

$M2 = (1.5\,kN)(10\,m + 2\,m) = 18\,kN\text{-}m$

↑ not considered for braking in the current implementation

$M_2' = (1.5\,kN)(10\,m - 0.15\,m) = 14.775\,kN\text{-}m$

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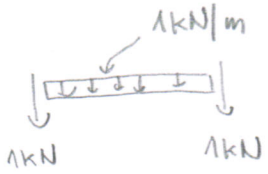
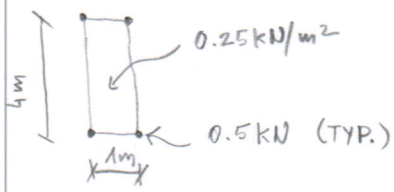
VERT + CENTR

10m WIDE LANE AND 4m WIDE VEHICLE HAVE BEEN USED FOR THIS LOAD CASE IN ORDER FOR THE OVERTURNING LOADS TO BE SMALLER THAN THE VERTICAL LOADS SO THAT OVERTURNING CAN BE CONSIDERED.



VEHICLE ELEVATION



VEHICLE PLAN

EXPECTED REACTIONS:

$F_Z = 1.2237\ kN$ (SAME AS CENTRIFUGAL LOADS ONLY)

$M_1 = \underbrace{(3kN)(3m)}_{\text{VERT. LOADS}} + \underbrace{(1.2237kN)(9.85m + 2m)}_{\text{CENTIFUGAL LOADS}} =$

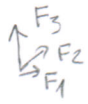
$= 23.5006\ kN\text{-}m$

$F_3 = 3kN$

$F_1 = 0kN$

CASE D

THE VEHICLE IS THE SAME AS FOR CASE C



CENTRIFUGAL

CENTRIFUGAL LOADS

$$F_c = -c\,(L_c)\,\frac{W}{R} = (-1)(20\,m)\frac{3\,kN}{100\,m} =$$

$$= 0.6\,kN$$

EXPECTED REACTIONS

$$F_2 = 0.6\,kN$$

$$M_1 = (0.6\,kN)(10\,m + 2\,m) = 7.2\,kN\text{-}m$$

↑ NOT CONSIDERED DUE TO ZERO VERTICAL LOAD

$$M_1' = (0.6\,kN)(10\,m - 0.15\,m) = 5.91\,kN\text{-}m$$