1

This section will detail the Straight bus lane calculations

$width_{NormalBus} := 2.55\,\mathrm{m} = 2.55\ \mathrm{m}$

This is from source A.

$width_{NormalLane} := 3.5\,\mathrm{m} = 3.5\ \mathrm{m}$

This is from source B.

$width\_\_NormalBus \cdot x = width\_\_NormalLane \xrightarrow{\text{solve for x}} [[x = 1.372549020]]$

With this proportion we calculate the width of our lane based on the width of our bus

$width\_\_OurBus := 10.3\,\mathrm{cm} = 10.3\ \mathrm{cm}$

$width\_\_OurLane := width_{OurBus} \cdot 1.372549020 = 14.13725491\ \mathrm{cm}$

2

this section will detail the calculations of the Turning bus lane required width
from source A we know that a bus is required to have its required area + 0.3 meters leeway to each side.
The following is calculation of the required area of the bus

2. 1

This section will detail the Calculation of maximal turn angle of a bus road
The following information is all from source A
An brief explanation of the formula use in this subsection can be found in the 2. 2 sub section
since this is simply a reversal of the aproch used in that subsection.

The distance between the centre of front wheels and back wheels
$l := 6\,\mathrm{m}$:

The distance between the centre of the front wheels to the front of the vehicle
$g := 2.72\,\mathrm{m}$:

The distance between the back wheels and the centre of the vehicle
$a_2 := 3.28\,\mathrm{m}$:

The width of the vehicle
$W := 2.55\,\mathrm{m}$:

The distance in strange units
$9.78 = 9.78$

The distance of 10 meters in the same units, using the knowlege that it coresponds to 10 meters
we calculate the distance in strange units that corresponds to 1 meter

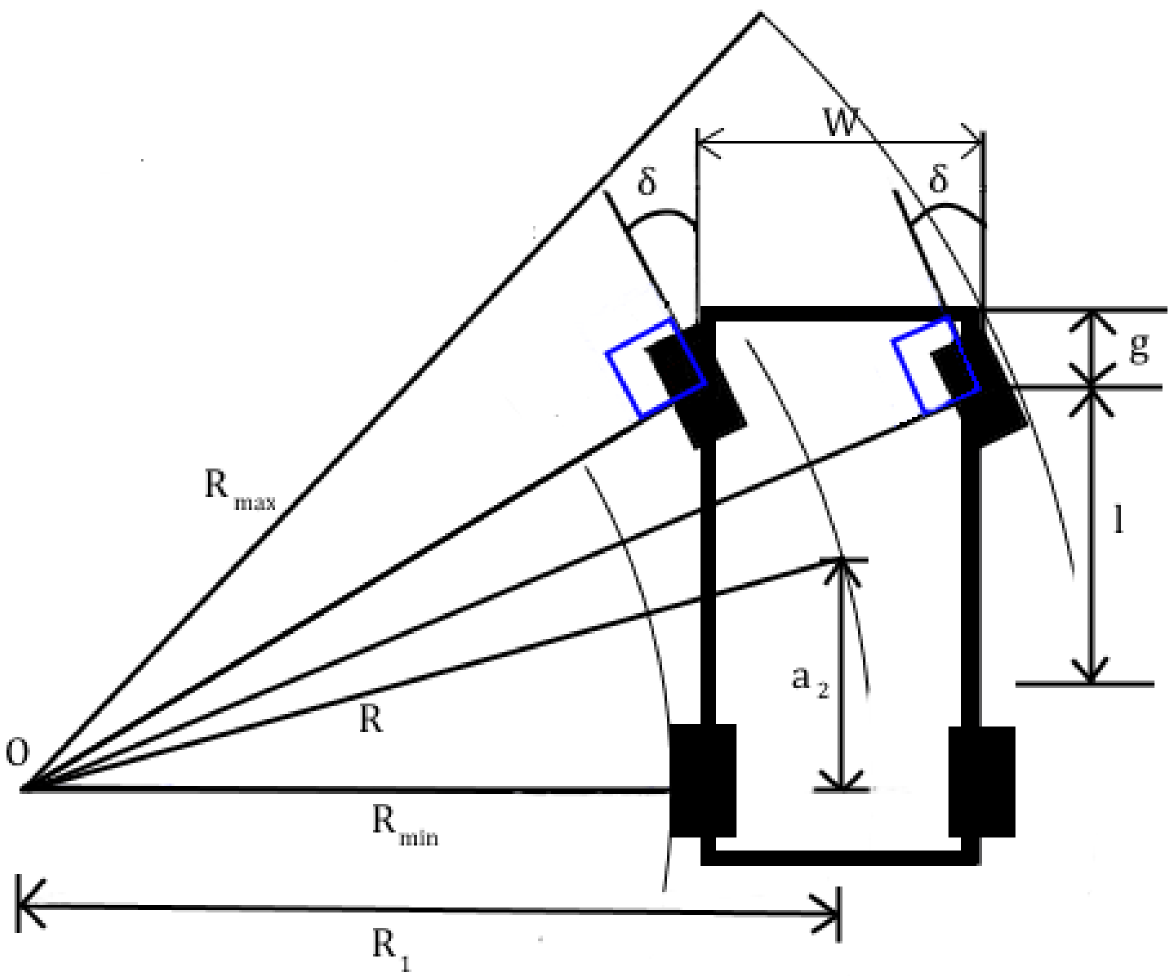
$\frac{5.03}{10} = 0.5030000000$

Calculation of the distance in meters

$\frac{9.78}{0.5030000000} = 19.44333996$

Diameter of bus turn

$D_{min} := 19.44333996\,m = 19.44333996\ m$



origial formula:

$D_{min} \cdot 0.5 = R_1 - \left(\frac{W}{2}\right)$:

isolated R_1:

$R_1 := 0.5\ D_{min} + \frac{W}{2} = 10.99666998\ m$

öriginal formula:

$R_1 = \sqrt{R^2 - a_2^2}$:

isolated R:

$R := \sqrt{R_1^2 + a_2^2} = 11.47541505\ \mathrm{m}$

original formula:

$R := \sqrt{a_2^2 + l^2 \cdot \cot(\delta)^2}$:

isolated Degrees:

$\delta := \operatorname{arccot}\left(\sqrt{\frac{R^2 - a_2^2}{l^2}}\right) = 0.4994740131$

$convert(\delta, degrees) = 28.61775292\ degrees$

restart

2. 2

This section will calculate the turning radius and required turning area
This details the calculation of the area of the bus when turning the maximal allowed degrees
The following data is from the bus created for this project

The distance between the centre of front wheels and back wheels

$l := 23\,\mathrm{cm}$:

The degrees the front wheels are turning, converted into radians
this number is from the maximal calculated road turning angle

$\delta := 28.61775293 \cdot 0.0174532925 = 0.4994740126$

The distance between the centre of the front wheels to the front of the vehicle

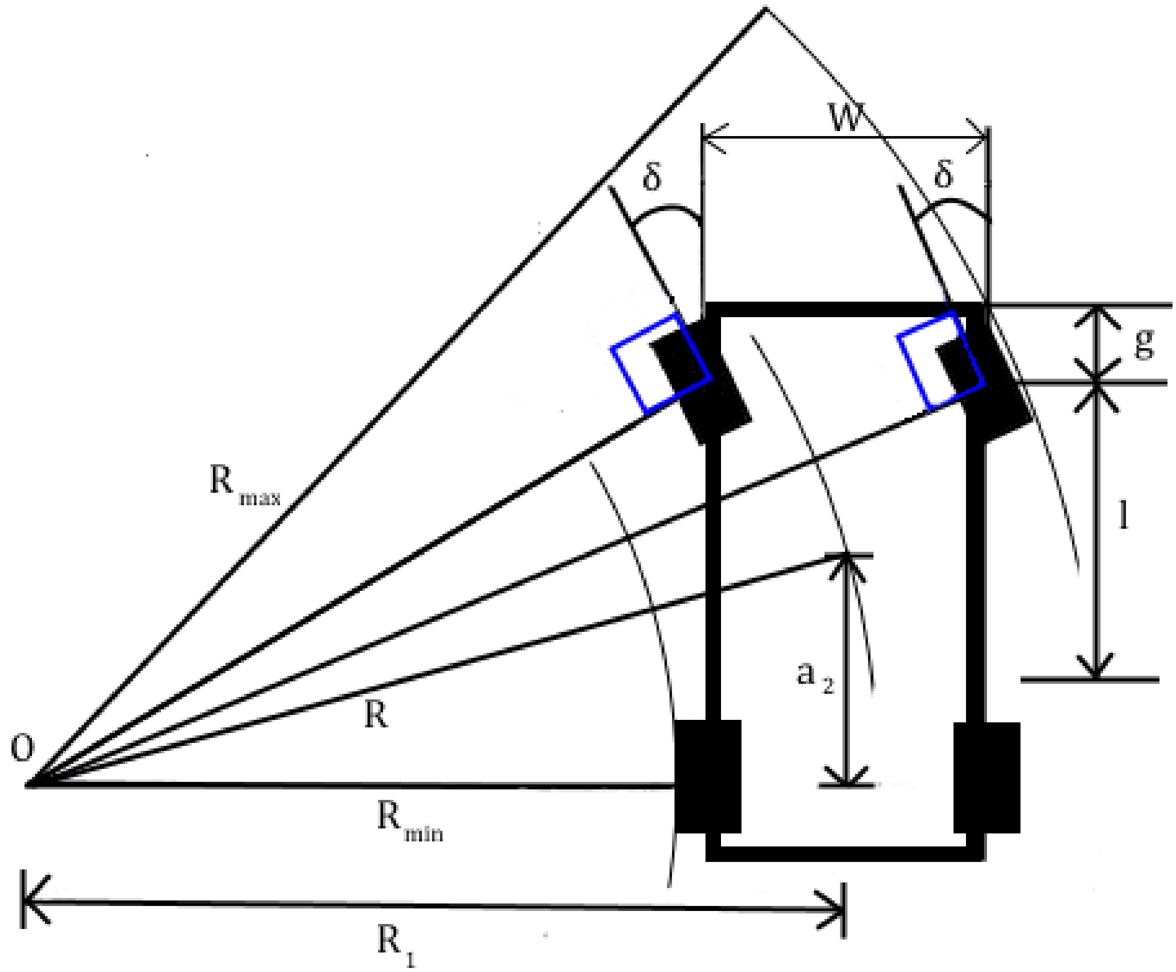
$g := 6\,\mathrm{cm}$:

The distance between the back wheels and the centre of the vehicle

$a_2 := 11.5\,\mathrm{cm}$:

The width of the vehicle

$W := 10.3\,\mathrm{cm}$:



Calculation of the radius to the centre using the cotangent function and the Pythagorean theorem

$R := \sqrt{a_2^{\,2} + l^2 \cdot \cot(\delta)^2} = 43.69440954 \text{ cm} \xrightarrow{\text{at 5 digits}} 43.694 \text{ cm} \xrightarrow{\text{simplify symbolic}}$
0.4369400000 m

Using the calculated radius we calculate the distance from the centre of rotation to the centre of the vehicle again using the Pythagorean theorem

$R_1 := \sqrt{R^2 - a_2^{\,2}}\ 42.15390166 \text{ cm}$

Calculating the minimal radius, subtracting half of the width of the vehicle from the radius to the center of the vehicle

$R_{min} := R_1 - \left(\frac{W}{2}\right) = 37.00390166 \text{ cm}$

Calculating the maximum radius again by using the Pythagorean theorem

$R_{max} := \sqrt{\left(R_{min} + W\right)^2 + (l + g)^2} = 55.48566582 \text{ cm}$

Difference between the radius's

$R_{\Delta} := R_{\max} - R_{\min} = 18.48176416\ \mathrm{cm}$

Diameters

$\mathrm{D}_{\max} := R_{\max} \cdot 2 = 110.9713316\ \mathrm{cm}$

$\mathrm{D}_{\min} := R_{\min} \cdot 2 = 74.00780332\ \mathrm{cm}$

$\mathrm{D}_{\max} + \dfrac{20.9 - 14.13}{2}\ \mathrm{cm} \xrightarrow{\text{at 5 digits}} 114.36\ \mathrm{cm} =$

$R_{\min}\ 37.00390166\ \mathrm{cm} \xrightarrow{\text{remove units}} 0.3700390166 \xrightarrow{\text{assign to a name}} R_{mi}$

$R_{\max} = 55.48566582\ \mathrm{cm} \xrightarrow{\text{remove units}} 0.5548566582 \xrightarrow{\text{assign to a name}} R_{mx}$

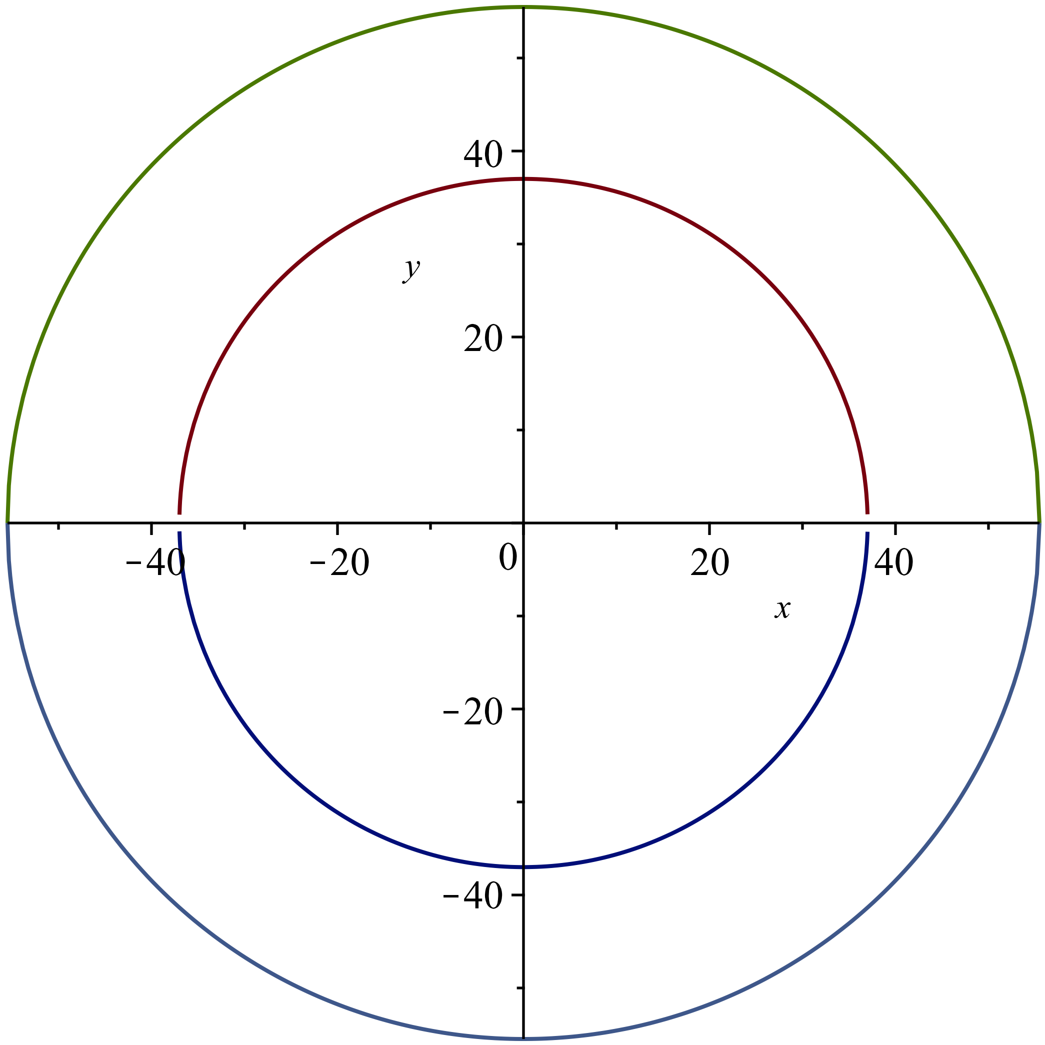
$c_{\min} := x\text{\^{}}2 + y\text{\^{}}2 = (100 \cdot R_{mi})^2 :$

$cplot_{\min} := solve(\ c_{\min}, y\ ) :$

$c_{\max} := x\text{\^{}}2 + y\text{\^{}}2 = (100 \cdot R_{mx})^2 :$

$cplot_{\max} := solve(\ c_{\max}, y\ ) :$

$plot(\ [cplot_{\min}, cplot_{\max}], x = -(100 \cdot R_{mx}) \mathinner{..} (100 \cdot R_{mx}), y = -(100 \cdot R_{mx}) \mathinner{..} (100 \cdot R_{mx}), scaling = constrained\ );$



2.2.1

This is simply a overview of the calculated radiuses

$$R_{max\Delta} := \frac{\mathrm{D}_{\mathrm{max}}}{2} = 55.48566580\ \mathrm{cm}$$

$$R_{min\Delta} := \frac{\mathrm{D}_{\mathrm{min}}}{2} = 37.00390166\ \mathrm{cm}$$

$$R_{\Delta 2} := R_{max\Delta} - R_{\mathrm{min}} = 18.48176414\ \mathrm{cm}$$

$$width_{OurLane} := 14.13725491\,\mathrm{cm} = 14.13725491\ \mathrm{cm}$$

this is equal to 0.1 meters in the new scale(since we know *width__OurLane* is 3.5 m)

$$zeroPointOneMeters := \frac{width\_\_OurLane}{35} = 0.4039215689\ \mathrm{cm}$$

$leeway := zeroPointOneMeters \cdot 6 = 2.423529413\ \mathrm{cm}$

$width\_\_OurTurning := leeway + R_{\Delta 2} = 20.90529355\ \mathrm{cm}$

$R_{minNew} := R_{max\Delta} - width_{OurTurning} = 34.58037225\ \mathrm{cm}$

3

This section shows the calculations of the difrance in width from straight to curved road

$$witdth_{\Delta OnEachSide} := \frac{width_{OurTurning} - width_{OurLane}}{2} = 3.384019320\ \mathrm{cm}$$