# EZ-Traffic-AI

## User Guide (Version 1.5)

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Contents:

# UE 4.25 - 4.27

## Overview:

These traffic blueprints are your easy guide to creating a traffic system for small environments for your game. With a few easy clicks, you can set up a pretty complex traffic system on your own. Although it's the first release and there might be some bugs in the code but eventually, they will be removed and interesting features will be added.

Link to the project: This will be updated once uploaded.

Link to tutorials:

Demo: Will be updated soon

Guide to implement custom models: Will be updated soon

Features

- Easy and intuitive blueprints.
- Splines align to landscape with one click.
- Automatically assign nearby roads and communicates to cars.
- Traffic light is just drop and click and it automatically aligns with the roads.
- Flexible control with many variables.
- Takes U-turn in case you didn't place any roads ahead.
- One-way roads are supported.
- Simulate 90 cars at more than 90 FPS.
- Per road car spawn amount control.

## Variable and Blueprint guide:

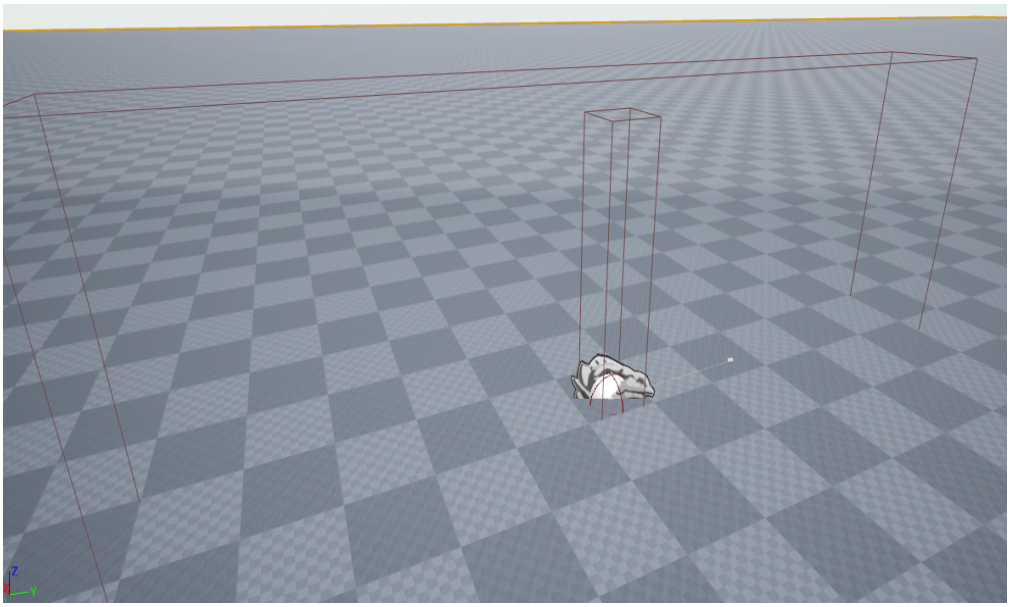
There are a ton of variables to give you the maximum flexibility to tweak the settings to your liking. The cars run on tick for the steering but roads and traffic lights don't run on the tick to reduce the performance hit. The car right now uses Pawn sensing but this will be removed shortly with the next update to boost performance.

There is a total of 5 blueprints, Road splines, Road Boss (the main controller and initializer and Setup BP), Sedan AI (Car), Traffic Light 4way, and Traffic Light 3 way. The main controls are situated in the Road splines, Road boss and few in the Traffic lights. Let's explore one by one.

Road-Splines:

Below is a picture of how a road spline will look when placed in the map. It has a spline, some collision boxes, that's all. Now how to we convert it to spline for the car to follow. Its simple, just drag the spline along your road and be sure to place some extra spline

points if there are undulations on the map. (YOU DON'T NEED TO ADJUST THEM RIGHT NOW, I WILL DO THAT FOR YOU 😊)



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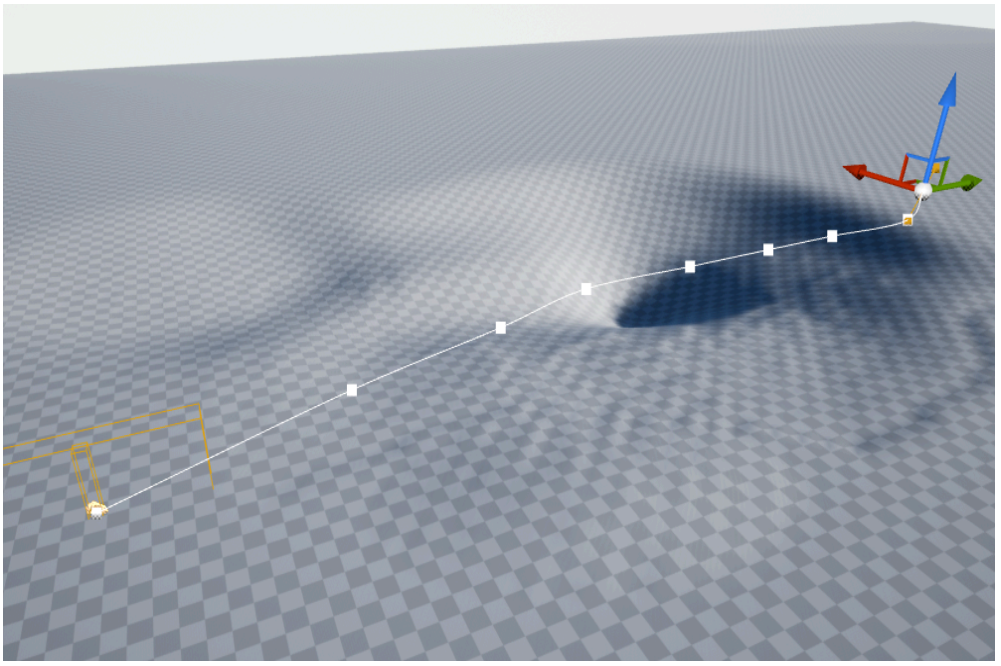
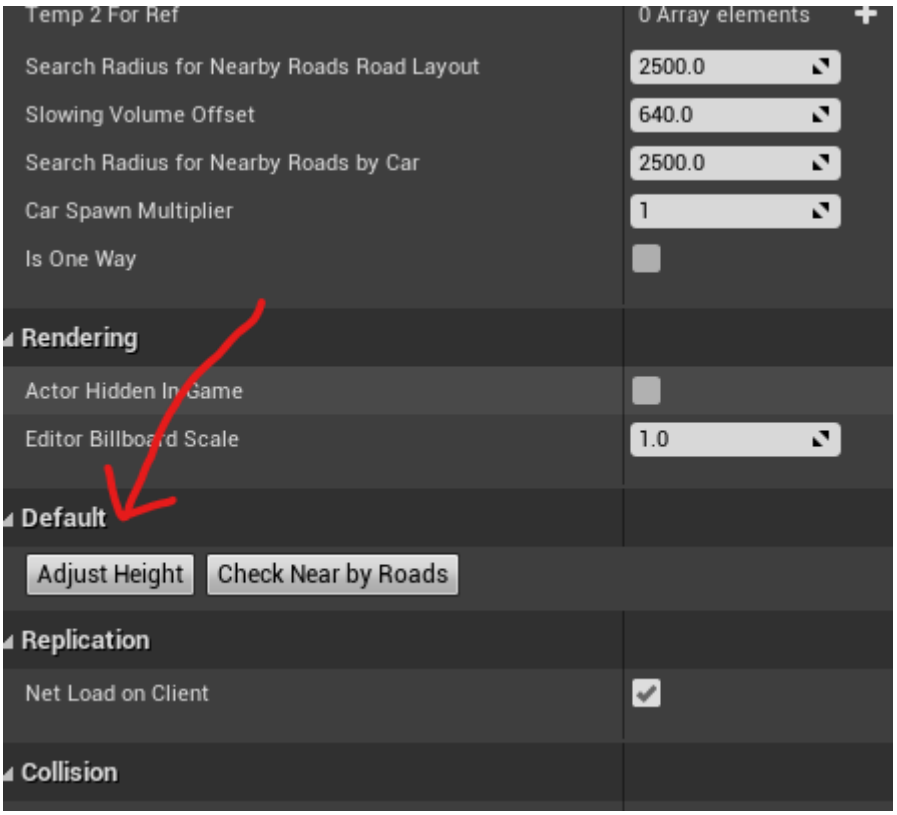
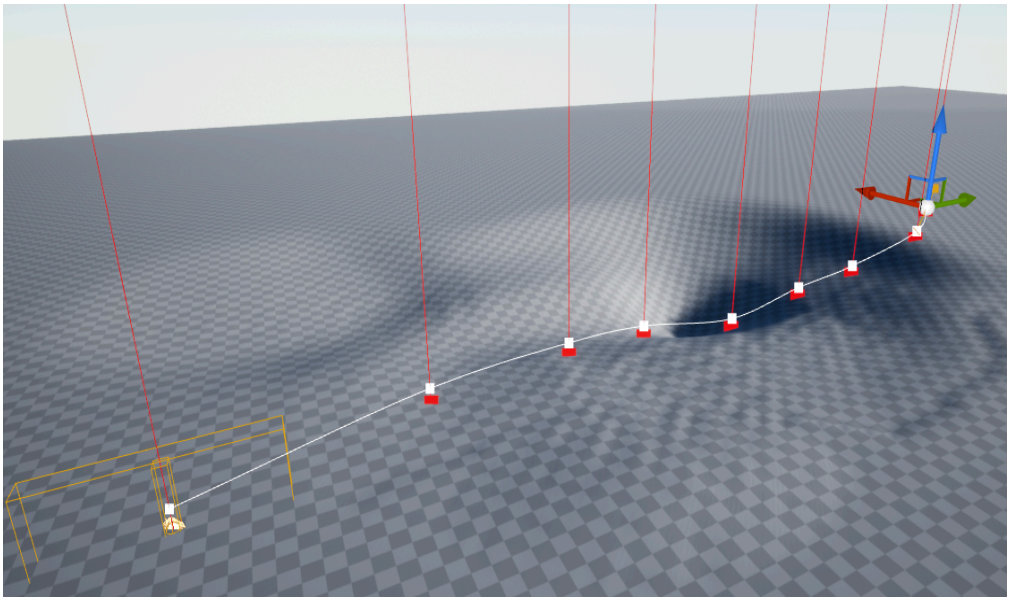
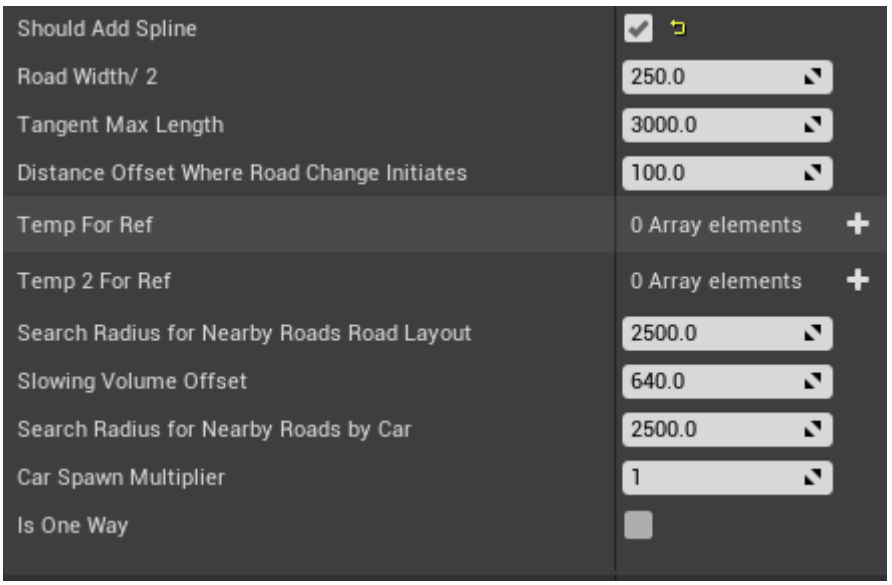


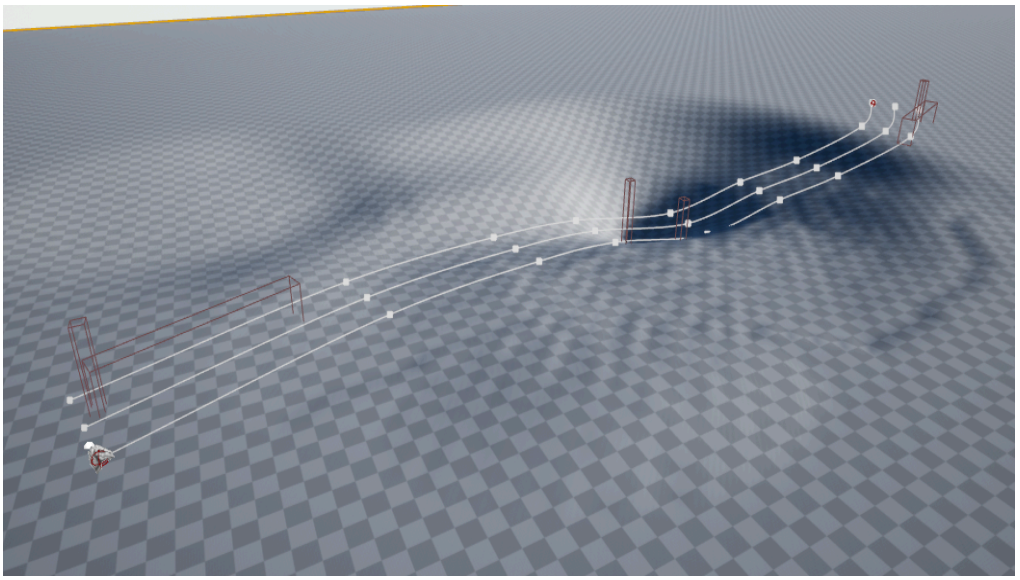
Now the variables will come into play. First of all what you should do is click the adjust height editor event. This will auto-align your spline to the required level.



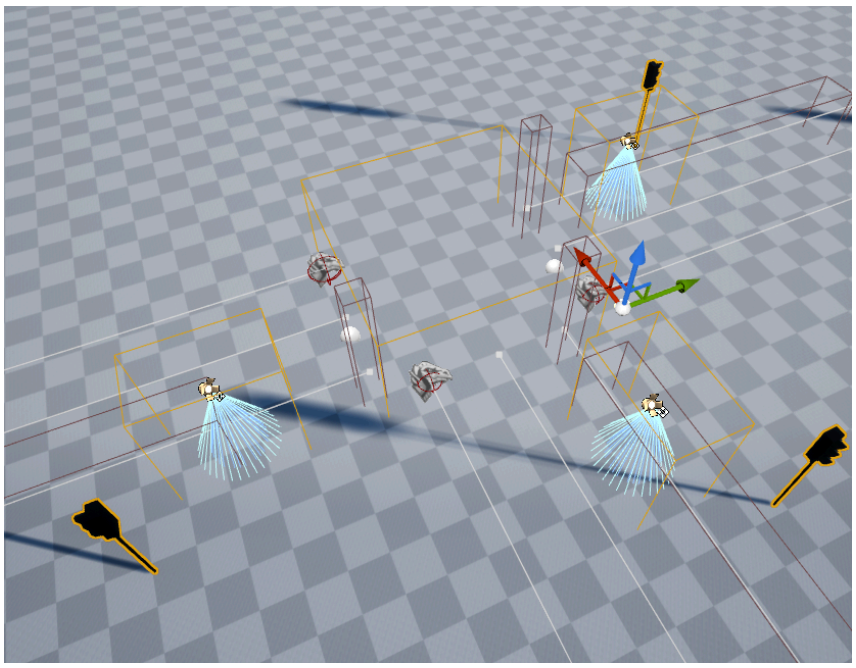
Then make the Boolean named “Should add spline”. This variable will add two more splines which are the ones the car will follow as left and right lane. Currently this BP supports right lane cars but I will increase the compatibility to use left lane cars also (like in London and India cars are driven on the left side). The splines will not be visible unless you click on some other actor, but you need not bother. Now let’s talk about the parameters. But before that you must do one last thing.



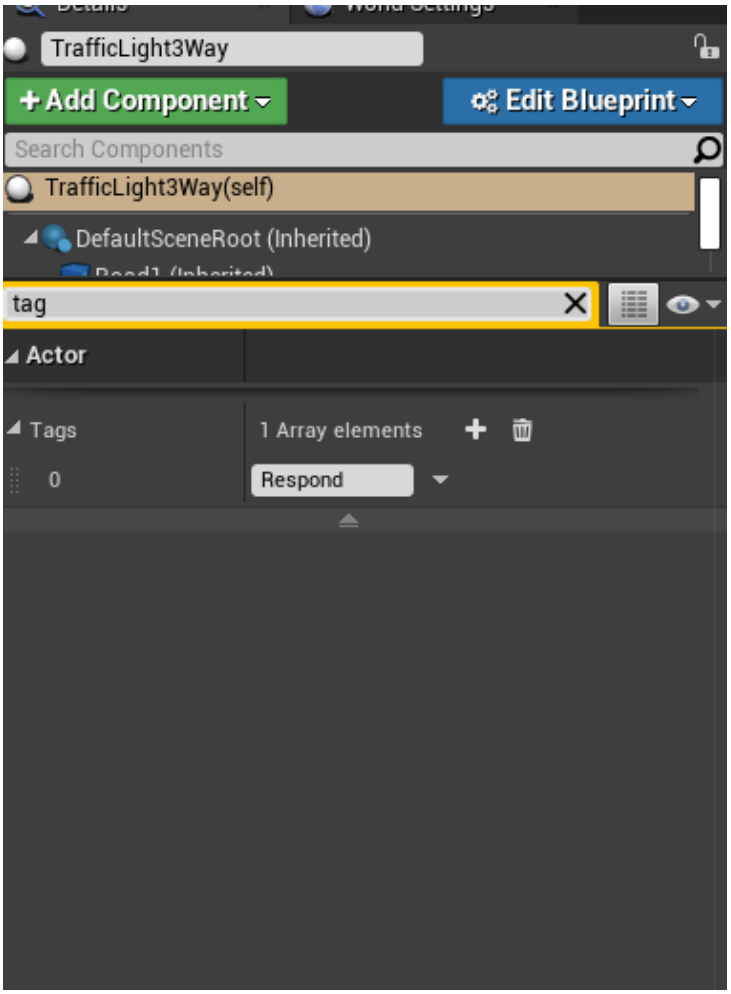



Next, you need to add the “Road Boss” blueprint which is like a central computer that makes your efforts less. Place it on the map after you have laid down your roads. You can keep adding new roads later also, no issues. Now place the traffic light blueprints in the junctions according to the number of roads, whether it’s a 4 way or 3-way junction. After all these are set up, select your Road- Boss BP and press the Event button named “Assign Roads” three-four times, you will notice that all your traffic lights will now align to the roads. Your roads are now complete and ready to use.

Sometimes the three-way traffic light misfires and doesn’t align (1 or 2 of them at max) In that case you need to align the collision mesh and the traffic light mesh along the specific roads and remove the actor tag named “Respond”

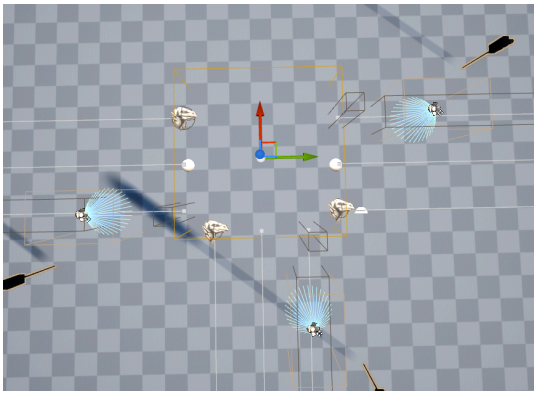


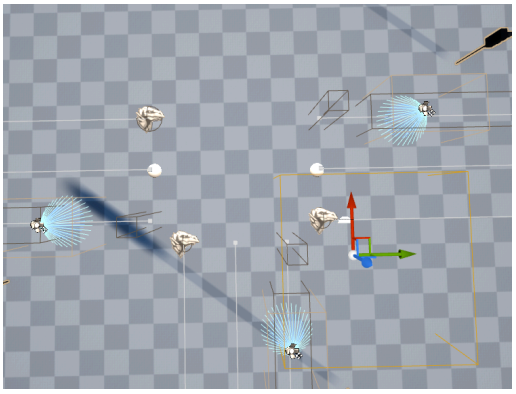
This is how it should look, otherwise do it manually



Tag to be removed, it will not be affected when you realign other traffic lights automatically using Road Boss BP

One more problem may arise where the mid-collision box that you are seeing in the last picture of traffic light isn't at the centre and it needs to be aligned properly for all such traffic lights.





The left one is correct where the collision box is in the middle and not touching much part of the connected roads

After all this is setup now let's learn about the variables:

Road Blueprint:

**Road Width:** Self Explanatory

**Should add spline:** This should be on and in case you updated your landscape and hit the "Height Adjust" your main spline will be updated but you need to toggle this Boolean to update the road splines too. Also sometimes you may need to manually update the rotation of the collision boxes at the end of the spline by the name "Box1/Box2" in case they don't update automatically.

**Tangent Max length:** Should not be touched but you can play with it to learn what it does, won't do anything in a straight road.

**Distance offset where Road change initiates:** Self Explanatory. Defines the position of the collision box that triggers road change. Keep it around 50-300.

**Temp for Ref/Temp 2 for Ref:** Will show the nearby roads closest to the selected road and is passed on to the car following the road. Can be used for debugging in case you feel some roads are not selected you can manually put them into the boxes. Temp for Ref normally shows the roads closer to the root of the main road spline, so take care of this direction in case you fill roads manually. The Temp2 For Ref shows roads closer to the end of the road.

**Search Radius for Nearby roads during Road Layout:** Does exactly what's written. For small junctions keep it around 2000-2500 and for bigger junctions with far away roads from each other use around 3000-4000. 2500 is the safe value for most use case but you need to do trial and error..

**Slowing Volume offset:** It determines the location of the slowing volume collision mesh (Box 1 and Box 2) from the end of the road. If you ask me I would try to adjust it such that the collision volume comes before all the collision volumes of the traffic lights so that my car can slow down before entering the traffic light area. If they are not aligning with the road, please align them manually.

**Search radius for Nearby Roads by car:** Keep this similar to the **Search Radius for Nearby roads during Road Layout** value.

**Car spawn multiplier:** Basically it multiplies the number of car to be spawned (number is defined in the Road Boss BP).

**Setting it 0 :** No car is spawn in that spline

**Setting it 1 :** Same number of cars as mentioned in the Road Boss BP

**Setting it 2:** Twice the amount mentioned in Road Boss BP

**Is One Way:** It makes the road one way and cars only travel from the root side to the other side. It's kind of a destructive setting and will make your Road BP unusable for Two way, so once you turn this on for some Road BP, delete it and replace it with a new Road BP if you want to revert it to a normal two-way road.

Road Boss Blueprint:

**Max Car Per Road:** Maximum cars it spawns at the beginning per road. It doesn't have auto spawn during the game which is a feature to be added soon. Right now, it spawns a fixed amount of cars per road and the amount stays constant.

**Min Car Per Road: Just to randomize**

**Traffic Light Change Duration:** The time in which the traffic light changes

**Traffic Light Collision Offset Along spline:** The collision component in the traffic light blueprint which makes the car to stop or go, and their position relative to the end point of the road can be defined by this. Keep it close to 150 or 200.

**Traffic Light mesh Offset Spline Side:** Offset of the traffic light mesh towards the right side of each road.

**Light Post Distance from Collision box:** Additional offset along the spline given to the static mesh components so that a turning car doesn't collide with them.

**Traffic light road search distance:** Keep it close to 1800-2500, you may need to play with this a bit. Start by placing only one of the traffic lights (preferably a 3way traffic light) and press Assign Roads function in the Road Boss BP. If it works well and good, if it doesn't delete the Traffic light, place a new one and again try. 2500 should

work well with normal junctions. Once it starts working, place other Traffic lights into your scene and press Assign Roads.

**Traffic Light Collision Box:**

Normal : 12 , 3, 8

Small Roads: 4, 3, 8

## Upcoming Updates:

1. Bug fixed if any is spotted.
2. Automatic spawning and despawning for open worlds. (Will be getting this update by december - UE5.10 version already has this update)
3. Parking System (Working on it - projected deadline is December end)
4. Bug fix for 3way Traffic light not aligning automatically

# UE 5.10 Preview Release 2

## Overview:

These traffic blueprints are your easy guide to creating a traffic system for small environments for your game. With a few easy clicks, you can set up a pretty complex traffic system on your own. It's an updated release with much more exciting features, although chaos being a new physics engine, there might be some bugs in the code but eventually, they will be removed and interesting features will be added on request basis. I am happy to say that the current version can scale up to much larger worlds, thanks to the automatic spawn and despawn system built into it.

Link to the project: This will be updated once uploaded.

Link to tutorials:

Demo: Will be updated soon

Guide to implement custom models: Will be updated soon

## Features:

- Easy and intuitive blueprints.

- Dynamic spawning system for scaling to larger worlds.
- Splines align to landscape with one click.
- Or even deform your landscape to the given spline. The option is yours.
- Automatically assign nearby roads, traffic lights and communicate to cars.
- Traffic light is just drop and click and it automatically aligns with the roads.
- Flexible control with many variables.
- Take a U-turn in case you didn't place any roads ahead.
- One-way roads are supported but still under development and avoid whenever possible.
- Simulate 50 cars at more than 150 FPS. (Avg 160 fps with 50 cars running on a mobile ryzen 7 4800h) (just for comparison of the cpu I get 160 fps on valorant due to cpu bottlenecking)
- Per road car spawn amount control and limit total active cars in the world.

## Variable and Blueprint guide:

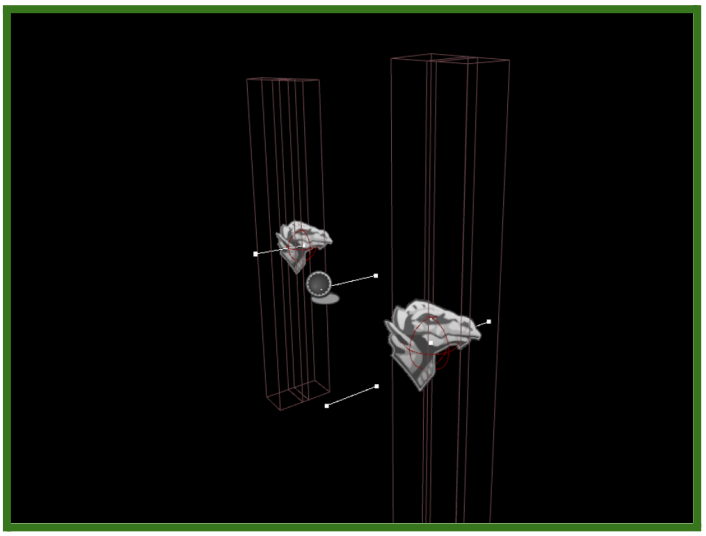
There are a ton of variables to give you the maximum flexibility to tweak the settings to your liking. The cars run on tick for the steering but roads and traffic lights don't run on the tick to reduce the performance hit. Pawn sensing has been removed as promised earlier.

There are a total of 6 blueprints: Road splines, Road Boss (the main controller and initializer and Setup BP), AI_traffic_master(Car), Spawner(do not touch), Traffic Light 4-way, and Traffic

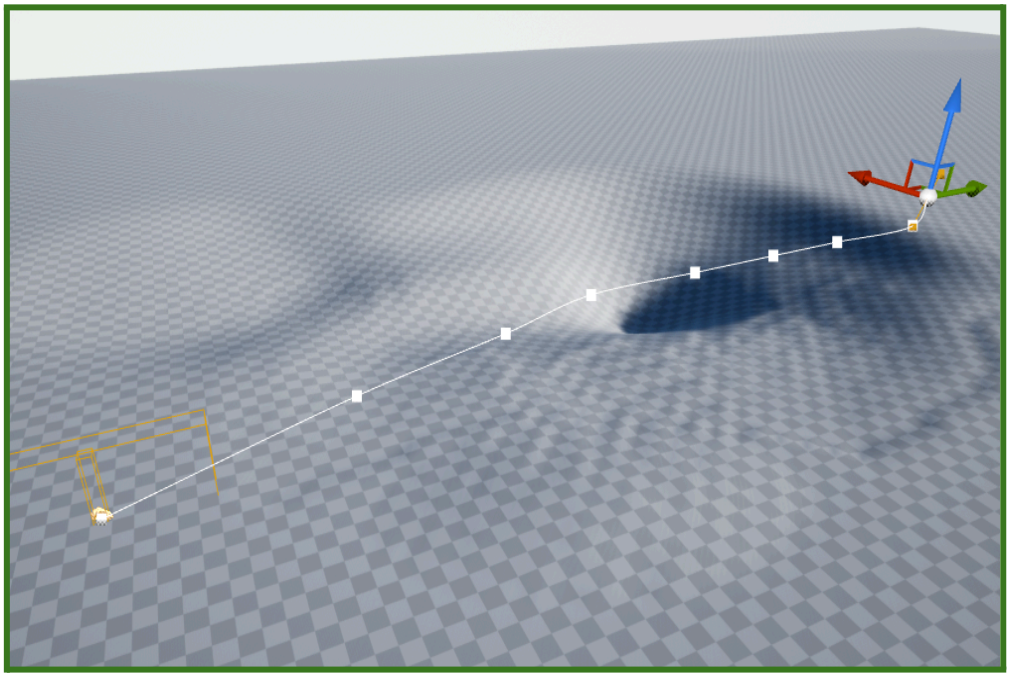
Light 3-way. The main controls are situated in the Road splines, Road boss and few in the Traffic lights. Let's explore them one by one.

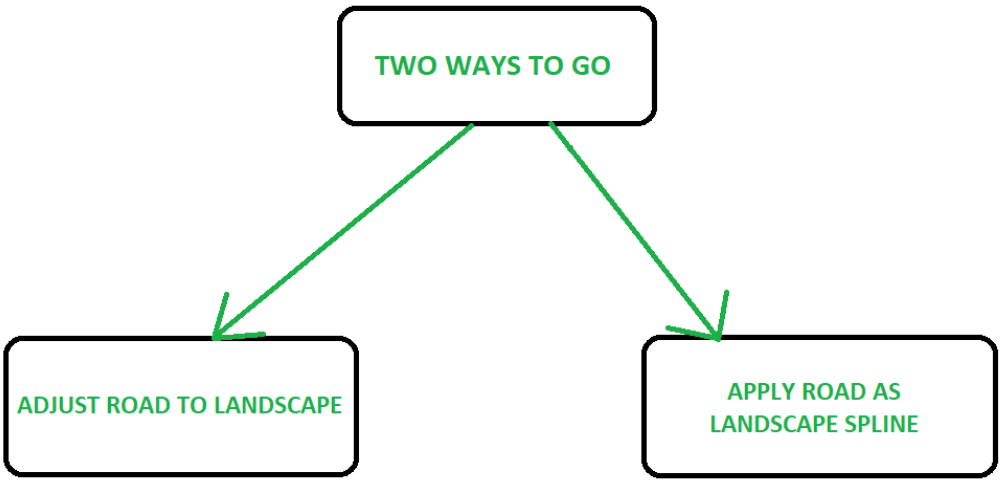
## ROAD-SPLINES:

Below is a picture of how a road spline will look when placed in the map. It has a spline, some collision boxes, that's all. Now how do we convert it to spline for the car to follow? It's simple, just drag the spline along your road and be sure to place some extra spline points if there are undulations on the map. (YOU DON'T NEED TO ADJUST THEM RIGHT NOW, I WILL DO THAT FOR YOU 😊)



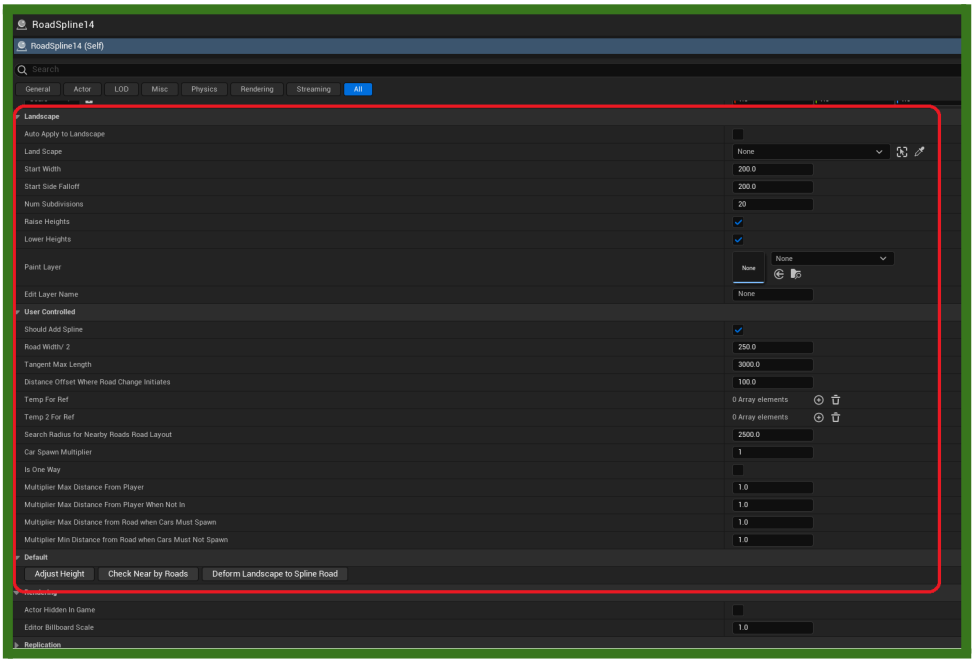
It should look like this:

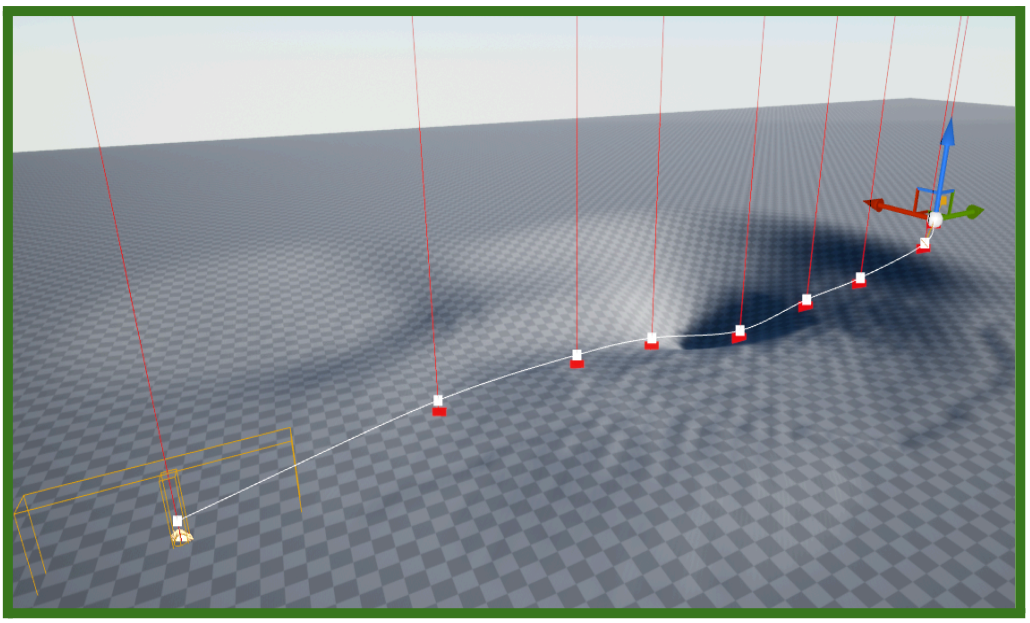




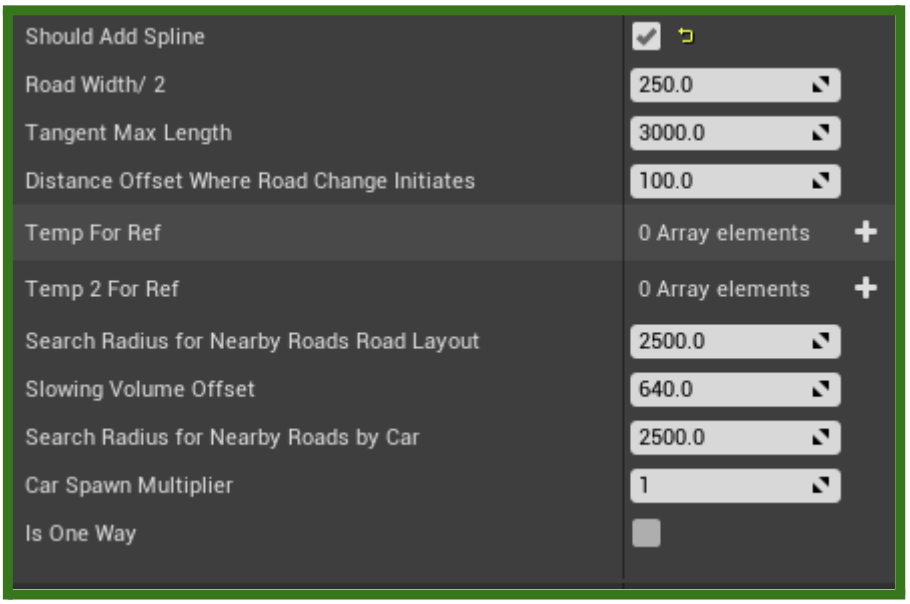

## 1) ADJUST ROAD TO LANDSCAPE:

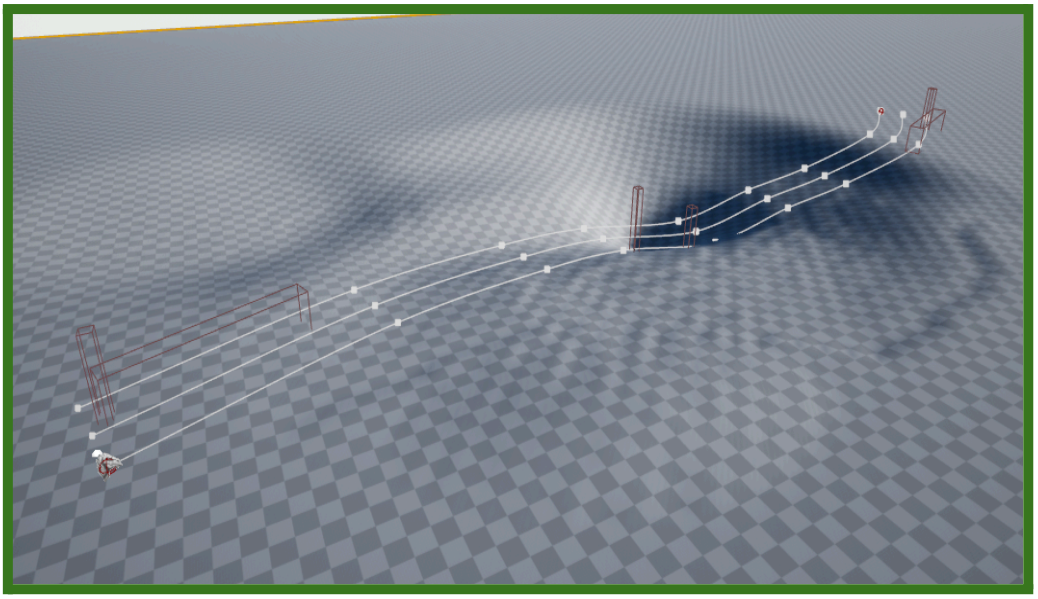
Now the variables will come into play. First of all what you should do is click the ADJUST HEIGHT editor event. This will auto-align your spline to the required level. You can find it in the default section as shown below.





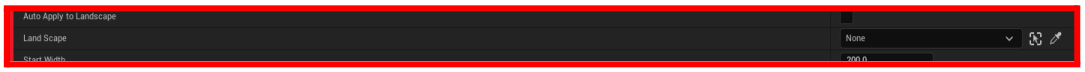
Then make the Boolean named “Should add spline”. This variable will add two more splines which are the ones the car will follow as left and right lane. Currently this BP supports right lane cars but I will increase the compatibility to use left lane cars also (like in London and India cars are driven on the left side). The splines will not be visible unless you click on some other actor, but you need not bother. Now let’s talk about the parameters. But before that you must do one last thing.



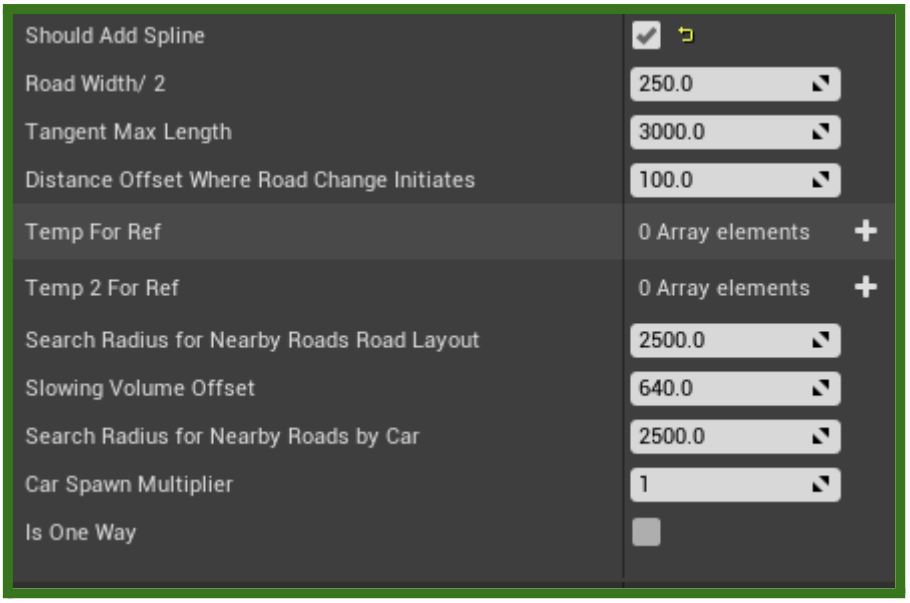


## 2) ADJUST LANDSCAPE TO ROAD:

This basically acts similar to a landscape spline that we work with in the landscape editor. All the variables in the LANDSCAPE section can be used to vary your spline properties. Once you set all the settings go to the default section of the road_spline bp and click on the button saying DEFORM LANDSCAPE TO SPLINE ROAD. But make sure to select your landscape before attempting anything, otherwise it won't do anything.



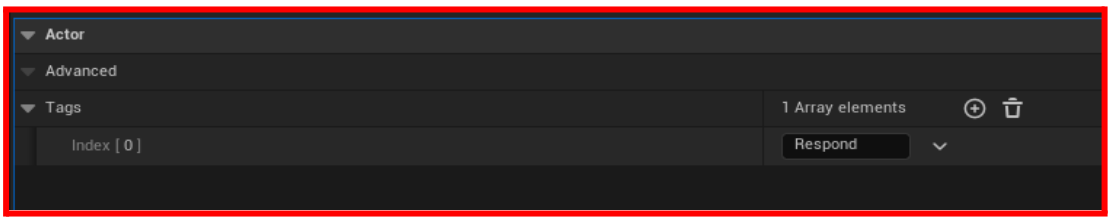

Then make the Boolean named "SHOULD ADD SPLINE". This variable will add two more splines which are the ones the car will follow as left and right lane. Currently this BP supports right lane cars but I will increase the compatibility to use left lane cars also (like in London and India cars are driven on the left side). The splines will not be visible unless you click on some other actor, but you need not bother. Now let's talk about the parameters. But before that you must do one last thing.

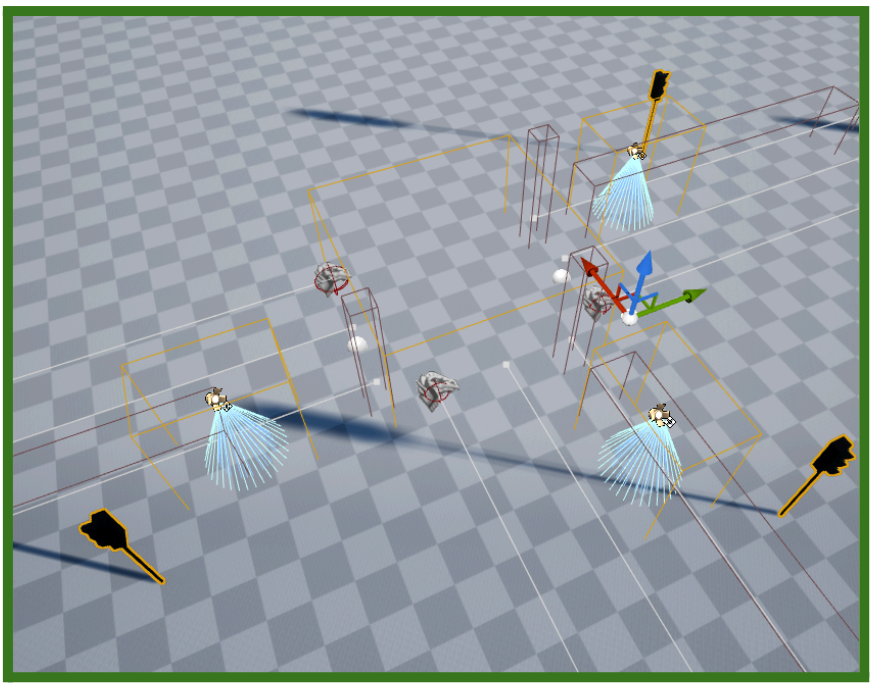



## ROAD-BOSS:

Next, you need to add the "Road Boss" blueprint which is like a central computer that makes your efforts less. Place it on the map after you have laid down your roads. You can keep adding new roads later also, no issues. Now place the traffic light blueprints in the junctions according to the number of roads, whether it's a 4 way or 3-way junction. After all these are set up, select your Road- Boss BP and press the Event button named "ASSIGN ROADS" three-four times, you will notice that all your traffic lights will now align to the roads. Your roads are now complete and ready to use.

Sometimes the three-way traffic light misfires and doesn't align (1 or 2 of them at max) In that case you need to align the collision mesh and the traffic light mesh along the specific roads and **remove** the actor tag named "Respond" from the traffic light causing error. Sometimes deleting and placing a new traffic light also eliminates this error.





**THIS IS HOW IT SHOULD LOOK, OTHERWISE DO IT MANUALLY**

Tag is to be removed, then it will not be affected when you realign other traffic lights automatically using Road Boss BP. It will not respond anymore to the "ASSIGN ROADS" editor event from the ROAD_BOSS BP

## After all this is setup now let's learn about the variables:

VARIABLES:

### Road Blueprint:

The Landscape section is the same as your regular landscape splines and I am skipping them.

User controlled section:

- **Road Width/2:** Self Explanatory
- **Should add spline:** This should be on and in case you updated your landscape and hit the "Height Adjust" your main spline will be updated but you need to toggle this Boolean to update the road splines too.
- **Tangent Max length:** Should not be touched but you can play with it to learn what it does, won't do anything in a straight road. For curved roads use higher values like around 30000-50000.

- **Distance offset where Road change initiates:** Self Explanatory. Defines the position of the collision box that triggers road change. Keep it around 50-300(max).
- **Temp for Ref/Temp 2 for Ref:** Will show the nearby roads closest to the selected road and is passed on to the car following the road. Can be used for debugging in case you feel some roads are not selected you can manually put them into the boxes. Temp for Ref normally show the roads closer to the root of the main road spline, so take care of this direction in case you fill roads manually. The Temp2 For Ref shows roads closer to the other end of the road spline.
- **Search Radius for Nearby roads Road Layout:** Does exactly what's written. For small junctions keep it around 2000-3000 and for bigger junctions with far away roads from each other use around 3000-4000. 3000 is the safe value for most use cases but you may need to do trial and error.
- **Car spawn multiplier:** Basically it decides how many spawners per road should be there. (Cars spawned per spawner is decided in the Road_Boss bp) Typically for small roads keep it 1, for very long roads you can keep as high as you want but keep it as low as possible to increase performance. Refer to the example map in the project. You can keep lower spawners but increase cars spawned per spawner to increase performance and unnecessary ticking actors in the world.

  **Setting it 0 :** No car is spawned in that spline

  **Setting it 1 :** Same number of cars as mentioned in the Road_Boss_BP

  **Setting it 2:** Twice the amount mentioned in Road_Boss_BP

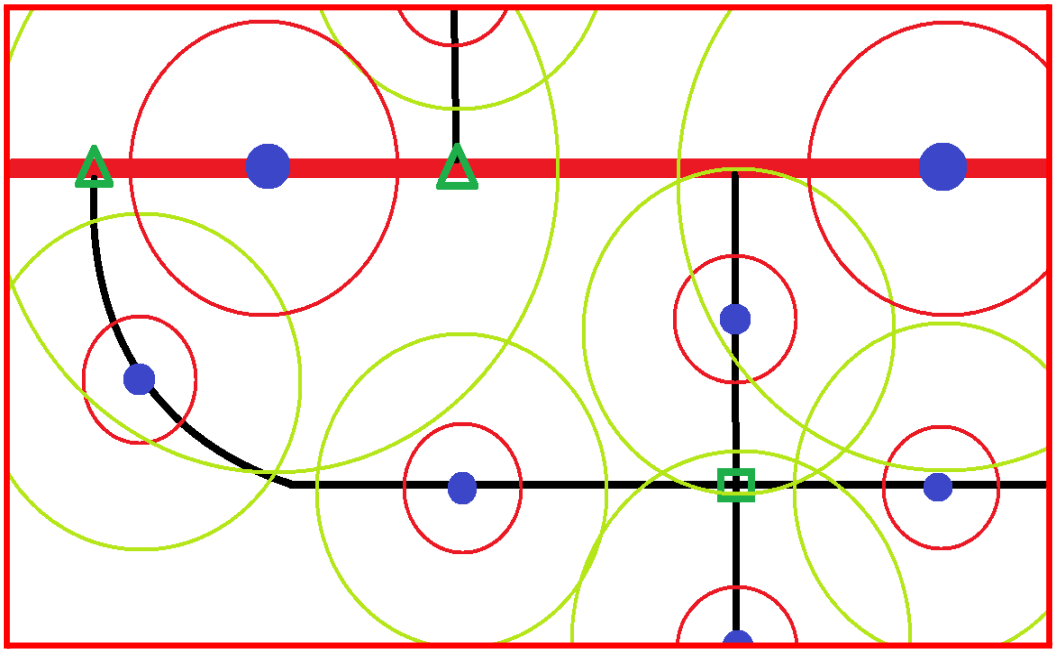
- **Is One Way:** It makes the road one way and cars only travel from root side to the other side. It's kind of a destructive setting and will make your Road BP unusable for Two way, so once you turn this on for some Road BP, delete it and replace with a new Road BP if you want to revert it to a normal two-way road. **(Experimental feature!!!)**
- **Multiplier Max Distance From Player:** Controls how far the car goes from the player before despawning. I will discuss this in the tutorial, but for easy calculation:

  **Setting it 1 (Default):** If the road is only visible from very small distances. Ex: alley ways.

  **Setting it between 1.2 - 1.5:** If the road is visible from a long distance. Start from 1.2 and increase it till you don't see any cars popping into the view from visible distance. Ex: Highways, long roads connected by traffic lights.

***1.25 is a sweet spot though in this case, consider sticking to it, unless extremely sure what you are doing.***

- **Multiplier Max Distance From Player when not in view:** Controls how far the car goes from the player before despawning when the **car is not in view**. Keep it at the default value of 1 and only increase it if you feel like when you look back and turn back again and some cars have just disappeared. **A max value of 1.25 is suggested.**
- **Multiplier Max Distance From Road when Car Must Spawn & Multiplier Max Distance From Road when Car Must Not Spawn:** Defines the region within which cars are spawned. See below for a demonstration. Of Course the circles are usually much bigger(radius close to road length) in real product but just for ease of visualization consider the radius of the green circles are defined by the **Multiplier Max Distance From Road when Car Must Spawn** and the red circle is **Multiplier Max Distance From Road when Car Must Not Spawn** , which means the car only spawns when with the are between the green and red circles for each SPAWNER (BLUE) . This spawning and despawning is occurring even when the player is standing idle but at a lower pace in order to avoid unnecessary cpu usage. Its hard to directly visualize this circles ingame so you might require a bit of trial and error to see if cars are popping in or being destroyed when in your view.



***ROADS AND SPAWNER VISUALIZATION WITH COLLISIONS***

## Road Boss Blueprint:

- **Max Car Per Road:** Maximum cars it spawns at the beginning per spawner per road (Since a road can have multiple spawners).
- **Min Car Per Road:** Minimum cars it spawns at the beginning per spawner per road (Since a road can have multiple spawners).
- **Max Cars in the world:** Total allowed cars at a time ± 2. For optimization purposes. So, your total car count at any point of time will be lower than this value.
- **Traffic Light Change Duration:** The time in which the traffic light changes
- **Traffic Light Collision Offset Along spline:** The collision component in the traffic light blueprint which makes the car to stop or go, and their position relative to the end point of the road can be defined by this. Keep it close to 150 or 200.
- **Traffic Light Mesh Offset from Spline towards its Side:** Offset of the traffic light mesh towards the right side of each road.
- **Traffic Light Mesh Offset Distance from Collision box:** Additional offset along the spline given to the static mesh components so that a turning car doesn't collide with them.
- **Traffic light road search distance:** Keep it close to **2500-3000**, you may need to play with this a bit. Start by placing only one of the traffic lights (preferably a 3-way traffic light) and press Assign Roads function in the Road Boss BP. If it works well and good, if it doesn't delete the Traffic light, place a new one and try again. 2500 should work well with normal junctions. Once it starts working, place other Traffic lights into your scene and press Assign Roads.
- **Traffic Light Collision Box:**

  Normal : 5 , 3, 8

  Small Roads: 3.5, 3, 8

The below 4 does the same thing as its named after and is best left at default settings. Will talk about it in tutorial video and it works similar to four similar variables in the ROAD_Spline BP. Basically the math is something like:

$$Required\ Range = Length\ of\ Road\ \text{X}\ Var(RoadSplineBP)\ \text{X}\ Var(RoadBoss\ BP)$$

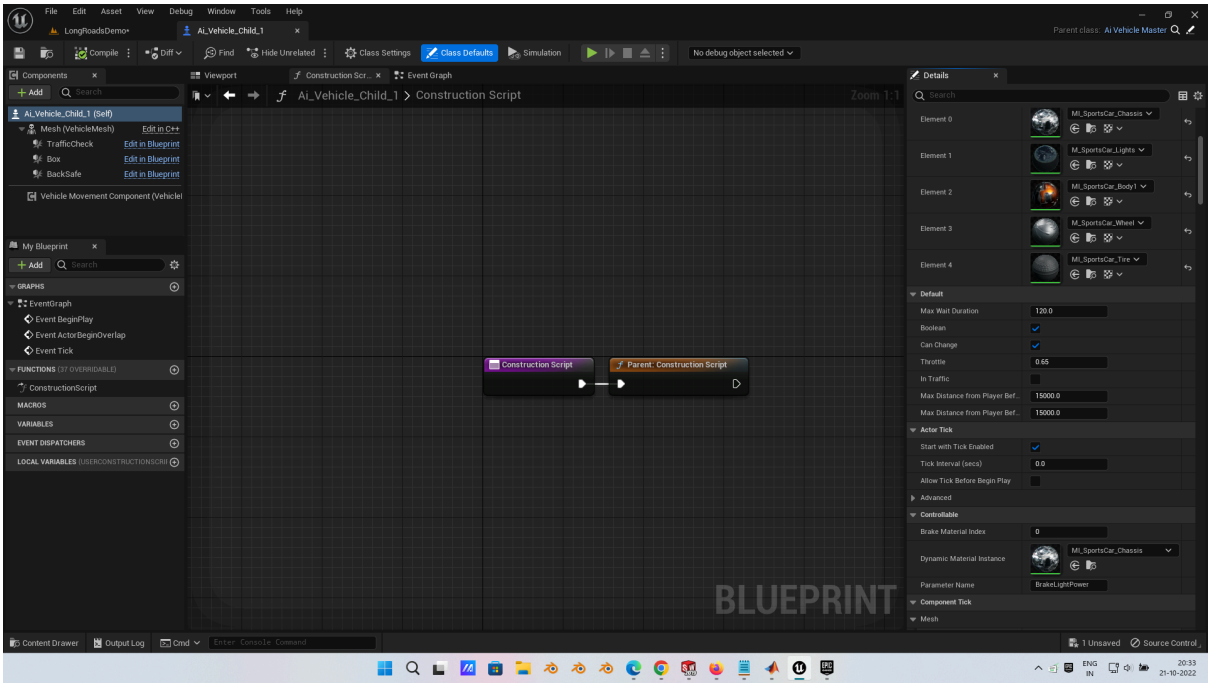
- **Scaled( x RoadLength)DistanceAtWhichCarDespawns**
- **Scaled( x RoadLength)DistanceAtWhichCarDespawns_IfNotInViewport**
- **Scaled( x RoadLength)MaxDistanceFromRoadWhenCarsMustSpawn**
- **Scaled( x RoadLength)MinDistanceFromRoadWhenCarsMustNotSpawn**

***NOTE: Remember to press the ASSIGN ROADS editor event in the ROAD_BOSS_BP everytime you change any settings to update it.***

## ADD YOUR VEHICLE:

Create a child blueprint of the AI_Vehicle_Master. Do the following:

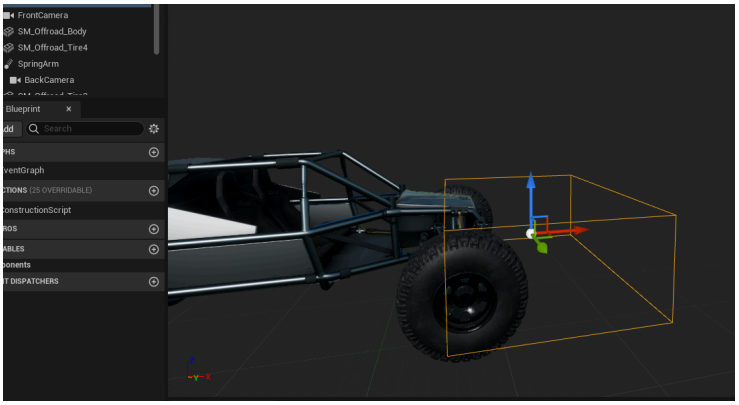
1. Change the mesh by selecting the skeletal mesh in the components menu.
2. Create an animation blueprint for your car and use it in the blueprint. (Lot of videos available on youtube for reference)
3. Rename the bones for your car wheels (Basically same as any car blueprint steps - refer the internet)
4. Select AI_vehicle_child in the components menu (left top) and in the details menu on the right scroll down to see the section named CONTROLLABLE and those three parameters you will need to change.
    a. If you don't want any brake lights leave that area and set BRAKE MATERIAL INDEX to some value greater than the number of materials your car has.
    b. If you want brake lights than select the index of your brake light material and in the dynamic brake material reference select the material instance you are using.
    c. In the parameter name write the name of the parameter you are using in your material to control the brightness or emissive power.



## ***BUGS and REQUIRED MEASUREMENTS TO AVOID IT:***

**Since UE5 is in its early stages I was facing some bugs related to the collision box of the cars not behaving properly which is why you need to follow these steps in order to avoid it.**

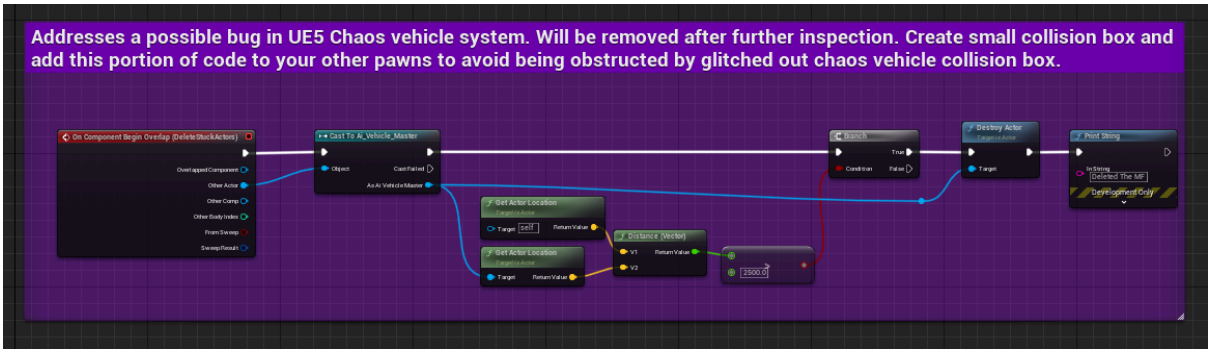
**Go to your player character and add a collision box:**




**Not necessarily this large but it should be close to the base and in front of the player pawn. (COLLISION PRESET: OVERLAP ALL)**

**In the case of a human character you can make it such that it covers the lower half of the character and just slightly bigger than the player capsule.**

**Add this code to the same box collision. You are good to go. I will do more tests where the bug is and try to resolve this by the next update.**




## CURRENT KNOWN BUGS

- **Vehicle sometimes stops driving when out of View. Must be something related to how chaos vehicles are optimised.**
- **Vehicle leaves behind a car collision mesh when out of view.**