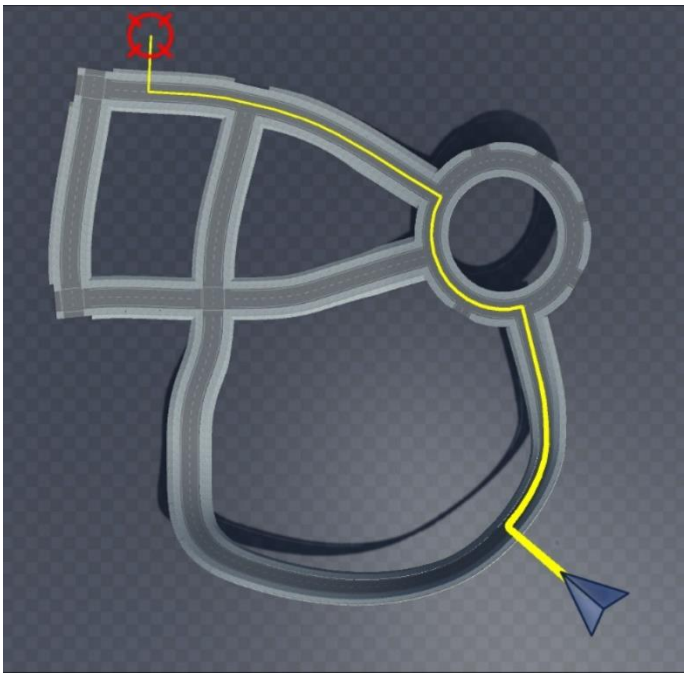
MB Road System



MB Road System allows you to:

- Create and shape roads, using any custom mesh that you want!
- Connect and disconnect roads from and to intersections.
- Automatically create a graph with correct edge-weights.
- Use that Graph for A* Pathfinding.

The package includes:

- All the scripts needed to visually edit the road system.
- Example meshes for roads.
- Example Prefabs for roads and intersections.

Getting Started

- Open the Road Editor-Window by clicking on `Tools/RoadSystem/Show Editor` or `Window/Road System Editor`.
- All buttons have custom ToolTips, so just hover over a button for more info.

Creating a new Road System

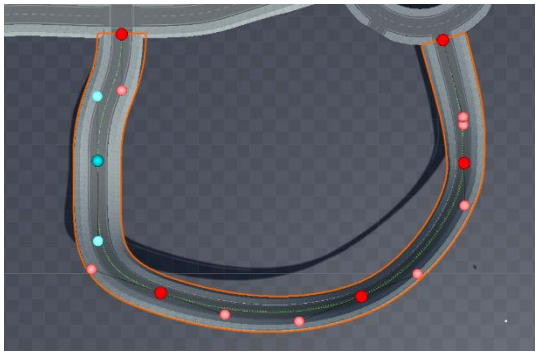
- Select the `GameObject` in the hierarchy, under which you want to create the `RoadSystem`, or nothing if the new `RoadSystem` should be a top-level object.
- Click the button labelled `Create a new Road System`.

Adding and Shaping Roads

- Select the `GameObject` in the hierarchy, under which you want to create the road.
    1. If the selected object is a road itself, or an intersection, the new road will be created on the same level in the hierarchy.
- If you want new roads to have certain settings, change the Prefab used for new roads by Alt-Clicking the button. Alternatively, you can find the Prefab slot in `Edit/Project Settings/Mb RoadSystem` under `Road Settings`.
- With the newly created road selected, you will see a green line representing the curve of the road, as well as yellow normals. The red spheres allow you to select a control point.
- If a control point is selected, you can view and edit its properties in the window that pops up in the scene view.

Tools

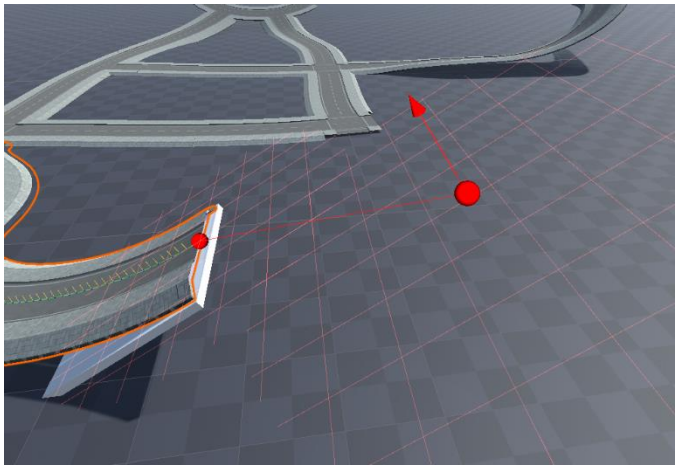
- **Move Tool**: Move individual point.
- **Rotate Tool**: Rotate control point, as you would expect.
- **Scale Tool**: Instead of the normal scale handles, the selected point will have two Bezier handles that you might know from image editing software. Since this is scale mode, only the length of the handles can be changed, not the angle.
- **Rect Tool**: This tool has been repurposed to function like a Bezier editor in other software. You can move control points and handles freely. Using orthographic view can be quite useful here.
- Transform Tool: No special functionality.
- `Editor Tool/Road System/Road Link Tool`: More on that later.

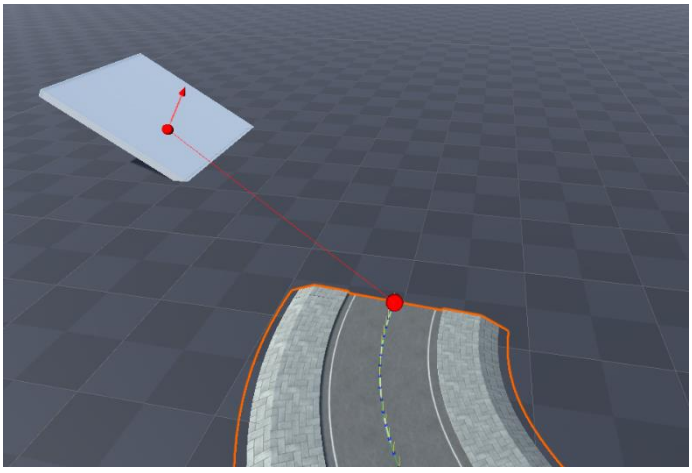


The Move-, Rotate-, and Scale-Tool will fall back to default functionality, if no control point is selected. Also, toggling the Tool Handle rotation (Shortcut: X) works on these tools.

Adding and Removing Control Points

- To remove a control point, select it and hit Backspace. The option can also be found under `Tools/Road System/Remove Point`
- There are three ways to add a control point:
    1. Holding shift, and left clicking to insert a point along the selected road.
    2. Extruding the selected end by pressing `Ctrl+E`, or clicking `Tools/Road System/Extrude`
    3. Extruding the selected or closest end to the cursor by Ctrl clicking.
        - If the option `Use Ray Cast` is enabled, the road will extend to where your mouse intersects with the scene, otherwise it will stay on the same depth relative to the camera.
        - If the option Copy Hit Normal is enabled, the new control point will have the same normal as the surface under your cursor, otherwise it will copy the orientation of the connected point if the pivot rotation is set to local, or the world's up vector otherwise.
        - Additionally, holding shift will extend horizontally on the y-coordinate of the selected end point, or relative to its orientation if the pivot rotation is set to local.

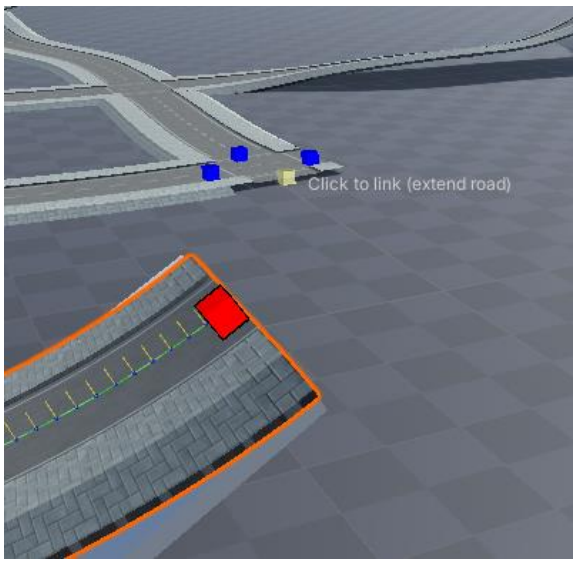




Adding Intersections

- You can add one of the existing intersections simply by dragging the Prefab of your choosing into the hierarchy. Make sure, however, that it is below the same `RoadSystem` as all your roads. Also, remember to move the intersection itself, and not the visible model.
- More on creating your own intersections later.

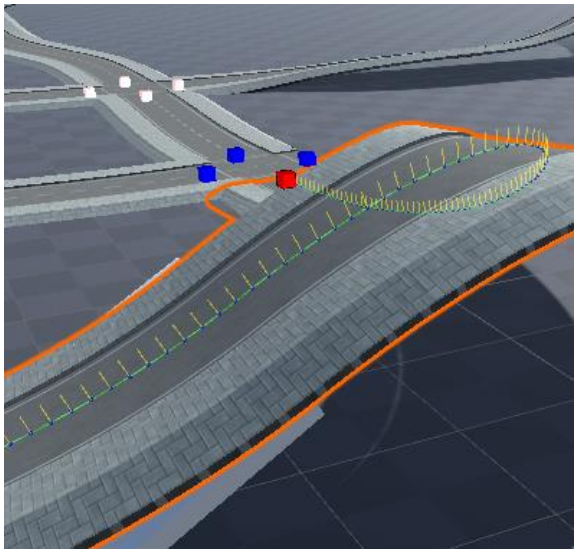
Connecting and Disconnecting Roads from and to Intersections



- First, activate the `Road Link Tool` either by finding it in the Editor Tools button (next to the transform tool), under `Tools/RoadSystem/Link Points`, or in the Road Editor Window.
- You are now able to select any disconnected road endpoint, disconnected intersection anchor point, or connected pair.

Connecting a Road to an Intersection

- Select either a disconnected road endpoint, or intersection anchor.
- Hold down shift and click the other point you want to connect to.
- This will move the road end point to the intersection.
- If you also hold down Ctrl, a new control point will be added to the road, so that it extends to the intersection.



Disconnecting a Road from an Intersection

- With a pair of points selected, the `Tools/RoadSystem/Unlink Point` option does just that. This also works if the Road Link Tool is not active.
- Alternatively, while in Road Link Tool mode, hold down Ctrl and click on the connection you want to sever.

Road System Navigator

`RoadSystemNavigator` is a `Monobehabiour` Script that continuously uses a road system to calculate the optimal path to a specified goal.

- Add the `RoadSystemNavigator` component to any `GameObject`
- Either drag the road system you want to use into the `Current Road System` slot or use a script to dynamically update it.
- Set the `Goal` attribute to the value you want, and that does not have to be on the road itself.
- You can use `Navigation Line Updater` script to automatically update a `LineRenderer` which represents the current path to the goal.

Adding your own Assets

The supplied roads and intersections only serve as a quick example as to what can be done with this tool. However, a lot more can be achieved by creating your own custom roads and intersections! You should know how to use a tool like blender, but there is no scripting skill needed for this.

Creating Custom Intersections

This part is very simple. You can look at the supplied prefabs to see for yourself. An intersection is structured in the following way:

- The Intersection itself: A `GameObject` with an `Intersection` component.
- Connection points for roads: Child `GameObjects` of the intersection, with a `RoadAnchor` component each. The road will point in the local positive z direction (forward), and the normal will face in positive y (up)
- The actual model itself is not actually needed, but if you add one, it should also be a child of the intersection.

The recommended workflow is as follows:

1. Create the model in Blender.
2. Create a new intersection in Unity (`GameObject` with an `Intersection` component)
3. Drag the model under the new intersection and position it so that the origin of the intersection lines up with where the roads intersect (Do not forget to add a collider!)
4. Add `RoadAnchors` and position them precisely. This might take some math on your hand or look at the vertex positions of the intersection model in blender to get exact coordinates and orientation. Trial and Error also is a viable option.
5. Optionally create a prefab from the new intersection.

Creating Custom Roads

Adding new Road Types is slightly more involved. The `Road` script itself, however, is very simple, and it is all you need to create a curve that connects intersections. This will also work with pathfinding, so you can use it if you already have a street model, and do not want to use the mesh generation.

If you want to use the mesh generation, these are the steps:

1. Create a model in blender.
    a. Make sure that it points the correct direction (along the **y-axis**), although that is not necessary. It just makes it easier since the default conversion in the mesh generator is from Blender space.
    b. Keep vertex counts low, because it affects how long your roads can be before Unity's vertex limit kicks in.
    c. The length of the road does *not* need to be grid-aligned.
2. Create a new road in Unity. The needed components are:
    a. `Mesh Filter` (leave the mesh slot empty)
    b. `Mesh Renderer` (remember the materials!)
    c. `Mesh Collider` (if you want collision, also leave the mesh slot empty)
    d. `Road`
    e. `Road Mesh Generator`
3. Drag the model you created into the **`Source Mesh`** slot in the `RoadMeshGenerator`.
4. The UV Offset option defines by what amount the uv-coordinates are displaced every time the road mesh is tiled.
5. Shape the road any way you want, so that if you use it as a prefab for new roads, the shape will be copied.
6. Create a Prefab, so that you can select it by alt-clicking the "new road" button.

Depending on which tool you use to create the mesh, you might need to convert the coordinate space. Right now, there are two presets to choose from: Blender and Unity. This can be chosen in the `RoadMeshGenerator` component. To change it for all roads, you can set the option in the `RoadSystem` component.

For more control, the `Source Orientation` property under `Settings` in the `RoadMeshGenerator` component allows you to select any axis for the local forward and up vector, as well as choose handedness.