Wheel Loader Controller
User Manual v1.0

WSM GAME STUDIO

Doing all the hard work for you!

2020

SUMMARY

1. Intro

Thank you for purchasing “Wheel Loader Controller”!

This package contains all that you need to include a simple and functional wheel loader to your game.

More wheel loader models may be included in the future and/or sold separately as extensions (Here).

It’s really simple to use and customize.

2. How to Use This Asset

In this section you will learn how this asset works and how to use it based on the sample prefabs.

2.1. What can it do? (Quick Start Guide)

This asset contains ready to use wheel loader prefabs which you can drive and use to lift and move cargo around your game. It also contains a Roll Off Dumpster and a ready to use Rock prefab to be used as cargo.

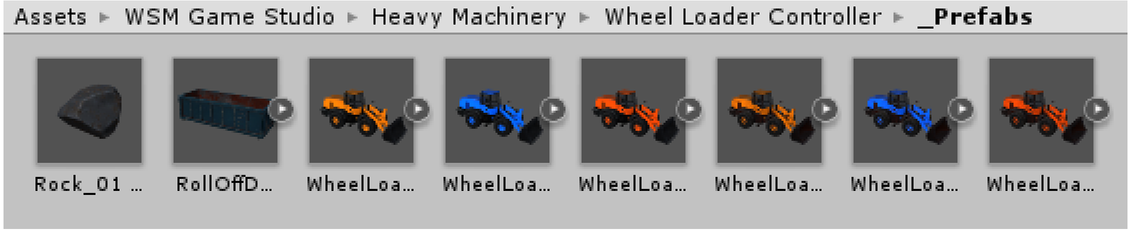
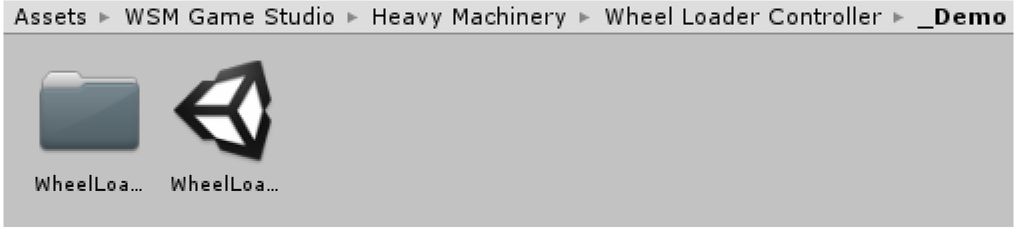


Figure: Sample Prefabs

There are 3 wheel loader colors by default (yellow, orange and blue), all of which have an old and new texture variation. (albedo, metallic, AO and normal maps included).

Figure: Brand New x Old Textures Variations

To see these prefabs in action, please take a look at the demo scene included on the package.



Assets ▸ WSM Game Studio ▸ Heavy Machinery ▸ Wheel Loader Controller ▸ **_Demo**

Figure: Demo Scene

Hint: By pressing the Tab key on the demo scenes you can show or hide the current wheel loader input keys. This can be useful for testing the wheel loader for the first time.

This asset supports both **Self Leveling** and **Non-Self Leveling** wheel loaders. (See the Wheel Loader Controller section for more information on how to switch the leveling mode).

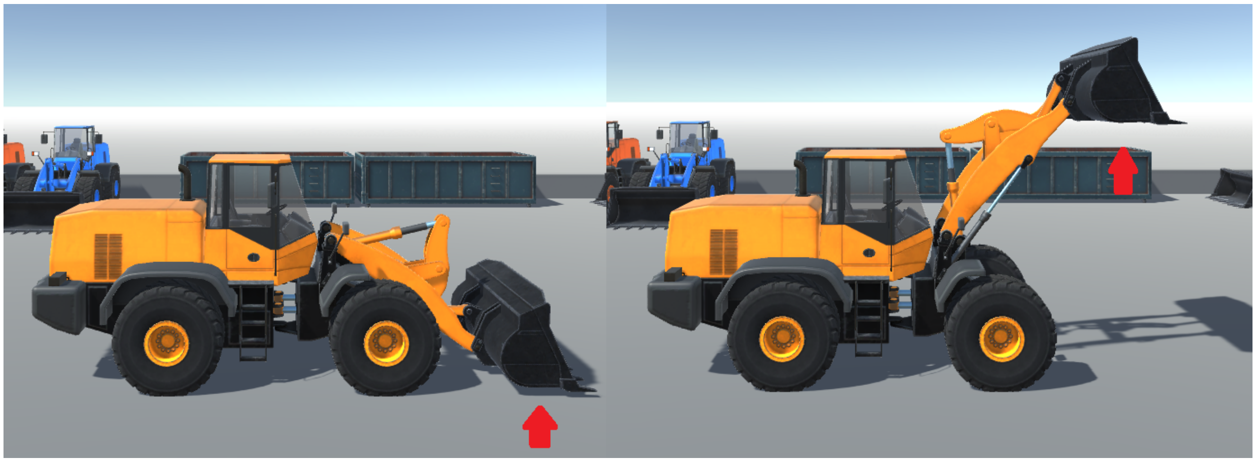


Figure: Self Leveling wheel loader

Self Leveling loaders automatically adjust the bucket angle while raising or lowering the loader frame to keep the bucket leveled and avoid cargo dropping.

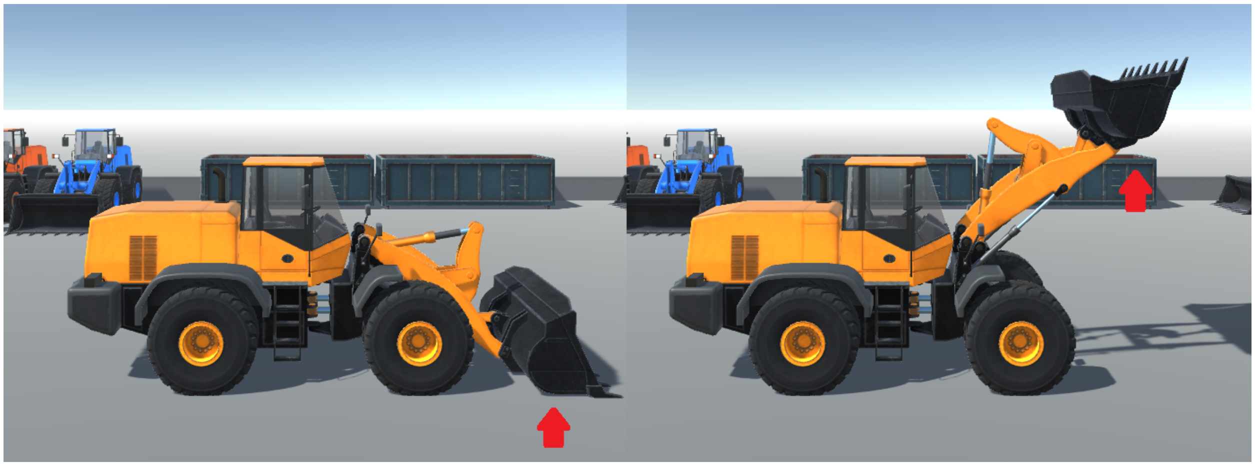


Figure: Non-Self Leveling wheel loader

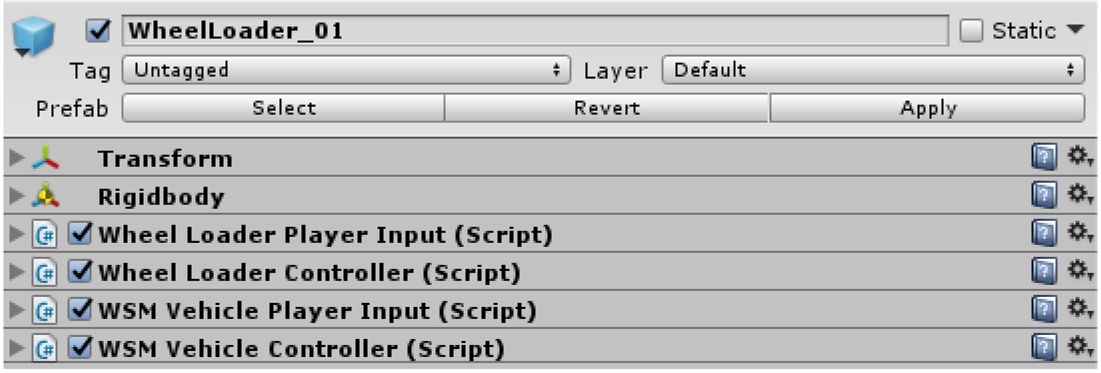
Non-self leveling doesn't adjust the bucket angle while raising or lowering the loader frame, which means the bucket will rotate as much as the loader frame.

Note: Wheel Loaders prefabs are set to Self leveling by default.

2.2. How it Works

This asset was designed with modularity and easy customization in mind. Therefore, the Component Game Design Pattern was implemented to keep player input, wheel loader behaviour and vehicle behaviour are as decoupled as possible. Each wheel loader is composed of four main modules:

- Wheel Loader Player Input
- Wheel Loader Controller
- Vehicle Player Input
- Vehicle Controller



☑ WheelLoader_01 □ Static

Tag: Untagged

Layer: Default

Transform

Rigidbody

☑ Wheel Loader Player Input (Script)

☑ Wheel Loader Controller (Script)

☑ WSM Vehicle Player Input (Script)

☑ WSM Vehicle Controller (Script)

Figure: Wheel Loader Components

The wheel loader and vehicle input modules are responsible to gather and feed player input into the corresponding controller modules. For more information about these modules and how to customize input, please take a look at the Wheel Loader Input and Vehicle Input sections.

The Wheel Loader Controller component is responsible for handling all wheel loader specific behaviour. Which means, handling the bucket and loader frame movements and SFX. For more information, please take a look at the Wheel Loader Controller section.

The Vehicle Controller component is responsible for handling all vehicle specific behaviour (Ex: acceleration, steering, vehicle physics, etc.). For more information, please take a look at the Vehicle Controller section.

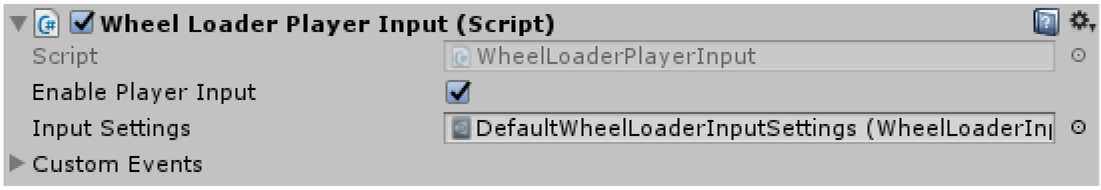
This modular approach was adopted to allow customization by the replacement of any module for third party or custom modules. For example, a client that already owns a custom or third party vehicle controller, may wish to replace the default vehicle related modules and still be able to control the wheel loader mechanical parts by using the Wheel Loader Controller component.

3. Wheel Loader Modules

This section covers the wheel loader related modules and settings.

3.1. Wheel Loader Input

This component is responsible for handling player input for all wheel loader specific behaviours. It holds a reference to the Default Wheel Loader Input Settings file, which contains the keyboard key configurations for controlling the mechanical parts of your wheel loader.



☑ **Wheel Loader Player Input (Script)**

Script: WheelLoaderPlayerInput

Enable Player Input: ☑

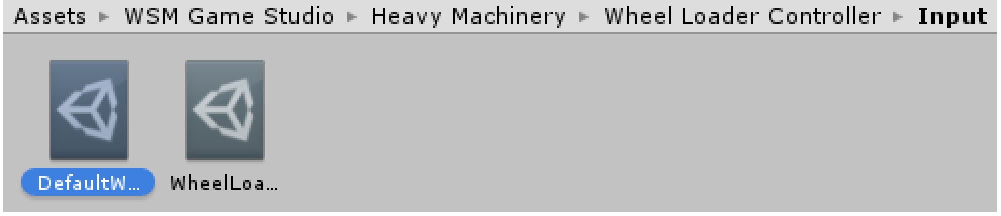
Input Settings: DefaultWheelLoaderInputSettings (WheelLoaderIn|

▶ Custom Events

Figure: Wheel Loader Player Input

> **Note:** Enable Player Input can be used to toggle input on/off.

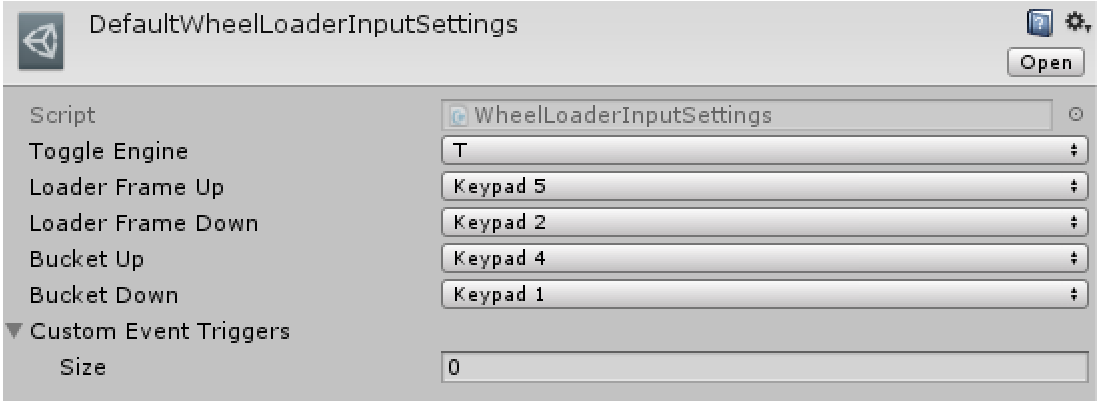
The Default Wheel Loader Input Settings file is located under the "WSM Game Studio ▶ Heavy Machinery ▶ Wheel Loader Controller ▶ Input" folder.



Assets ▸ WSM Game Studio ▸ Heavy Machinery ▸ Wheel Loader Controller ▸ **Input**

Figure: Wheel Loader Input Settings Location

By selecting this file, you can see and customize the input keys used to control your wheel loader.



DefaultWheelLoaderInputSettings

Script	WheelLoaderInputSettings
Toggle Engine	T
Loader Frame Up	Keypad 5
Loader Frame Down	Keypad 2
Bucket Up	Keypad 4
Bucket Down	Keypad 1
▼ Custom Event Triggers	
Size	0

Figure: Wheel Loader Input Settings

You can also create a new custom input settings by right-clicking on your project and using the Unity Creation menu: "Create ▶ WSM Game Studio ▶ Heavy Machinery ▶ Wheel Loader Input Settings".

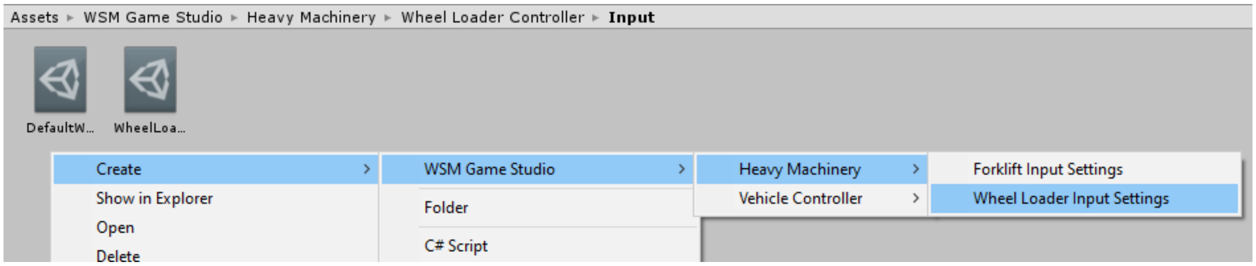
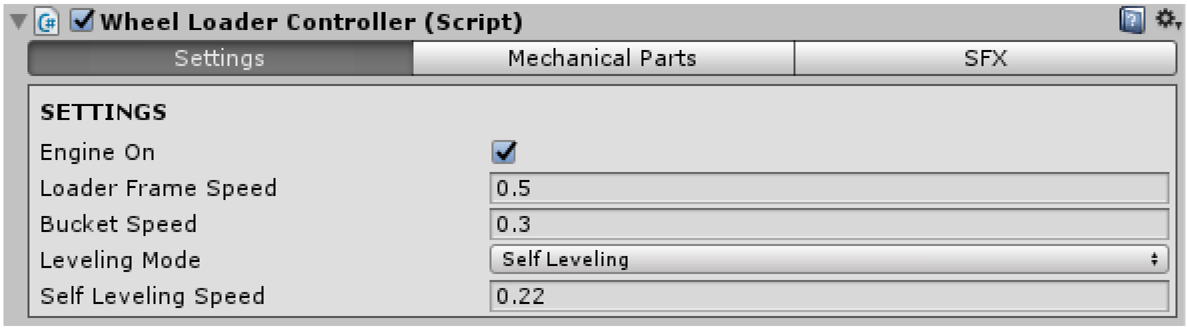


Figure: Creating a new Wheel Loader Input Settings

You can create as many input settings as you wish, this can be very useful for testing different input settings for your game.

3.2. Wheel Loader Controller

This component is responsible for controlling the bucket and loader frame mechanical movements.



SETTINGS

Engine On ☑

Loader Frame Speed 0.5

Bucket Speed 0.3

Leveling Mode Self Leveling

Self Leveling Speed 0.22

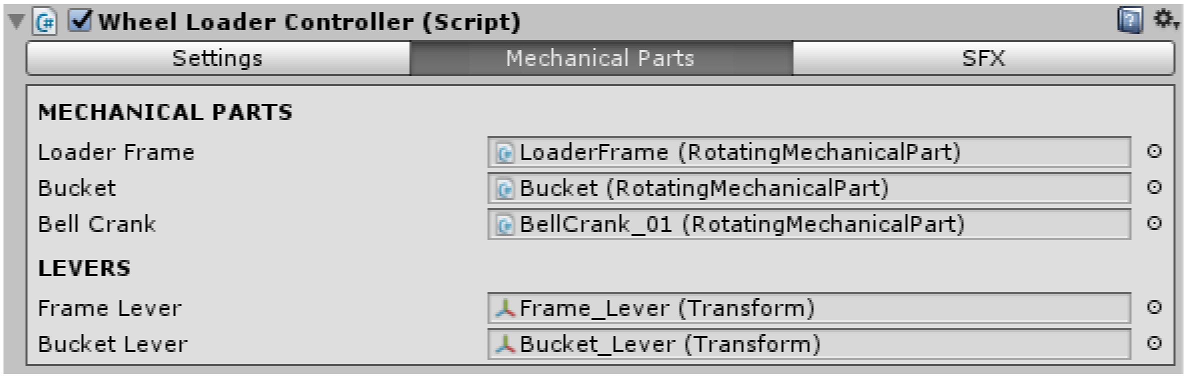
Figure: Wheel Loader Controller

At the Settings tab, you can set up the bucket and loader frame movements speed and enable or disable the mechanical parts engine.

You can also switch between **Self Leveling** and **Non-self leveling** bucket configuration, by changing the Leveling Mode property.

Note: The wheel loader mechanical parts engine and vehicle engine are separated for the sake of modularity.

Also, If you change either the frame or bucket speeds, you may need to also adjust the Self Leveling Speed property, to fine tune the bucket self leveling.



Wheel Loader Controller (Script)

MECHANICAL PARTS

Loader Frame	LoaderFrame (RotatingMechanicalPart)
Bucket	Bucket (RotatingMechanicalPart)
Bell Crank	BellCrank_01 (RotatingMechanicalPart)

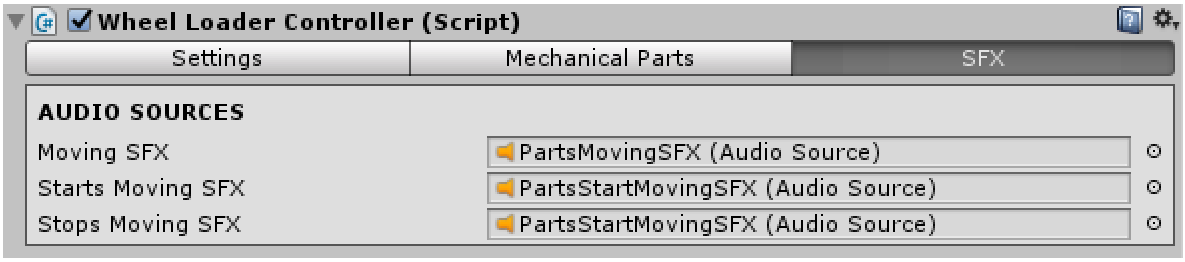
LEVERS

Frame Lever	Frame_Lever (Transform)
Bucket Lever	Bucket_Lever (Transform)

Figure: Wheel Loader Mechanical Parts

The Mechanical Parts tab holds the references to all wheel loader mechanical parts.

Note: Besides the bucket and frame related mechanical parts, it also supports levers, to simulate the operator manually moving the levers at the cabin.



Wheel Loader Controller (Script)

AUDIO SOURCES

Moving SFX	PartsMovingSFX (Audio Source)
Starts Moving SFX	PartsStartMovingSFX (Audio Source)
Stops Moving SFX	PartsStartMovingSFX (Audio Source)

Figure: Wheel Loader SFX

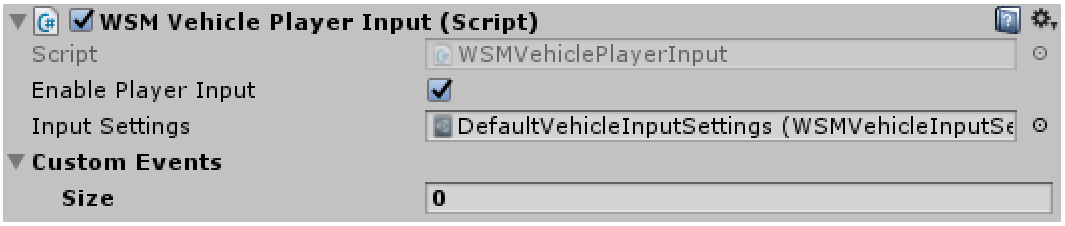
The SFX tab holds references to all the mechanical movements related Audio Sources.

4. Vehicle Modules

This section covers the vehicle related modules and settings.

4.1. Vehicle Input

This component is responsible for handling player input for all vehicle specific behaviours. It holds a reference to the Default Vehicle Input Settings file, which contains the keyboard key configurations for driving your wheel loader.

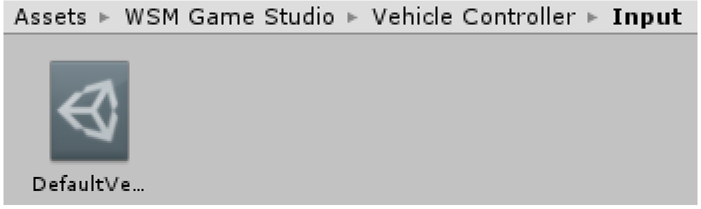


☑ WSM Vehicle Player Input (Script)

Script	WSMVehiclePlayerInput
Enable Player Input	☑
Input Settings	DefaultVehicleInputSettings (WSMVehicleInputSe
Custom Events	
Size	0

Figure: Vehicle Player Input

The Default Vehicle Input Settings file is located under the “WSM Game Studio ► Vehicle Controller ► Input” folder.

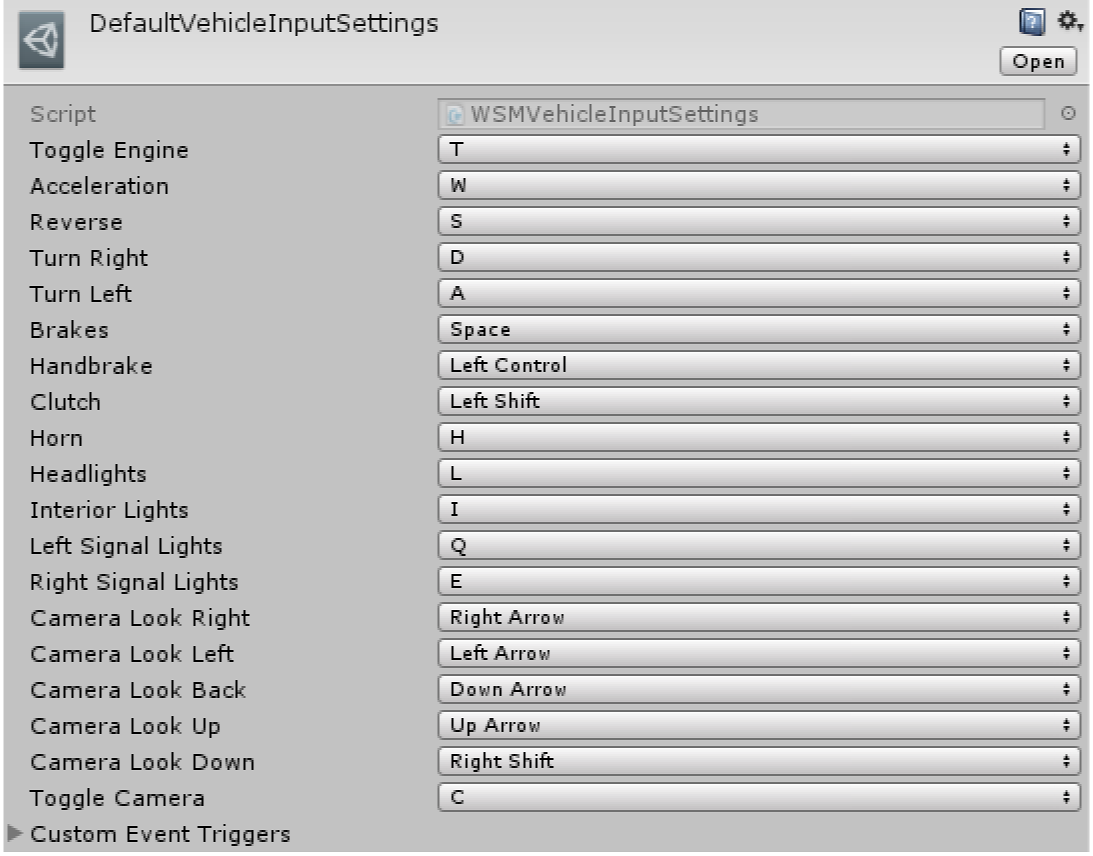


Assets ▸ WSM Game Studio ▸ Vehicle Controller ▸ **Input**

DefaultVe…

Figure: Vehicle Player Input Location

By selecting this file, you can see and customize the input keys used to control your vehicle.



DefaultVehicleInputSettings

Script	WSMVehicleInputSettings
Toggle Engine	T
Acceleration	W
Reverse	S
Turn Right	D
Turn Left	A
Brakes	Space
Handbrake	Left Control
Clutch	Left Shift
Horn	H
Headlights	L
Interior Lights	I
Left Signal Lights	Q
Right Signal Lights	E
Camera Look Right	Right Arrow
Camera Look Left	Left Arrow
Camera Look Back	Down Arrow
Camera Look Up	Up Arrow
Camera Look Down	Right Shift
Toggle Camera	C
▶ Custom Event Triggers	

Figure: Vehicle Input Settings

You can also create a new custom input settings by right-clicking on your project and using the Unity Creation menu: “Create ► WSM Game Studio ► Vehicle Controller ► Vehicle Input Settings”.

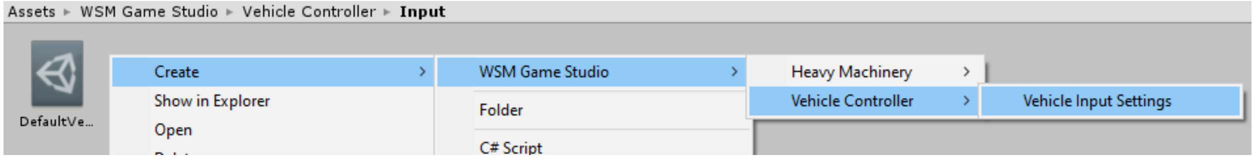
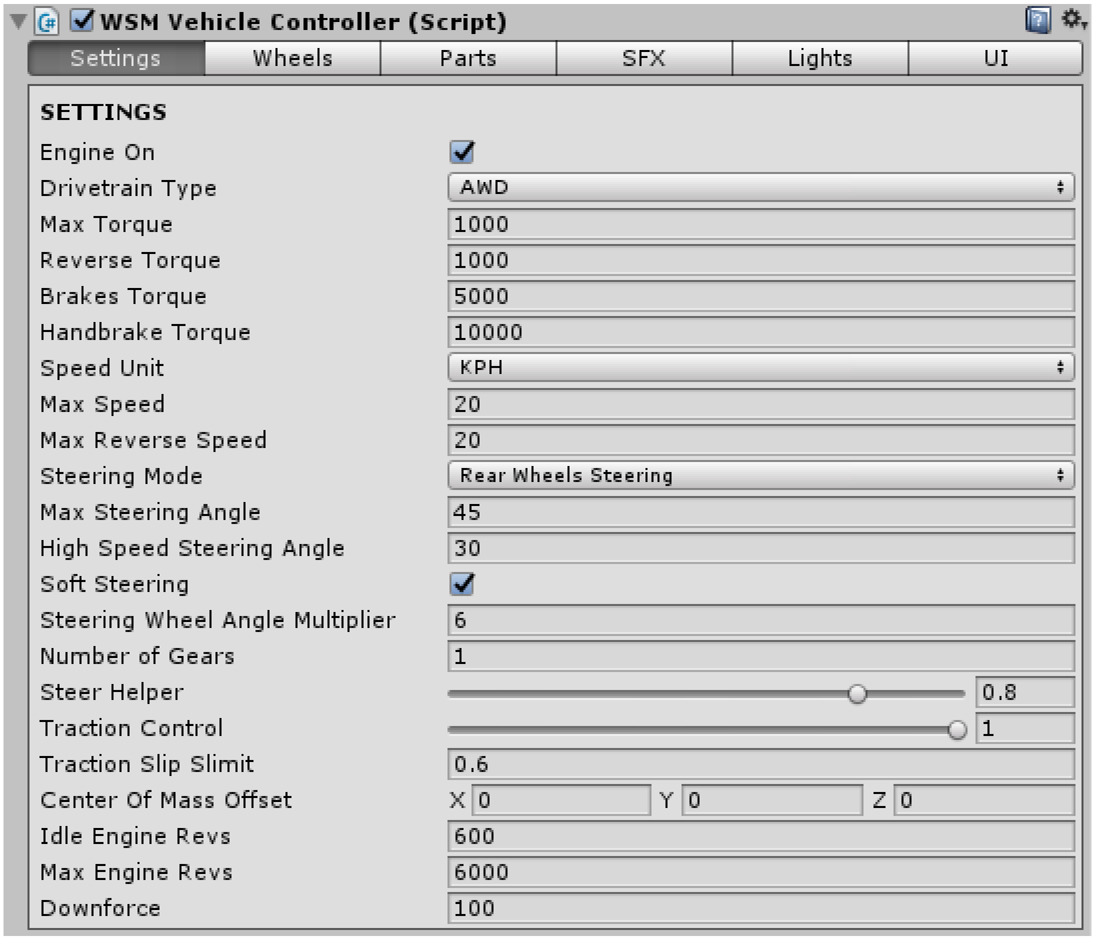


Figure: Creating a new Vehicle Input Settings

4.2. Vehicle Controller

This component is responsible for controlling vehicle related behaviours and vehicles physics.



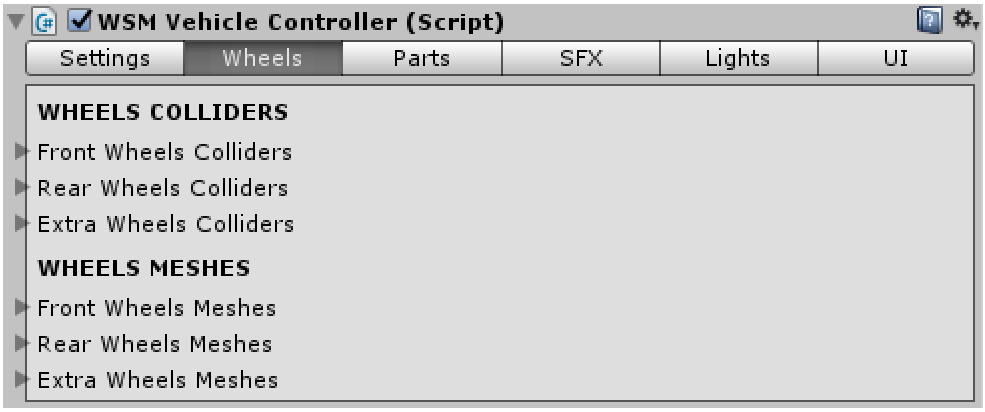
SETTINGS

Engine On	☑
Drivetrain Type	AWD
Max Torque	1000
Reverse Torque	1000
Brakes Torque	5000
Handbrake Torque	10000
Speed Unit	KPH
Max Speed	20
Max Reverse Speed	20
Steering Mode	Rear Wheels Steering
Max Steering Angle	45
High Speed Steering Angle	30
Soft Steering	☑
Steering Wheel Angle Multiplier	6
Number of Gears	1
Steer Helper	0.8
Traction Control	1
Traction Slip Slimit	0.6
Center Of Mass Offset	X 0 Y 0 Z 0
Idle Engine Revs	600
Max Engine Revs	6000
Downforce	100

Figure: Vehicle Settings

Most vehicle settings located here are very straightforward and use the same nomenclature as the corresponding real world counterpart. The most specific settings will be covered in this section.

Note: If you have any questions about any specific setting that was not covered in this section, feel free to email me about it (See Contact Info & Support section)



WHEELS COLLIDERS

- Front Wheels Colliders
- Rear Wheels Colliders
- Extra Wheels Colliders

WHEELS MESHES

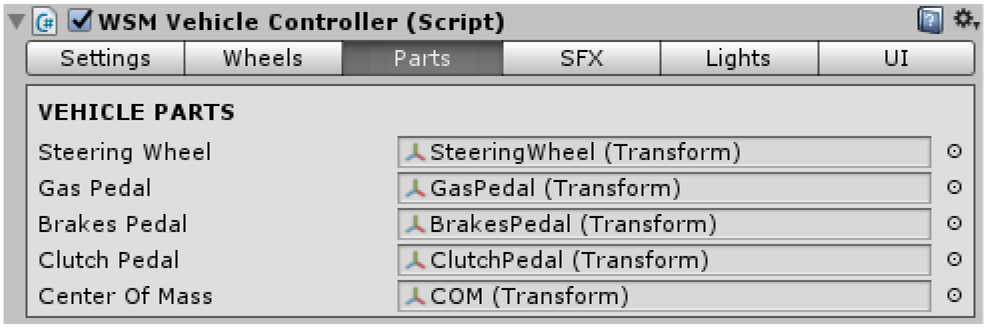
- Front Wheels Meshes
- Rear Wheels Meshes
- Extra Wheels Meshes

Figure: Vehicle Wheels

The Wheels tab holds references to all Wheel Colliders and Wheels Meshes. Front and rear wheel references are separated from each other. It was designed this way, so it would be possible to set up which wheels receive traction and which wheels are used for steering.

Note: Wheels traction is defined by the ***Drivetrain Type*** property and steering is defined by the ***Steering Mode*** property (Settings tab)

If your vehicle has more than four wheels, you can also use the Extra Wheels collections to assign the additional wheels references.



VEHICLE PARTS

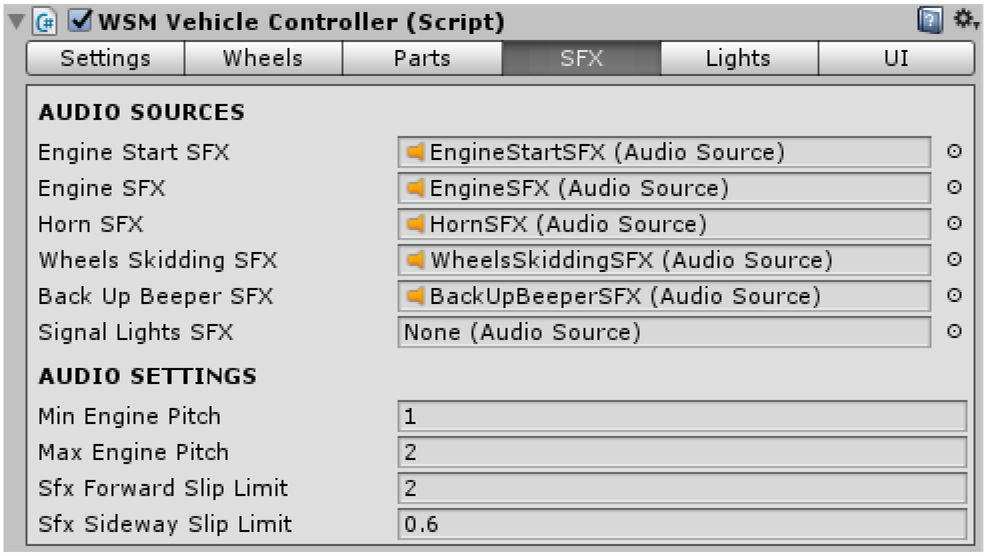
Steering Wheel	SteeringWheel (Transform)
Gas Pedal	GasPedal (Transform)
Brakes Pedal	BrakesPedal (Transform)
Clutch Pedal	ClutchPedal (Transform)
Center Of Mass	COM (Transform)

Figure: Vehicle Parts

The Parts tab holds references to all vehicles moving parts. If your vehicle has an open cabin or if your game supports cabin interior view, this is where you can set a reference to your steering wheel and pedals.

The rotation ratio between the wheels and the steering wheel is defined by the ***Steering Wheel Angle Multiplier*** property (Settings tab).

The Center of Mass reference is used to visualize the vehicle center of mass position. Which can be adjusted by the ***Center of Mass Offset*** property (Settings tab).



☑ WSM Vehicle Controller (Script)

AUDIO SOURCES

Engine Start SFX	EngineStartSFX (Audio Source)
Engine SFX	EngineSFX (Audio Source)
Horn SFX	HornSFX (Audio Source)
Wheels Skidding SFX	WheelsSkiddingSFX (Audio Source)
Back Up Beeper SFX	BackUpBeeperSFX (Audio Source)
Signal Lights SFX	None (Audio Source)

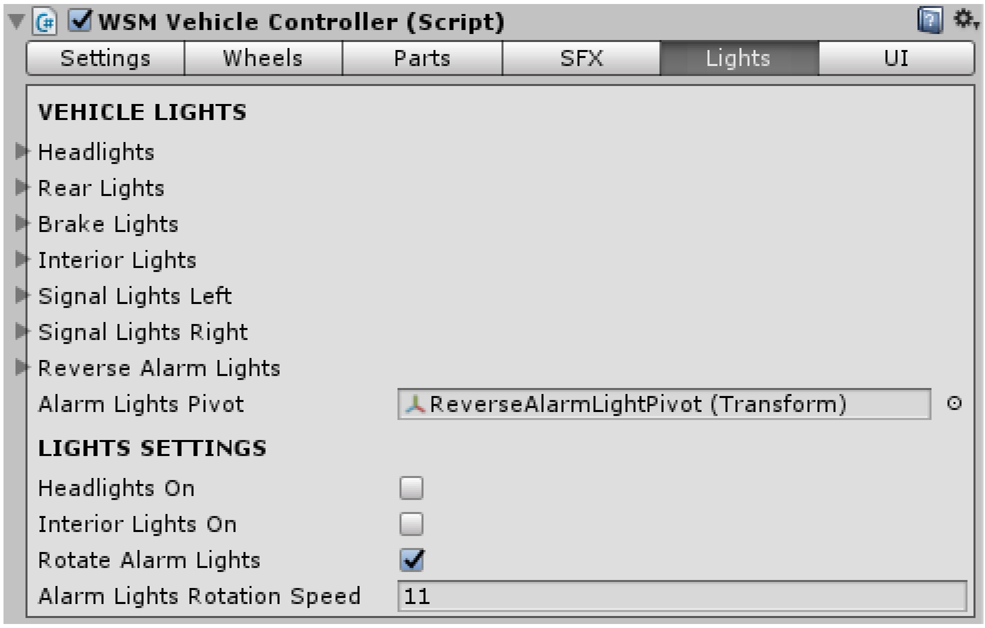
AUDIO SETTINGS

Min Engine Pitch	1
Max Engine Pitch	2
Sfx Forward Slip Limit	2
Sfx Sideway Slip Limit	0.6

Figure: Vehicle SFX

The SFX tab holds references to the vehicle's Audio Sources. Audio settings are also located here.

The min and max engine pitch properties are used to simulate engine revving and gear switching sounds. The slip limit properties are used to adjust when the wheel skidding SFX should be played.



☑ WSM Vehicle Controller (Script)

VEHICLE LIGHTS

- ▶ Headlights
- ▶ Rear Lights
- ▶ Brake Lights
- ▶ Interior Lights
- ▶ Signal Lights Left
- ▶ Signal Lights Right
- ▶ Reverse Alarm Lights

Alarm Lights Pivot	ReverseAlarmLightPivot (Transform)

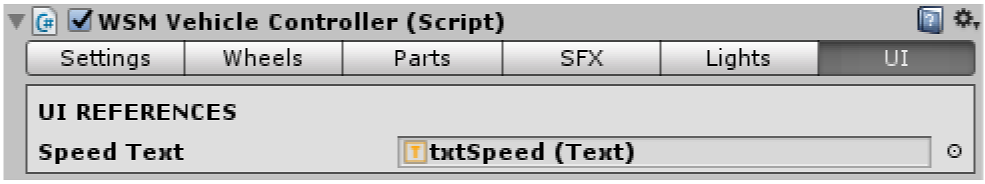
LIGHTS SETTINGS

Headlights On	□
Interior Lights On	□
Rotate Alarm Lights	☑
Alarm Lights Rotation Speed	11

Figure: Vehicle Lights

The Lights tab holds references to the vehicle's lights. Lights settings are also located here.

Note: Alarm lights rotation refers to the ***Reverse Alarm Lights***. Some trucks and other heavy vehicles usually have rotating lights to warn pedestrians, besides the backup beeper sound.



WSM Vehicle Controller (Script)

UI REFERENCES

Speed Text: txtSpeed (Text)

Figure: Vehicle UI

The UI tab holds a reference to the vehicle related UI. For now, it contains only an option for outputting the current vehicle speed.

Note: You can choose KPH and MPH by changing the ***Speed Unit*** property (Settings tab).

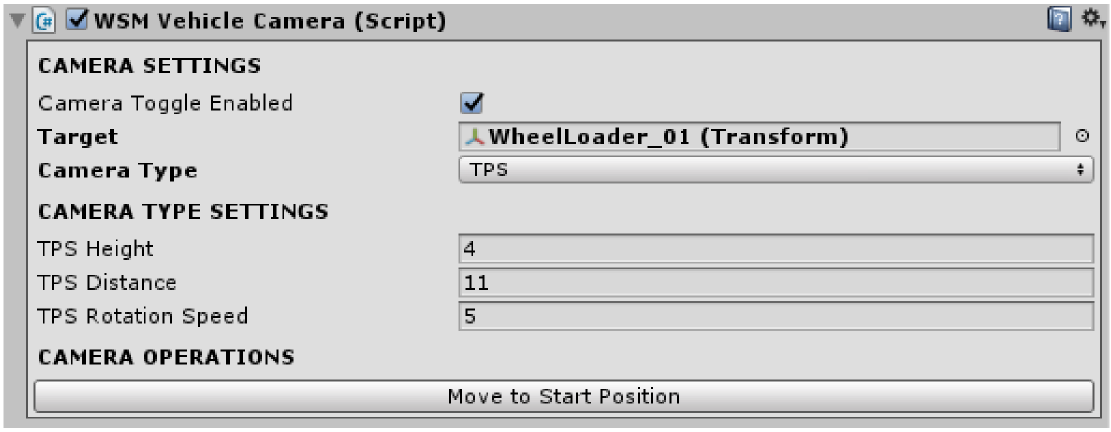
4.3. Vehicle Camera

A simple vehicle camera is also included in this package. The following camera types are currently supported:

- TPS (Third Person)
- FPS (First Person)
- Top Down

Also, runtime camera toggle can be enabled or disabled here. (See Vehicle Input section for more details on camera input keys)

Note: The Vehicle Camera component only shows the settings of the currently selected camera type.



WSM Vehicle Camera (Script)

CAMERA SETTINGS

Camera Toggle Enabled: ☑

Target: WheelLoader_01 (Transform)

Camera Type: TPS

CAMERA TYPE SETTINGS

TPS Height: 4

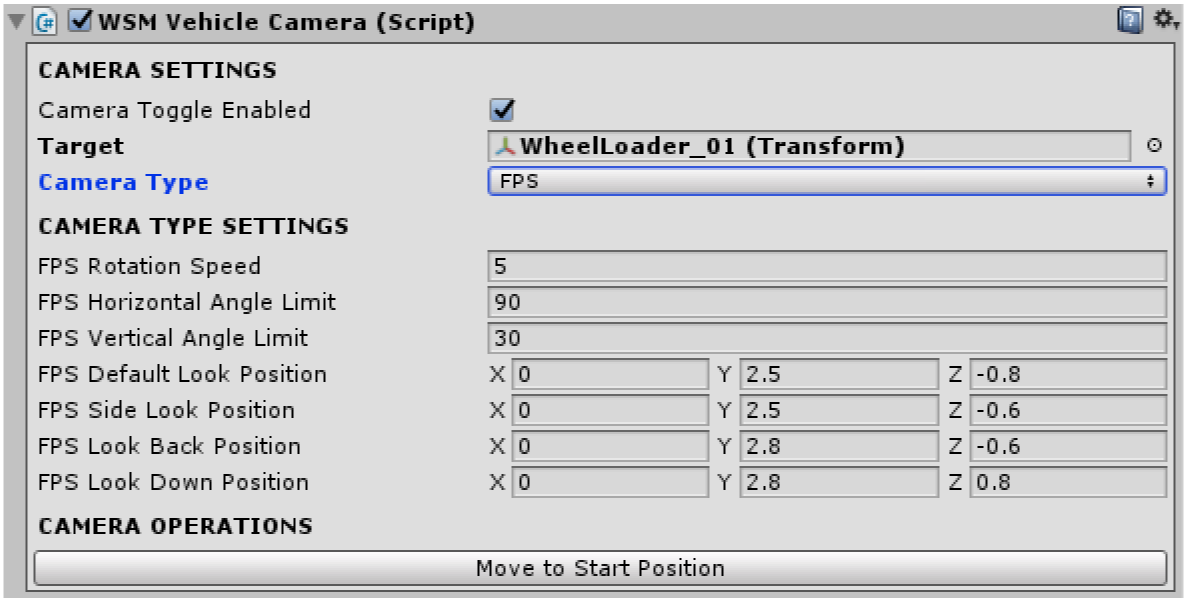
TPS Distance: 11

TPS Rotation Speed: 5

CAMERA OPERATIONS

Figure: TPS Camera Settings

You can adjust the height, distance and speed of the TPS camera. While the TPS camera is selected, you can also look left, right or backwards.



☑ WSM Vehicle Camera (Script)

CAMERA SETTINGS

Camera Toggle Enabled ☑

Target: WheelLoader_01 (Transform)

Camera Type: FPS

CAMERA TYPE SETTINGS

FPS Rotation Speed: 5

FPS Horizontal Angle Limit: 90

FPS Vertical Angle Limit: 30

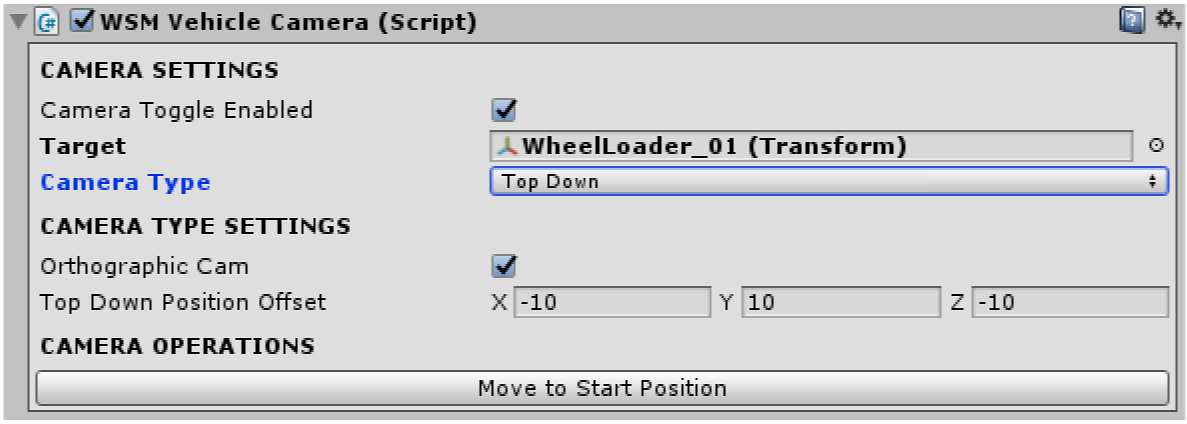
	X	Y	Z
FPS Default Look Position	0	2.5	-0.8
FPS Side Look Position	0	2.5	-0.6
FPS Look Back Position	0	2.8	-0.6
FPS Look Down Position	0	2.8	0.8

CAMERA OPERATIONS

Figure: FPS Camera Settings

While the FPS camera is selected, you can look left, right, backwards, up and down. You can also change the camera position for each look direction. This allows you to simulate some interesting behaviours, like putting the head out of the window when looking backwards.

Note: The position shift technique was used to focus on the wheel loader bucket while looking down on the FPS camera.



☑ WSM Vehicle Camera (Script)

CAMERA SETTINGS

Camera Toggle Enabled ☑

Target: WheelLoader_01 (Transform)

Camera Type: Top Down

CAMERA TYPE SETTINGS

Orthographic Cam ☑

Top Down Position Offset: X -10 Y 10 Z -10

CAMERA OPERATIONS

Figure: Top Down Camera Settings

While the Top Down camera is selected, you can adjust the camera position offset and choose between orthographic or perspective camera projection.

Tip: Use the ***Move to Start Position*** operation to preview the camera position after adjusting the settings.

5. Additional Info

5.1. Customization

This package includes a simple wheel loader model for sample purposes. More wheel loader models may be included in the future and/or sold separately as extensions (Here).

If you have your own models, it is possible to create custom wheel loaders by using the sample prefabs as a starting point and replacing the models using the Unity Editor default prefab editing workflow.

Just make sure your custom wheel loader main body, bucket, loader frame, doors, cylinders and wheels models are separated from each other as shown in the sample image below.

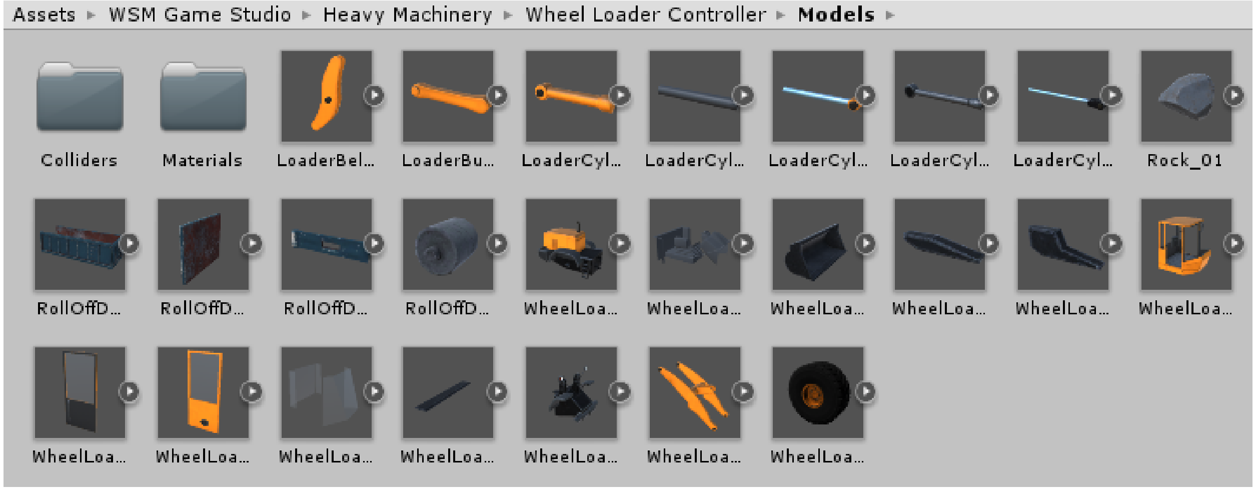


Figure: Default Wheel Loader Models

5.2. Wheel Loader Carrying Weight Capacity

As in real life, the wheel loaders included on this asset have limited carrying weight capacity. Trying to raise cargo above this limit will shift the wheel loader center of mass, making it harder to safely transport the cargo or, in case of really heavy cargo, to keep the wheel loader wheels on the ground.

Rule of thumb is, a wheel loader cannot carry cargo heavier than itself. For example, if you intend to lift a wheel loader, you need a bigger and heavier wheel loader to do the job.

For this asset, the recommended rigidbody mass value for cargo must not exceed 40% of the wheel loader mass.

Since sample prefabs are set to 10000 rigidbody mass, the maximum recommended mass sum for cargo is 4000.

> **Note:** Due to Unity physics engine limitations, the wheel loader rigidbody cannot exceed 10000 mass. Rigibodys with mass greater than 10000 may cause unpredictable physics behavior on Unity games.

5.3. Rear Steering Vehicle Guidelines

The Vehicle Controller included in this package does support rear wheel steering vehicles.

Rear wheel steering vehicles, like forklifts for example, tend to easily oversteer on higher speeds which can result in undesired vehicle fishtailing.

To avoid fishtailing, increase the Steer Helper property value until your vehicle reaches the desired trade-off between realism and control.

Since vehicles are nonlinear systems, the optimal Steer Helper value will change accordingly to your vehicle aerodynamics, center of mass and settings. It's recommended to test each vehicle and adjust the settings until the desired behaviour is achieved.

6. License

By purchasing this asset you are allowed to use it for unlimited games and/or 3D projects (like animations, simulation softwares, etc). Both personal and commercial use.

You are **NOT** allowed to resell or distribute the assets components individually or as part of another asset package (including, models, scripts, etc).

7. Contact Info & Support

If you have any questions, need support or have some business inquiries, feel free to get in touch.

The best way to reach us is by email on **wsmgamestudio@gmail.com**.

Asset Store
Discord

Sketchfab
Instagram
Facebook
Twitter
Youtube Channel