

Engineering Academic Discipline

Motorsport Engineering HND

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Student name: Nia Jenkins

Student number: 2519702

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Introduction

The aim of our project is to evaluate and enhance the performance of a Morgan 4, with the goal of bringing the vehicle up to race standard. The car is currently operational but not yet suitable for competitive racing. To achieve this, we plan to assess its current performance, identify the main areas for improvement, and implement modifications to key systems, including the chassis, suspension, exhaust, and brakes. By upgrading these components, we aim to prepare the Morgan for successful competition in university-level events.

As this is a group project, each team member has a clearly defined role to ensure every aspect of the vehicle's performance is addressed. The project includes both practical work, such as hands-on modifications, and data analysis to identify issues and verify performance changes. Success will be measured through improvements in performance metrics, such as handling and brake efficiency, along with completing all planned upgrades within the project timeline and maintaining effective team collaboration throughout.

Members and responsibilities

Team members and their responsibilities

Name	Role	Responsibilities
Luke Davies	Suspension and VI-grade	This role involves evaluating and improving the car's current suspension setup to enhance handling and stability on track. They are also responsible for building and use a virtual vehicle model in VI-grade to simulate changes, helping the team understand how modifications may affect the overall vehicle performance.
Jay Hodson	Airbox and exhaust	This role involves designing and improving the airbox and exhaust system to allow the engine to breathe more efficiently and deliver better performance. They work closely with the team member responsible for the airbox and engine to ensure that all modifications integrate correctly and contribute to the car's overall output.
Josh Davies	Chassis development	This role involves inspecting and upgrading the chassis to improve strength, safety, and performance while keeping the vehicle's weight as low as possible. They ensure that chassis modifications support improvements made to other systems such as the suspension and engine.
Keira Phillips	Airbox and engine	This role involves integrating airbox improvements with engine performance tuning, including testing and adjusting engine systems to achieve optimum output. They work closely with the airbox and exhaust team member to ensure that all upgrades are compatible and contribute effectively to overall vehicle performance.
Niall Hindmarch		This team member did not participate in project meetings and therefore has no assigned responsibilities.

My role and responsibilities

My role in this project is to analyse and improve the braking system and tyres of the Morgan. This involves inspecting the current brake system, reviewing the relevant racing regulations, and analysing performance data from the car's previous outings. Based on this information, I will evaluate potential upgrades, such as improved calipers, or wheel spacers, to determine whether they could enhance the car's racing performance. When required, I will purchase, prepare, and install the necessary components, ensuring that all modifications improve braking efficiency and vehicle safety while remaining compliant with racing standards.

To carry out this role effectively, I need strong practical mechanical skills and a solid understanding of vehicle dynamics. Attention to detail is essential, as small faults in the braking system can have major consequences on track. This role also requires the ability to analyse test data, plan suitable upgrades, and implement modifications safely and accurately.

According to my Belbin self-assessment, my strongest role is completer finisher. This describes someone who reliably sees tasks through to the end, ironing out problems and ensuring everything works correctly. These traits align closely with the requirements of managing brakes and tyres, as these components are safety-critical and demand precise and thorough work. My assessment also identified teamworker as another strong role. This is valuable in a group project as it helps me collaborate effectively, support other team members when needed, and contribute to a positive working environment.

Group tasks and timings

Name	Task	Description	Start date:	Complete by date:
Suspension				
Luke	Collect vehicle data	Measure wheelbase, track width, vehicle mass, and unsprung mass for use in the VI-Grade model.	24/11/2025	01/12/2025
	Measure geometry	Measure the geometry of both the Plus-Four and Plus-Six suspension systems	24/11/2025	04/12/2025
	Create a suspension model	Use Wingeo to create a virtual model of both suspension systems	05/12/2025	12/12/2025
	Kinematic simulation	Use Wingeo to run a kinematics simulation of the suspension systems.	13/12/2025	20/12/2025
	On the car kinematics test	Perform a kinematics test on the vehicle to verify simulation results.	05/01/2026	30/01/2026
	Kinematic results analysis and comparison	Compare handling characteristics between the Plus-Four and Plus-Six systems.	31/01/2026	11/02/2026
VI-Grade				
Luke	Gather team member's data and create a VI model	Collect data from all team members and create a virtual Morgan model in VI-Grade.	02/12/2025	01/02/2026
	Model comparison	Compare the Plus-Four and Plus-Six models using the VI-grade Animation tool.	02/02/2026	12/02/2026
	Report write-up and presentation	Prepare the written report and create a group PowerPoint presentation.	01/02/2026	21/03/2026
Chassis				
Josh	Research current chassis performance	Investigate how the chassis behaves under racing conditions and calculate stress, strain, and torsion.	13/10/2025	22/10/2025
	Stress analysis	Calculate chassis stresses during cornering and straight-line racing to understand structural behaviour.	22/10/2025	28/10/2025
	Support suspension development	Collaborate with suspension team due to structural interaction between chassis and suspension components.	28/10/2025	01/11/2025
	Test upgrades	Gather data and install performance upgrades for evaluation during off-season testing.	01/11/2025	12/11/2025
	Compare results with previous years	Analyse new testing data against last year's results to assess improvements.	TBD	TBD

	Construct new chassis model	Begin designing a new ladder chassis using simulations and CAD, informed by previous analysis.	12/11/2025	20/11/2025
Intake system				
Jay / Keira	Research	Explore different intake design ideas, key performance areas, and suitable materials using online sources, and external advice.	20/10/2025	17/11/2025
	Designing	Produce sketches, select the preferred design, and model it using SolidWorks.	17/11/2025	29/11/2025
	Manufacturing	Manufacture the chosen intake design using the selected material.	08/12/2025	18/12/2025
	Testing	Fit the new intake to the Morgan and perform track testing.	TBD	TBD
	Analysing	Review testing data, compare performance to the standard intake, and identify any faults found during testing.	TBD	TBD
	Meetings	Weekly meetings with the project lecturer to discuss progress and next steps.	WEEKLY	WEEKLY
	Presentation	Create a group presentation summarizing progress and future plans until the final presentation at the end of the academic year.	23/11/2025	08/12/2025

My tasks

Task	Description	Hours required	Materials/parts needed	Start:	Complete by:
Weekly project meetings	Two 1-hour meetings per week over the project duration	40 (approx. 20 weeks)	Laptop, notes	06/10/2025	N/A
Understand current brake system	Inspect and document existing brake components such as the calipers, discs, and pads.	3	Spanner, jack, stands.	06/10/2025	10/10/2025
Inspect current tyre setup.	Check tyre compound, size, age, wear pattern, and suitability for racing,	2	Spanner, jack, stands	06/10/2025	13/10/2025
Review the relevant racing regulations	Review the Welsh Sports & Saloon Car Championship regulations relating to the brakes and tyre modifications.	2	Laptop	13/10/2025	15/10/2025
Research the existing brake systems	Determine whether the current brake system meets regulations.	3	Laptop	08/10/2025	15/10/2025
Measure wheel clearance	Measure caliper-to-wheel clearance to determine spacer feasibility.	2	A caliper gauge, tape measure.	08/10/2025	22/10/2025
Analyse previous outing data	Review brake data, focusing on braking temperatures, braking behaviour, stopping distance, and the tyre performance.	5	Laptop, MoTec	TBD	TBD
Determine upgrade options	Select potential new calipers, discs, pads, or spacers.	4	Laptop	22/10/2025	10/12/2025
Assess feasibility for brake upgrade	Compare cost, performance benefits, lead times of each upgrade option.	4	Laptop	22/10/2025	10/12/2025
Purchase tyres	Order wet, dry, and intermediate sets	2	Laptop	04/11/2025	12/11/2025
Purchase upgraded caliper (if needed)	Order upgraded brake components.	2	Laptop	TBD	TBD
Purchase wheel	Identify the correct thickness for spacers from recorded data and purchase	2	Laptop	TBD	TBD

spacers (if needed)					
Install the upgraded components (if required)	Fit the upgraded components, ensuring correct fitment, alignment, torque settings, and clearance.	4	Torque wrench, jack, stands	TBD	TBD
Bleed the brakes and safety check the vehicle	Fully bleed the system, check for any leaks, conduct a pedal feel to ensure safety.	3	Brake fluid, bleed kit.	TBD	TBD
Install the spacers (if using)	Fit the spacers between the hub and wheel, and torque to the correct specification	2	Jack, stands, torque wrench	TBD	TBD
Install the new tyres	Fit the new tyres, then check alignment, tyre pressure and balance.	3	Jack, stands, wheel balance	TBD	TBD
Create a presentation	Produce a PowerPoint presentation for the group presentation	6	Laptop	24/11/2025	08/12/2025
Take the Morgan out testing	Take the Morgan out for track day to gain some data.	7	N/A	TBD (hoping February)	N/A

Bill of materials

Item	Approx cost (£)	Lead time
Wet tyres ¹ (Blu Earth AE50)	600 (for set)	7 days
Intermediate tyres ² (ADVAN AD09)	750 (for set)	7 days
Dry tyres ³ (ADVAN A052)	800 (for set)	7 days
Brake caliper ⁴ (4 piston)	450	7 days
Brake spacers ⁵	30 (depending on recorded data)	5 days
Brake fluid ⁶ (DOT 4)	15	1 day

¹ <https://www.blackcircles.com/brands/yokohama/blueearth-a-ae50#anchorAllSizes>

² <https://www.yokohamatire.com/tires/advan-neova-ad09>

³ <https://www.mrtyremotorsport.com/product/yokohama-advan-a052-trackday-tyres/>

⁴ <https://www.demon-tweeks.com/uk/ap-racing-cp5100-4-piston-radial-mount-brake-caliper-7000558/>

⁵ https://www.pcdparts.co.uk/products/wheel-spacers/hubcentric-wheel-spacers?srsId=AfmBOoqAuEgMVQ42p_0IT1I_O9bOI-KasfuBX47p8EPf9x7hnuNI9EAi

⁶ <https://www.amazon.co.uk/Castrol-Brake-Fluid-DOT-1-litre/dp/>

Milestones

Before starting my section of the project, I established a series of milestones to ensure that the brakes and tyres are properly prepared, and work stays on schedule. These milestones mark key completion points for important tasks and ensure the Morgan is ready for safe and effective testing.

Milestone	Description	Target date
Brake and tyre system documented	The brake and tyre system will be documented following the initial inspection.	13/10/2025
Regulations are reviewed and compliance confirmed	The racing regulations will be reviewed to ensure the brakes and tyres meet all compliance requirements.	15/10/2025
Brake system data recorded	All brake data will be recorded for future reference in the project	22/10/2025
Performance data analysed	The performance data from the Morgan's previous outing will be analysed	TBD
Brake upgrade option assessed	The brake upgrade options will be reviewed to see which changes could improve the Morgan.	10/12/2025
Upgraded components purchased and prepared	Any upgraded components will be purchased and prepared for fitting on the Morgan.	TBD
Brakes and tyres fully installed and ready	The brakes and tyres will be fitted and ready for testing on track.	TBD

Gateway

A gateway is a controlled decision point where progress can only continue if specific, measurable criteria are satisfied. For my area of the project, the selected gateway is the 'assess feasibility for brake upgrade'. This is critical because it determines whether proposed upgrades, such as high-performance calipers or wheel spacers, are suitable to be purchased and fit to the Morgan.

Given the limited braking data for the vehicle, realistic targets are based on standard race-car guidelines and relevant regulation requirements. The brake upgrade can only progress if all the following objective performance criteria are met:

1. Brake caliper piston movement within tolerance of $\pm 0.5\text{mm}$

This is important because the caliper piston controls how the brake pads engage with the discs. If the pistons do not move smoothly or evenly, braking performance can become inconsistent, reducing stopping power and causing uneven pad or disc wear. This can create safety risks, such as the car pulling to one side under braking or experiencing brake fade. By ensuring that the piston movement is within the specified tolerance it confirms that the brake system is mechanically sound and reliable, providing a safe and trustworthy baseline before any upgrades are considered.

2. Tyre tread depth $\geq 4\text{mm}$

The tyres must have enough tread to ensure safe testing, so a minimum depth of 4mm is required. If the tread is below this level, the tyres grip on the track may be compromised, which can affect the braking performance and handling. This could also make performance testing unreliable and increase the risk of accidents. Ensuring the tyres meet this requirement provides a safe and reliable baseline for any upgrades or testing.

3. Pedal feel firm, with no sponginess or sinking

The brake pedal must feel firm and should not sink or feel spongy. An incorrect pedal feel may indicate air in the lines or other issues with the hydraulic system, which can compromise stopping power and safety. Checking the pedal ensures that the brakes are functioning correctly and consistently, providing a reliable baseline for any upgrades.

Risk and mitigation

1. Assess feasibility for brake upgrade

One area of concern is assessing whether a caliper upgrade will fit correctly and improve braking performance. Incorrect measurements or component incompatibility could result in the brakes performing poorly, reducing stability on track and affecting the reliability of performance analysis.

Considering this risk, it is moderately likely to occur. This is because there can be slight variations in measurements when collecting data. However, with careful attention and precision, accurate measurements can be taken to reduce this risk. To prevent this from happening, I will carefully check all measurements I have collected and compare them to the manufacturer's technical specifications to ensure the data is accurate. After doing so, I will carry out a mock-up installation to confirm the dimensions fit correctly, using the test data as a guide.

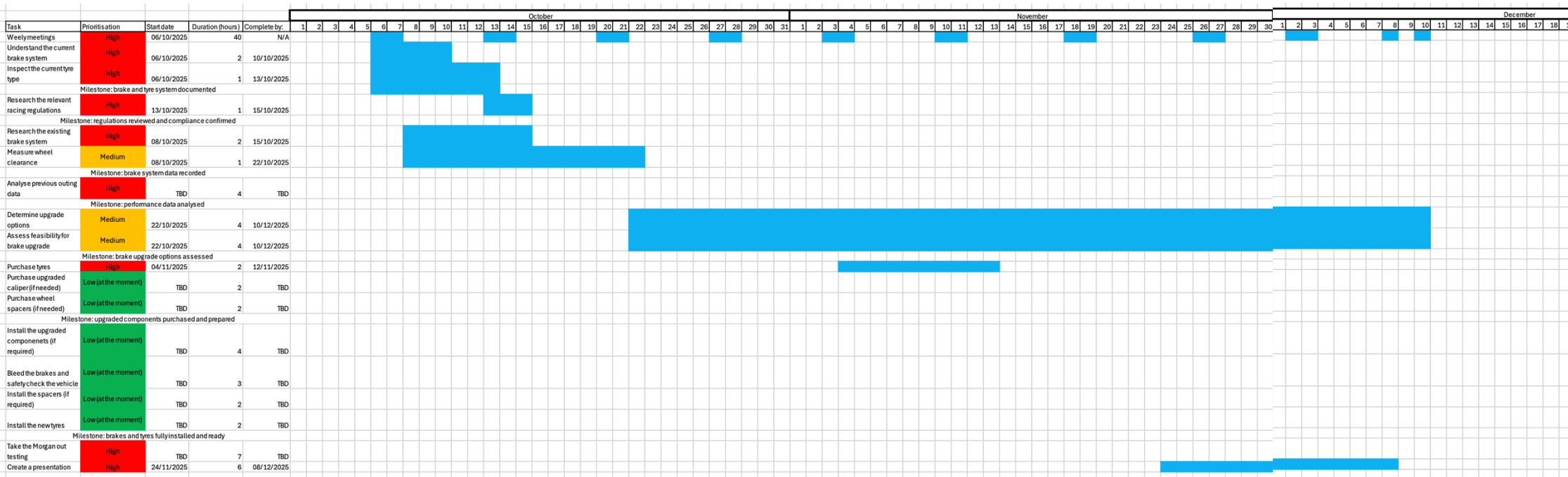
2. Analysing data from the Morgan's previous outing

Another area of concern is the potential misinterpretation, which could lead to poor upgrade decisions being made. This could result in wasted preparation time and resources, as well as delays to the overall timeline.

Considering the risk, it is moderately likely to occur. This is because misinterpretations of the data can happen. However, this can be reduced by double-checking the results with others to ensure consistent conclusions. To prevent this from happening, I will ask a supervisor to verify my analysis and confirm that the correct areas are being focused on to achieve the best possible performance from the Morgan.

Gantt chart

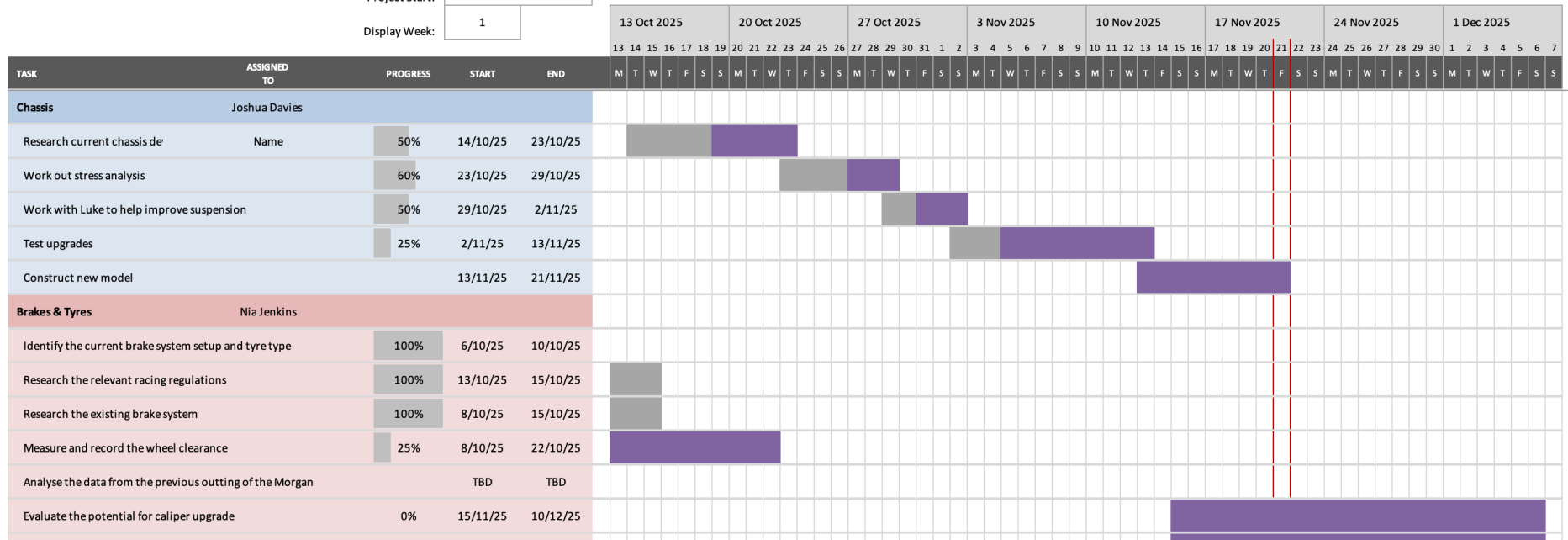
1. Personal



Project Lead

Tue, 14/10/2025

1



Milestones

Milestone	Description	Target date
Roles agreed and project plan*	As a group, decide who is going to focus on which tasks. Create a project plan and a timeline.	10/10/2025
Inspection of the vehicle	Inspect the Morgan's brakes, suspension, chassis, and intake. Analyse what needs to be modified.	23/10/2025
Brake and tyre assessment	Check brakes and tyres, ensure they meet the racing regulations, and identify areas for potential upgrades	25/10/2025
Intake system designed and finished	Finalise intake system design on CAD and select suitable materials.	29/11/2025
Suspension and chassis modelling*	Using VI-Grade and AutoCAD, build a virtual model of the suspension and chassis, and run simulations.	01/02/2026
Order all components needed	Buy all the parts needed for upgrades. This includes brakes, tyres, intake, chassis modifications.	TBD
Prepare PowerPoint presentation	Create a presentation summarising plans for the project, current progress, and next steps.	08/12/2025
Fit the upgrades on car*	Install the upgraded parts onto the vehicle. This includes the brakes, tyres, suspension, chassis, and intake.	TBD
On-track testing	Test the car on track for braking, handling, and performance, and record the results.	TBD (hoping February)
Analyse the results	Review the data collected from the testing. Analyse the feasibility of upgrades to the performance.	TBD

*Gateway milestone – progress only if criteria met

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