| | |
|---|---|
| **Vehicle Chosen:** | Vehicle 1 |
| **Motor Chosen:** | Motor 5 |
| **Battery Pack Chosen:** | Battery 3 |
| **Gearbox Chosen:** | Gearbox 1 |
| **Weather:** | Dry |

# INPUTS

Vehicle Specifications

| | |
|---|---|
| Year | 2024 |
| Make | Mazda |
| Model | MX-5 Miata |
| Weight (lbs) | 2368 |
| Drive Type | RWD |
| Tire Diameter (in) | 23.7 |

Motor Specifications

| | |
|---|---|
| Motor | Motor 5 |
| Rated Torque (Nm) | 600 |
| Rated Speed (RPM) | 5000 |
| No-Load Speed (RPM) | 10000 |

Battery Pack Specifications

| | |
|---|---|
| Battery | Battery 3 |
| Nominal Voltage (V) | 330 |
| Energy Capacity (kWh) | 150 |
| Peak Power (kW) | 400 |
| Weight (lbs) | 3000 |
| Cost ($) | 30000 |

Gearbox Specifications

| | |
|---|---|
| Gearbox | Gearbox 1 |
| Ratio (__:1) | 7 |

Coefficient of Friction

| | |
|---|---|
| Weather | Dry |
| Friction Coefficient | 0.7 |

# INTERMEDIATE CALCULATIONS

Forces at Wheels/Tires

| | |
|---|---|
| Vehicle Weight (kg) | 1074.105856 |
| Battery Weight (kg) | 1360.776 |
| Total Weight (kg) | 2434.881856 |
| Normal Force (N) | 23886.19101 |
| Traction Force (N) | 8360.166853 |

Torques

| | |
|---|---|
| Tire Radius (m) | 0.30099 |

| | | |
|---|---|---|
| | Torque at motor (Nm) | 359.4752316 |
| | Torque at Wheel (Nm) | 1258.16331 |
| Speeds | | |
| | RPM at Motor Torque | 7004.37307 |
| | Tire Circumference (m) | 1.891175946 |
| | Rated Speed at RPM (m/s) | 31.53929015 |
| | Rated Speed at RPM (mph) | 70.55149972 |
| | Traction Limited Through 60mph? | YES |
| Battery Pack | | |
| | Max Current (A) | 1212.121212 |
| | Capacity (Ah) | 454.5454545 |
| | C-rate (C) | 2.666666667 |
| Traction Limited Acceleration | | |
| | Total Mass (kg) | 2434.881856 |
| | Acceleration (m/s^2) | 3.4335 |
| Unlimited Traction Acceleration | | |
| | Total Mass (kg) | 2434.881856 |
| | Acceleration (m/s^2) | 4.905 |
| Constant Torque (CT) | | |
| | Force (N) | 13953.95196 |
| | Acceleration (m/s^2) | 5.730853809 |
| | Time (s) | 5.503419073 |
| Constant Power (CP) | | |
| | Delta Energy (kJ) | -336.6063749 |
| | Time (s) | -0.841515937 |
| Overall Times | | |
| | Fully Traction Limited (s) | 7.805446338 |
| | Sum of CT and CP (s) | 4.661903135 |
| | Accel of CT and CP (m/s^2) | 5.748725193 |
| Calculations at 60 mph | | |
| | Acceleration (m/s^2) | 5.748725193 |
| | Wheel RPM | 850.2646217 |
| | Kinetic Energy (J) | 874414.7721 |
| | Power (kW) | 187.5660533 |
| | Current to Accelerate Vehicle (A) | 568.3819798 |
| Torque of Motor (with limits) | | |
| | Force (N) | 13997.46667 |
| | Torque of Wheel (Nm) | 4213.097492 |

| | | |
|---|---|---|
| | Torque of Motor (Nm) | 601.8710703 |

# OUTPUTS

0-60 Times

| | | |
|---|---|---|
| | Unlimited Traction (s) | 5.463812436 |
| | Traction Constrained (s) | 7.805446338 |

| | |
|---|---|
| Loss of Traction? | YES |

Power/Current to Spin Wheels

| | | |
|---|---|---|
| | Power (kW) | 187.5660533 |
| | Current (A) | 568.3819798 |

| | |
|---|---|
| Vehicle Speed at Crossover (mph) | 70.55149972 |

| | |
|---|---|
| **Vehicle Chosen:** | Vehicle 2 |
| **Motor Chosen:** | Motor 3 |
| **Battery Pack Chosen:** | Battery 2 |
| **Gearbox Chosen:** | Gearbox 1 |
| **Weather:** | Dry |

# INPUTS

Vehicle Specifications

| | |
|---|---|
| Year | 2024 |
| Make | Toyota |
| Model | Camry |
| Weight (lbs) | 3340 |
| Drive Type | FWD |
| Tire Diameter (in) | 26.3 |

Motor Specifications

| | |
|---|---|
| Motor | Motor 3 |
| Rated Torque (Nm) | 300 |
| Rated Speed (RPM) | 5000 |
| No-Load Speed (RPM) | 10000 |

Battery Pack Specifications

| | |
|---|---|
| Battery | Battery 2 |
| Nominal Voltage (V) | 330 |
| Energy Capacity (kWh) | 100 |
| Peak Power (kW) | 300 |
| Weight (lbs) | 2000 |
| Cost ($) | 20000 |

Gearbox Specifications

| | |
|---|---|
| Gearbox | Gearbox 1 |
| Ratio (__:1) | 7 |

Coefficient of Friction

| | |
|---|---|
| Weather | Dry |
| Friction Coefficient | 0.7 |

# INTERMEDIATE CALCULATIONS

Forces at Wheels/Tires

| | |
|---|---|
| Vehicle Weight (kg) | 1514.99728 |
| Battery Weight (kg) | 907.184 |
| Total Weight (kg) | 2422.18128 |
| Normal Force (N) | 23761.59836 |
| Traction Force (N) | 8316.559425 |

Torques

| | |
|---|---|
| Tire Radius (m) | 0.33401 |

| | | |
|---|---|---|
| | Torque at motor (Nm) | 396.8305734 |
| | Torque at Wheel (Nm) | 1388.907007 |
| Speeds | | |
| | RPM at Motor Torque | 3386.157111 |
| | Tire Circumference (m) | 2.098646724 |
| | Rated Speed at RPM (m/s) | 16.91987507 |
| | Rated Speed at RPM (mph) | 37.84874534 |
| | Traction Limited Through 60mph? | NO |
| Battery Pack | | |
| | Max Current (A) | 909.0909091 |
| | Capacity (Ah) | 303.030303 |
| | C-rate (C) | 3 |
| Traction Limited Acceleration | | |
| | Total Mass (kg) | 2422.18128 |
| | Acceleration (m/s^2) | 3.4335 |
| Unlimited Traction Acceleration | | |
| | Total Mass (kg) | 2422.18128 |
| | Acceleration (m/s^2) | 4.905 |
| Constant Torque (CT) | | |
| | Force (N) | 6287.236909 |
| | Acceleration (m/s^2) | 2.59569214 |
| | Time (s) | 6.518444468 |
| Constant Power (CP) | | |
| | Delta Energy (kJ) | 523.140082 |
| | Time (s) | 1.743800273 |
| Overall Times | | |
| | Fully Traction Limited (s) | 7.805446338 |
| | Sum of CT and CP (s) | 8.262244742 |
| | Accel of CT and CP (m/s^2) | 3.243670557 |
| Calculations at 60 mph | | |
| | Acceleration (m/s^2) | 3.243670557 |
| | Wheel RPM | 766.2080431 |
| | Kinetic Energy (J) | 869853.7413 |
| | Power (kW) | 105.2805586 |
| | Current to Accelerate Vehicle (A) | 319.0319956 |
| Torque of Motor (with limits) | | |
| | Force (N) | 7856.758101 |
| | Torque of Wheel (Nm) | 2624.235773 |

| | | |
|---|---|---|
| | Torque of Motor (Nm) | 374.8908247 |

# OUTPUTS

0-60 Times

| | | |
|---|---|---|
| | Unlimited Traction (s) | 5.463812436 |
| | Traction Constrained (s) | 8.262244742 |

Loss of Traction? NO

Power/Current to Spin Wheels

| | | |
|---|---|---|
| | Power (kW) | 105.2805586 |
| | Current (A) | 319.0319956 |

Vehicle Speed at Crossover (mph) 37.84874534

| | |
|---|---|
| **Vehicle Chosen:** | Vehicle 3 |
| **Motor Chosen:** | Motor 6 |
| **Battery Pack Chosen:** | Battery 4 |
| **Gearbox Chosen:** | Gearbox 3 |
| **Weather:** | Dry |

# INPUTS

Vehicle Specifications

| | |
|---|---|
| Year | 2024 |
| Make | Chevrolet |
| Model | Tahoe |
| Weight (lbs) | 5661 |
| Drive Type | AWD |
| Tire Diameter (in) | 33 |

Motor Specifications

| | |
|---|---|
| Motor | Motor 6 |
| Rated Torque (Nm) | 600 |
| Rated Speed (RPM) | 3000 |
| No-Load Speed (RPM) | 6000 |

Battery Pack Specifications

| | |
|---|---|
| Battery | Battery 4 |
| Nominal Voltage (V) | 330 |
| Energy Capacity (kWh) | 200 |
| Peak Power (kW) | 600 |
| Weight (lbs) | 4500 |
| Cost ($) | 40000 |

Gearbox Specifications

| | |
|---|---|
| Gearbox | Gearbox 3 |
| Ratio (__:1) | 15 |

Coefficient of Friction

| | |
|---|---|
| Weather | Dry |
| Friction Coefficient | 0.7 |

# INTERMEDIATE CALCULATIONS

Forces at Wheels/Tires

| | |
|---|---|
| Vehicle Weight (kg) | 2567.784312 |
| Battery Weight (kg) | 2041.164 |
| Total Weight (kg) | 4608.948312 |
| Normal Force (N) | 45213.78294 |
| Traction Force (N) | 31649.64806 |

Torques

| | |
|---|---|
| Tire Radius (m) | 0.4191 |

| | | |
|---|---|---|
| | Torque at motor (Nm) | 884.2911668 |
| | Torque at Wheel (Nm) | 6632.183751 |
| Speeds | | |
| | RPM at Motor Torque | 1578.544166 |
| | Tire Circumference (m) | 2.633282962 |
| | Rated Speed at RPM (m/s) | 4.618614953 |
| | Rated Speed at RPM (mph) | 10.33156453 |
| | Traction Limited Through 60mph? | NO |
| Battery Pack | | |
| | Max Current (A) | 1818.181818 |
| | Capacity (Ah) | 606.0606061 |
| | C-rate (C) | 3 |
| Traction Limited Acceleration | | |
| | Total Mass (kg) | 4608.948312 |
| | Acceleration (m/s^2) | 6.867 |
| Unlimited Traction Acceleration | | |
| | Total Mass (kg) | 4608.948312 |
| | Acceleration (m/s^2) | 9.81 |
| Constant Torque (CT) | | |
| | Force (N) | 21474.5884 |
| | Acceleration (m/s^2) | 4.659325067 |
| | Time (s) | 0.991262659 |
| Constant Power (CP) | | |
| | Delta Energy (kJ) | 1606.007387 |
| | Time (s) | 2.676678979 |
| Overall Times | | |
| | Fully Traction Limited (s) | 3.902723169 |
| | Sum of CT and CP (s) | 3.667941638 |
| | Accel of CT and CP (m/s^2) | 7.30655028 |
| Calculations at 60 mph | | |
| | Acceleration (m/s^2) | 7.30655028 |
| | Wheel RPM | 610.644592 |
| | Kinetic Energy (J) | 1655165.518 |
| | Power (kW) | 451.2518686 |
| | Current to Accelerate Vehicle (A) | 1367.429905 |
| Torque of Motor (with limits) | | |
| | Force (N) | 33675.51258 |
| | Torque of Wheel (Nm) | 14113.40732 |

| | | |
|---|---|---|
| | Torque of Motor (Nm) | 940.8938215 |

# OUTPUTS

0-60 Times

| | | |
|---|---|---|
| | Unlimited Traction (s) | 2.731906218 |
| | Traction Constrained (s) | 3.667941638 |

Loss of Traction? YES

Power/Current to Spin Wheels

| | | |
|---|---|---|
| | Power (kW) | 451.2518686 |
| | Current (A) | 1367.429905 |

Vehicle Speed at Crossover (mph) 10.33156453

| Weather | Coefficient of Fricti |
|---|---|
| Wet | 0.4 |
| Dry | 0.7 |

| Vehicle Number | Make | Model | Year | Vehicle Weight (lbs | Drive Type | Tire Diameter (in |
|---|---|---|---|---|---|---|
| Vehicle 1 | Mazda | MX-5 Miata | 2024 | 2368 | RWD | 23.7 |
| Vehicle 2 | Toyota | Camry | 2024 | 3340 | FWD | 26.3 |
| Vehicle 3 | Chevrolet | Tahoe | 2024 | 5661 | AWD | 33 |

Full Specs

2024 Mazda MX-5 Miata Sport Specs & Features | Edmunds

2024 Toyota Camry Specs & Features | Edmunds

2024 Chevrolet Tahoe LS Specs & Features | Edmunds

| Name | Rated Torque (Nm) | Rated Speed (RPM) | No-Load Speed (RPM) |
|---|---|---|---|
| Motor 1 | 100 | 5000 | 10000 |
| Motor 2 | 100 | 3000 | 6000 |
| Motor 3 | 300 | 5000 | 10000 |
| Motor 4 | 300 | 3000 | 6000 |
| Motor 5 | 600 | 5000 | 10000 |
| Motor 6 | 600 | 3000 | 6000 |

| Name | Nominal Voltage (V) | Capacity (kWh) | Peak Power (kW) | Weight (lbs) | Cost ($) |
|---|---|---|---|---|---|
| Battery | 330 | 100 | 200 | 2000 | 15000 |
| Battery | 330 | 100 | 300 | 2000 | 20000 |
| Battery | 330 | 150 | 400 | 3000 | 30000 |
| Battery | 330 | 200 | 600 | 4500 | 40000 |

| Name | Ratio (__:1) |
|---|---|
| Gearbox 1 | 7 |
| Gearbox 2 | 10 |
| Gearbox 3 | 15 |