

Delivering Excellence Through
Innovation & Technology



Creating a world fit for the future

Ricardo plc Preliminary Results Presentation

Year ended 30 June 2019

Presented September 2019

www.ricardo.com

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HIGHLIGHTS – for the year ended 30 June 2019



- A resilient performance, demonstrating the development of the business and the success of diversification across sectors and geographies
- Strong growth in Performance Products and Energy & Environment in particular, offsetting a very challenging year in our European and US Automotive businesses
- Order intake robust at £386m, compared to £413m in FY 2017/18 and £366m in FY 2016/17
- Order book increased to £314m, up £19m on June 2018
- Revenue up 2% to £384.4m on FY 2017/18
- Underlying PBT similar to prior year at £37.0m (FY 2017/18: £37.5m)
- Record McLaren engine deliveries and ABS production commenced
- Two Australian acquisitions in Rail and Energy & Environment (May 2019 and July 2019, respectively)
- Net debt at £47.4m, including £22.4m acquisition costs (June 2018 Net debt: £26.1m)
- Dividend increased by 4% to 21.28p from 20.46p
- Current political and economic uncertainties aside, we are well positioned for growth from a strong, diversified order book and pipeline, recurring revenue from long-term production programmes and the benefit of recent acquisitions

Note: the prior period has been restated due to the impact of IFRS 15 'Revenue from contracts with customers' on a like-for-like basis with the current period.



Key indicators



| | Year ended 30 June | | Year-on-Year Movement |
|--|-----------------------|---------------------|--------------------------|
| | 2019 | 2018 ⁽¹⁾ | |
| Order intake (£m) | £386m | £413m | £(27)m |
| Order book (£m) | £314m | £295m | £19m |
| Underlying operating profit margin ⁽²⁾ (%) | 10.3% | 10.5% | (0.2)% |
| Underlying effective tax rate ^{(2) (3)} (%) | 22.2% | 21.3% | 0.9% |
| Underlying basic earnings per share (pence) ⁽²⁾ | 53.7p | 55.1p | (1.4)p |
| Dividend (pence) | 21.28p | 20.46p | 0.82p |
| Net debt (£m) | £(47.4)m | £(26.1)m | £(21.3)m |
| FCFe ⁽⁴⁾ | £15.2m | £26.0m | £(10.8)m |
| Pre-tax pension deficit (£m) | £8.5m | £4.6m | £3.9m |
| Closing headcount incl. subcontractors (no.) | 2,981 | 3,061 | (80) |

(1) the prior period has been restated due to the impact of IFRS 15 'Revenue from contracts with customers' on a like-for-like basis with the current period.

(2) excluding specific adjusting items, which comprise amortisation of acquired intangible assets, acquisition-related expenditure, reorganisation costs and non-recurring items.

(3) reported effective tax rate is 24.9%.

(4) calculated as net cashflow excluding dividends, FX, purchase of and/or proceeds from shares and acquisition and restructuring related costs.

Income statement



| £m | Year ended 30 June | | Year-on-Year Movement |
|-----------------------|-----------------------------------|---------------------------------------|--------------------------|
| | 2019 Underlying ⁽²⁾ | 2018 Underlying ^{(1) (2)} | % change |
| Revenue | 384.4 | 378.5 | 2% |
| Gross profit | 134.9 | 142.7 | (5)% |
| Administration costs | (95.3) | (103.0) | (7)% |
| Operating profit | 39.6 | 39.7 | - |
| Net finance costs | (2.6) | (2.2) | 18% |
| Profit before tax | 37.0 | 37.5 | (1)% |
| Taxation charge | (8.2) | (8.0) | 2% |
| Profit for the period | 28.8 | 29.5 | (2)% |

(1) the prior period has been restated due to the impact of IFRS 15 'Revenue from contracts with customers' on a like-for-like basis with the current period. Comparative information has also been re-presented to reclassify certain indirect payroll and depreciation costs from cost of sales to administrative expenses in a manner that is consistent with their classification in the current period.

(2) excluding specific adjusting items, which comprise amortisation of acquired intangible assets, acquisition-related expenditure, reorganisation costs and non-recurring items.

(3) a full income statement including these items is included in the Appendix.

Revenue by customer location



External Revenue

Year ended
30 June

| £m | 2019 | 2018 ⁽¹⁾ |
|--------------------------|--------------|---------------------|
| UK | 152.4 | 144.6 |
| Rest of Europe | 96.4 | 99.3 |
| Europe total | 248.8 | 243.9 |
| US | 61.3 | 47.6 |
| China | 30.9 | 38.9 |
| Rest of Asia | 31.4 | 40.8 |
| Asia total | 62.3 | 79.7 |
| Rest of the World | 12.0 | 7.3 |
| Total | 384.4 | 378.5 |

(1) the prior period has been restated due to the impact of IFRS 15 'Revenue from contracts with customers' on a like-for-like basis with the current period.

Segmental results



| £m | Year ended 30 June | | | | | |
|----------------------|--------------------|---------------------|--|---------------------|---|---------------------|
| | Revenue earned | | Underlying operating profit ⁽²⁾ | | Underlying operating profit ⁽²⁾ margin | |
| | 2019 | 2018 ⁽¹⁾ | 2019 | 2018 ⁽¹⁾ | 2019 | 2018 ⁽¹⁾ |
| Performance Products | 113.9 | 91.7 | 11.9 | 9.3 | 10.4% | 10.1% |
| Technical Consulting | 270.5 | 286.8 | 27.7 | 30.4 | 10.2% | 10.6% |
| Total | 384.4 | 378.5 | 39.6 | 39.7 | 10.3% | 10.5% |

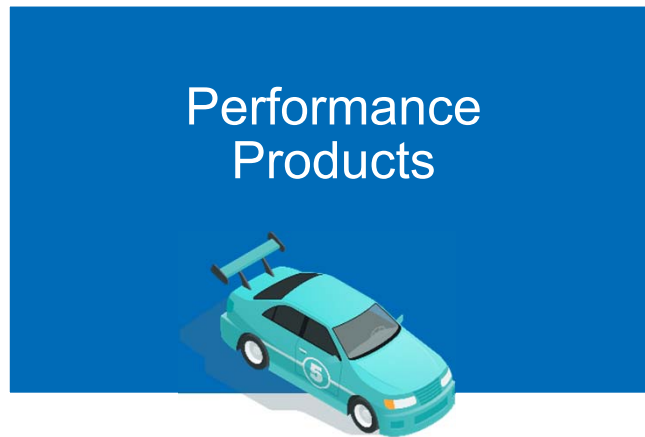
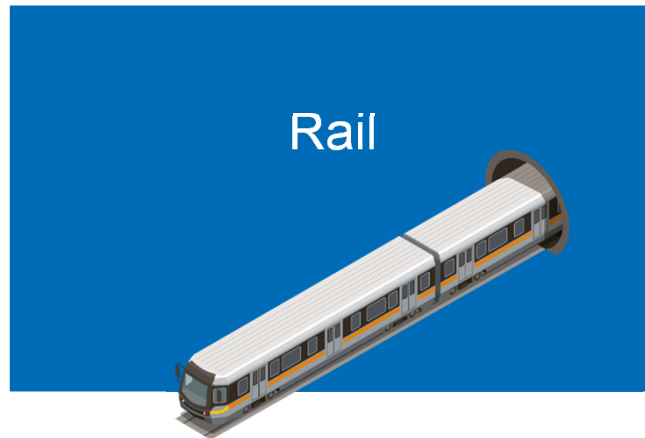
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(2) excluding specific adjusting items, which comprise amortisation of acquired intangible assets, acquisition-related expenditure and reorganisation costs.

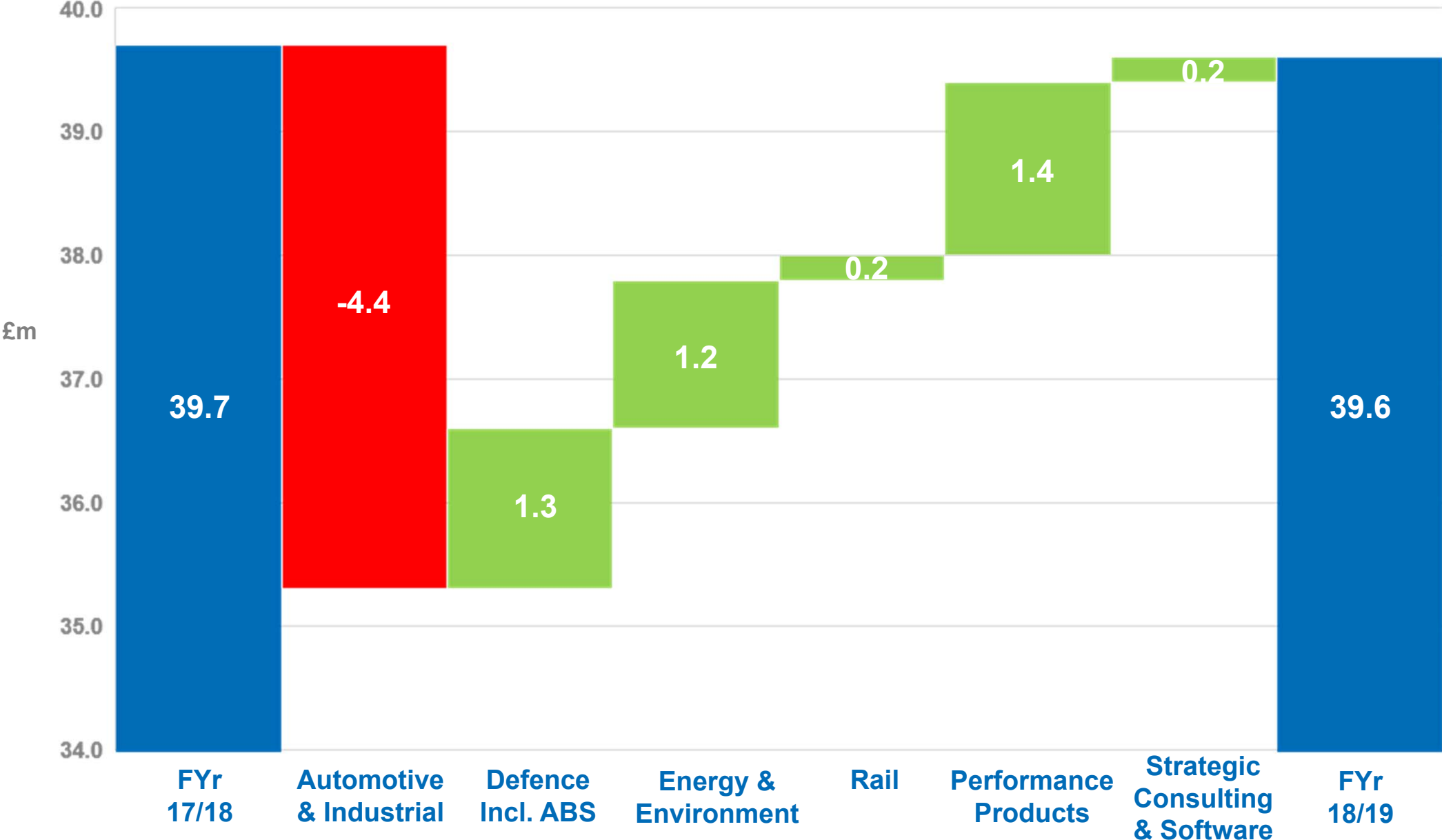
Segmental structure



- From 2020, segmental reporting will be changing from TC and PP to the segments below to give more granularity on the different areas of our business
- ABS will be reported in the Defence segment



Underlying operating profit bridge under the new segmental structure



Cash flow



| £m | Year ended 30 June | |
|---|-----------------------|---------------------|
| | 2019 | 2018 ⁽¹⁾ |
| Underlying operating profit | 39.6 | 39.7 |
| Depreciation and amortisation | 11.4 | 11.6 |
| Working capital decrease/(increase) | (7.8) | 1.3 |
| Dividends | (11.0) | (10.5) |
| Tax paid | (4.9) | (7.6) |
| Capital expenditure | (16.0) | (14.4) |
| Pension charge and funding | (4.3) | (4.4) |
| Cash flow hedges, FX, interest/other | (3.4) | 0.1 |
| Cash inflow before acq'n & restructuring related costs | 3.6 | 15.8 |
| Acquisition and restructuring related costs | (24.9) | (4.0) |
| Cash inflow/(outflow) ⁽²⁾ | (21.3) | 11.8 |
| Opening Cash Balance | (26.1) | (37.9) |
| Closing Cash Balance | (47.4) | (26.1) |

(1) the prior period has been restated due to the impact of IFRS 15 'Revenue from contracts with customers' on a like-for-like basis with the current period.

(2) cash inflow/(outflow) net of movement in borrowings

Balance sheet summary



| £m | 30 June | |
|--|--------------|---------------------|
| | 2019 | 2018 ⁽¹⁾ |
| Tangible non-current assets | 44.6 | 45.3 |
| Intangible non-current assets | 125.2 | 97.2 |
| Inventories, trade and other receivables | 155.9 | 148.6 |
| Assets held for sale | 2.9 | - |
| Net debt | (47.4) | (26.1) |
| Trade and other payables | (89.9) | (83.0) |
| Pension deficit | (8.5) | (4.6) |
| Other ⁽²⁾ | (10.9) | (6.6) |
| Net assets | 171.9 | 170.8 |

(1) the prior period has been restated due to the impact of IFRS 15 'Revenue from contracts with customers' on a like-for-like basis with the current period.

(2) other includes provisions, deferred tax and current tax liabilities.

Investments and acquisitions

Transport Engineering

- ƒ Cash impact in year net £18.9m. Further £0.5m paid in H1 FY20 for cash and net working capital. Additional £8.2m, subject to financial performance targets, to be paid over the next two years.

| Date Acquired | No. of people | Cash consideration | Revenue p.a. | Operating Profit p.a. |
|---------------|---------------|---------------------|--------------|-----------------------|
| 31 May 2019 | 95 | £21.7m (max £29.9m) | £15.3m | £3.5m |

PLC Consulting

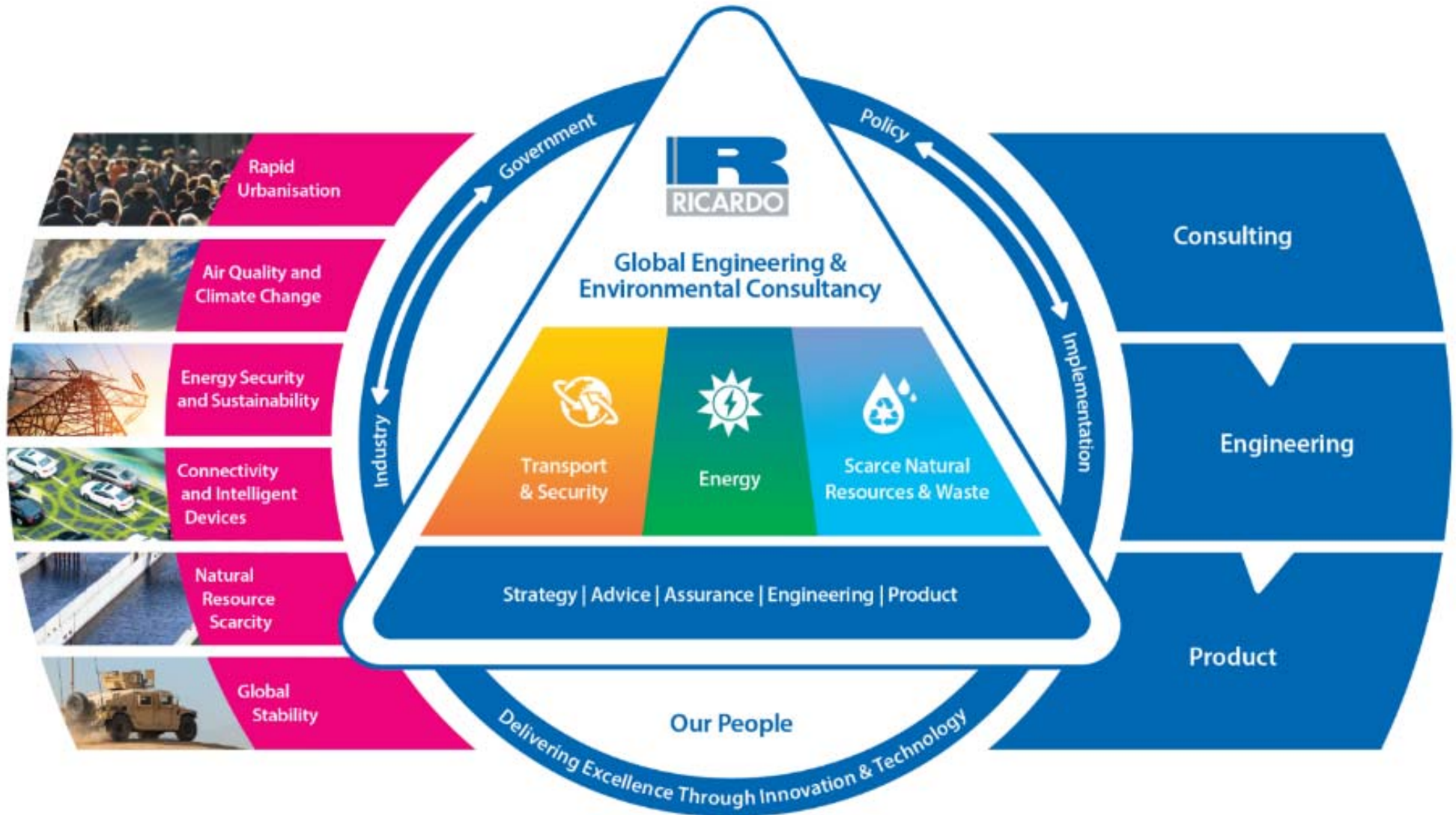
- ƒ £3.9m paid in H1 FY20. Additional £1.5m, subject to financial performance targets, to be paid over the next two years.

| Date Acquired | No. of people | Cash consideration | Revenue p.a. | Operating Profit p.a. |
|---------------|---------------|--------------------|--------------|-----------------------|
| 31 July 2019 | 21 | £3.9m (max £5.4m) | £2.2m | £0.8m |

Detroit Technical Center

- ƒ Purchase of DTC for £14.2m in August 2019 to provide strategic flexibility and realign cost base
- ƒ Potential sale of test facility in FY20 and office building in FY21
- ƒ Impairment and/or gains on freehold property and assets to be treated as specific adjusting items

Our ambition is to create a world fit for the future, meeting the challenges within the markets of Transport & Security, Energy, and Scarce Natural Resources & Waste.



3,000 people

88 Nationalities

51 Sites

20 Countries

Diverse, agile and flexible business model, navigating a volatile market and economic backdrop

- Continued Brexit uncertainty, very weak Automotive backdrop and slowing China economy
- CO₂ reduction and local urban emissions remain priorities - development and adoption of electrified transport and infrastructure
- US defence spend at high levels - new technologies, life extension, and cyber protection
- Investment in public transport and infrastructure to improve inter- and intra-urban mobility in developed and developing economies
- Public and government action on environmental, plastic, water, waste & recycling agendas



Balancing the business: By market sector and geography - two Australian businesses acquired



Transport Engineering

- Sydney based rail systems technical consultants
- Major rolling stock projects in NSW & Victoria
- Strong capability in:
 - Rolling stock life-cycle management
 - On-site inspection and auditing
 - Safety engineering
 - Reliability, availability and maintainability
 - Testing and systems integration
- Headcount of 95
- Revenue of c. £15m p.a.

PLC Consulting

- Melbourne based planning, environment and infrastructure consultancy
- Public and private customers in Property, Transport, Environmental, Mining and Infrastructure
- Strong capability in infrastructure and environment planning life-cycle
- Headcount of 21
- Revenue of c. £2m p.a.



Developing a diverse & sustainable business fit for the future



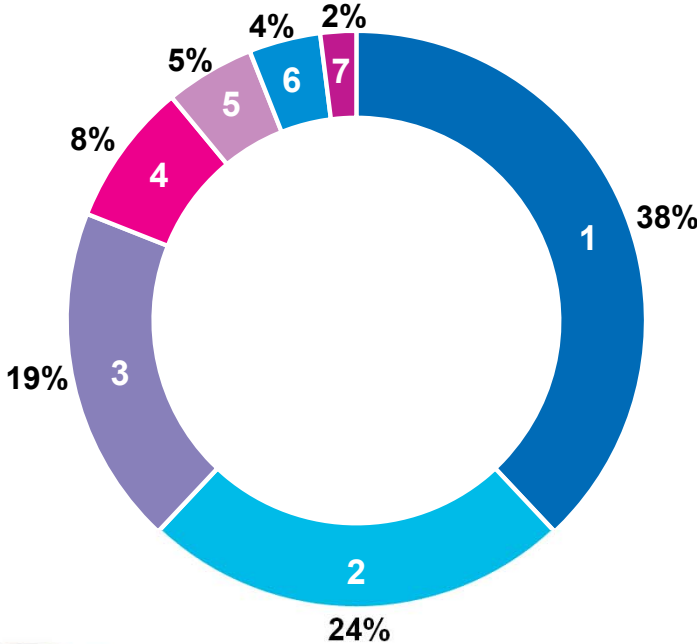
- >5,000 McLaren engines delivered. Next programme secured
- 3,500 ABS kits ordered with 1,650 delivered in ramp up year
- PanMon rail infrastructure trial systems delivered to Network Rail
- Rail contract extension for independent safety assessment of Doha Metro, Qatar
- Indian electrified urban vehicle programme secured
- Ricardo Software recurring revenue at £9m with renewal rate at 93%
- Supporting global cities and regions, including Mexico, Brazil, South Africa, Kenya, Vietnam and Bangladesh in understanding and managing their Greenhouse Gas emissions



A continued good balance of order intake and pipeline from across the globe



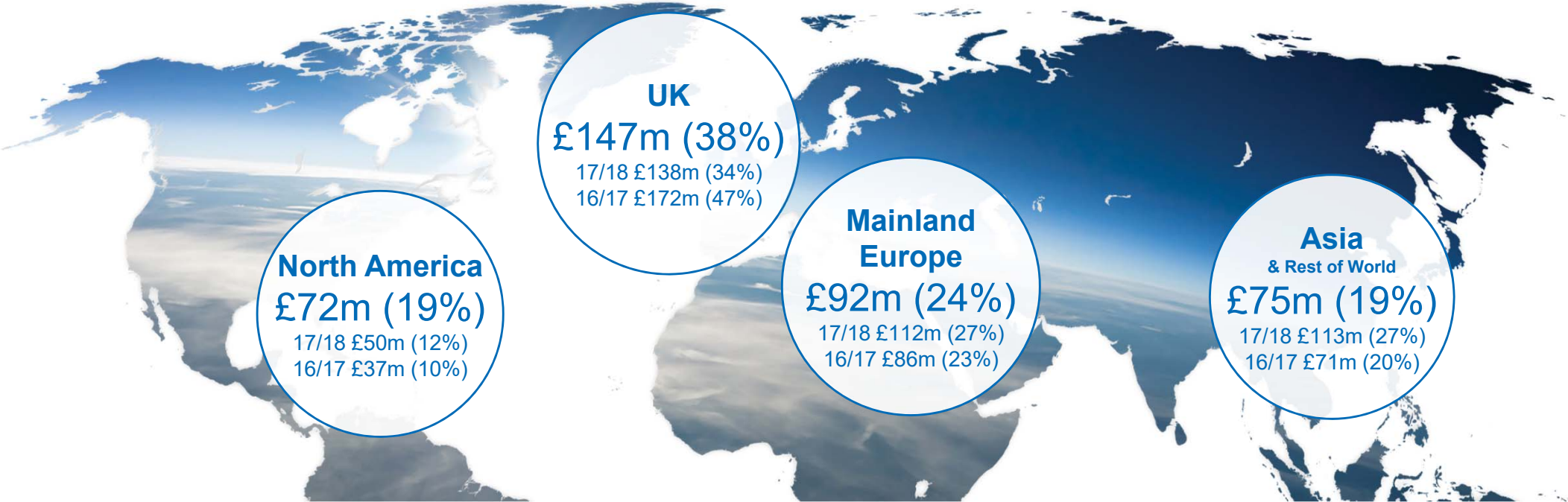
- 1. UK
- 2. Mainland Europe
- 3. North America
- 4. China
- 5. Japan
- 6. Rest of Asia
- 7. Rest of World



FY 2018/19
 Order Intake £386m

FY 2017/18
 Order Intake £413m

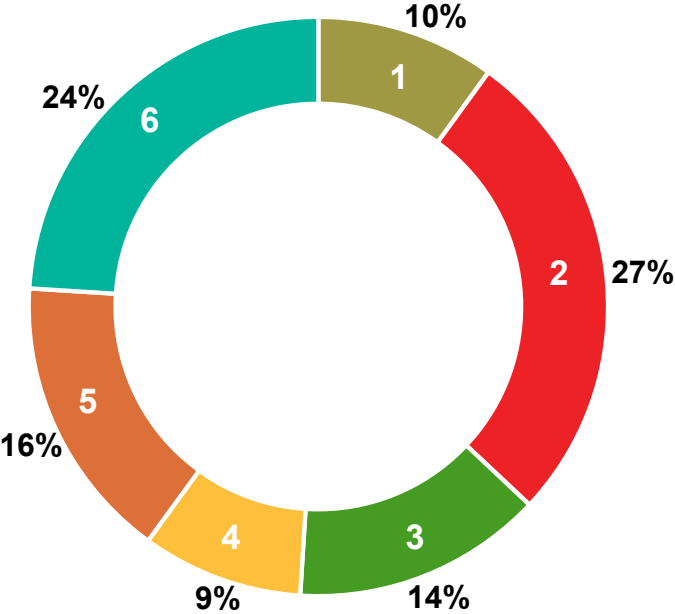
FY 2016/17
 Order Intake £366m



Well balanced market sector order intake with strong performance from Defence and High Performance Vehicles



- 1. Defence
- 2. High Performance Vehicles & Motorsport
- 3. Energy & Environment
- 4. Off Highway & Commercial Vehicles
- 5. Rail
- 6. Passenger Car & Motorcycle



FY 2018/19
 Order Intake £386m

FY 2017/18
 Order Intake £413m

FY 2016/17
 Order Intake £366m

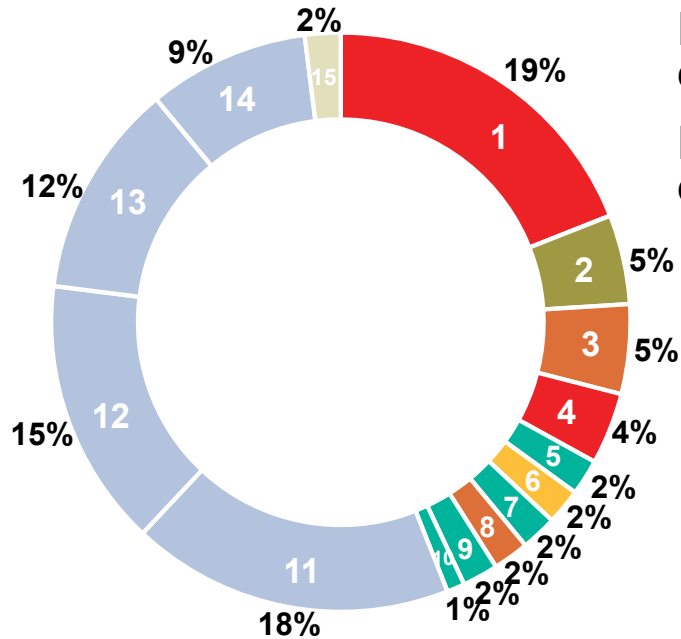


| Defence | HPV&M | E&E | Off-Highway & CV | Rail | Pas Car & Motorcycle |
|-------------------------|--------------------------|--------------------------|--------------------------|--------------------------|----------------------------|
| £40m | £103m | £54m | £34m | £61m | £94m |
| 17/18 £14m 16/17 £6m | 17/18 £86m 16/17 £88m | 17/18 £50m 16/17 £53m | 17/18 £37m 16/17 £30m | 17/18 £82m 16/17 £73m | 17/18 £144m 16/17 £116m |

Diverse customer mix, with a good level of multi-year business. Our top 3 customers are spread across Performance Products, Defence and Rail



Ricardo External Order Intake by Customer for year ended 30 June 2019

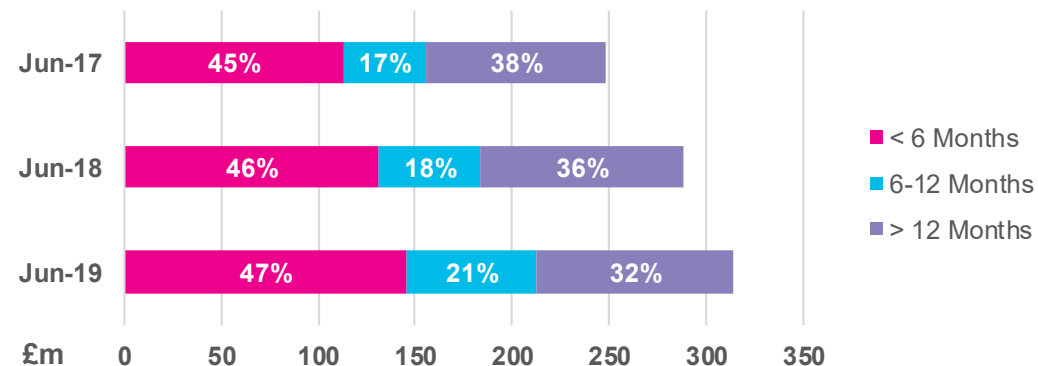


FY 2018/19
Order Intake £386m
FY 2017/18
Order Intake £413m
FY 2016/17
Order Intake £366m

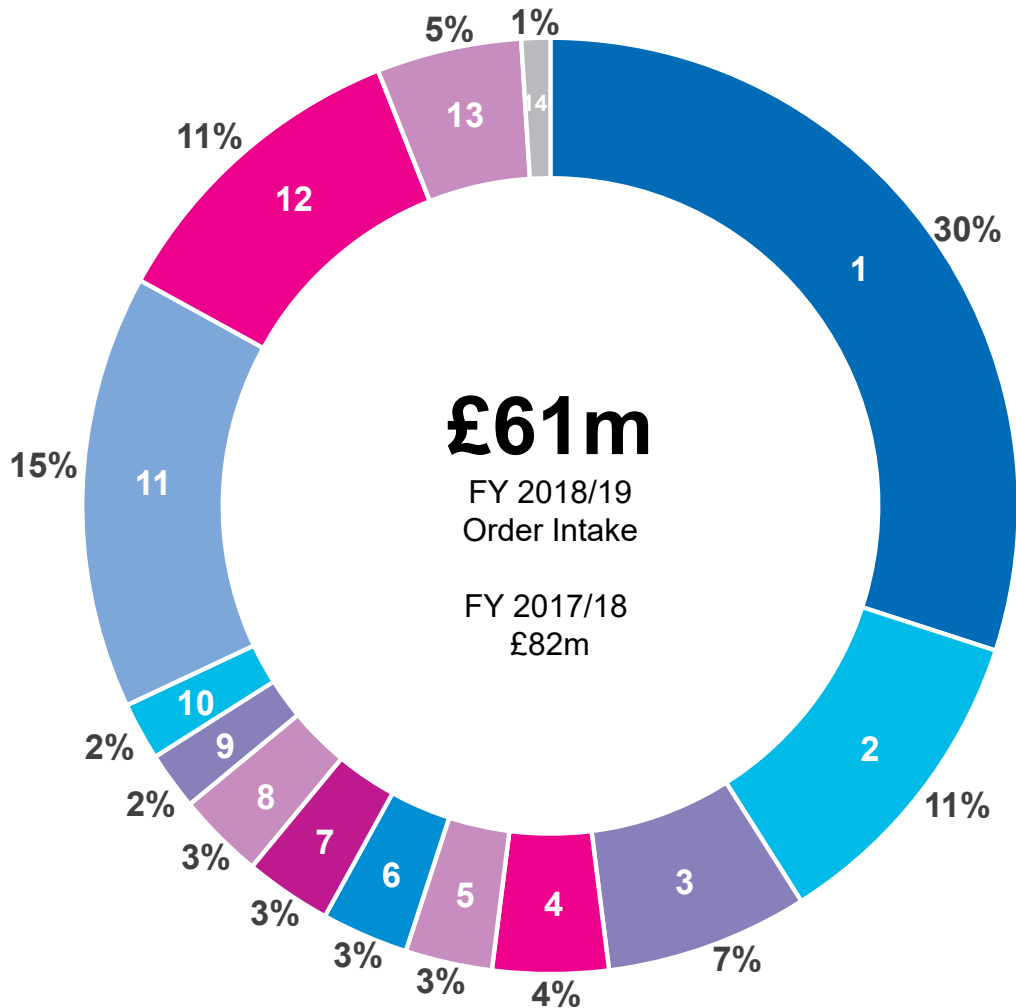


- | | | |
|-----------------|-------------------|---------------------------------|
| 1. Key client 1 | 6. Key client 6 | 11. Other UK clients |
| 2. Key client 2 | 7. Key client 7 | 12. Other Asia clients |
| 3. Key client 3 | 8. Key client 8 | 13. Other North America clients |
| 4. Key client 4 | 9. Key client 9 | 14. Other Europe clients |
| 5. Key client 5 | 10. Key client 10 | 15. Rest of World clients |

Order Book Profile

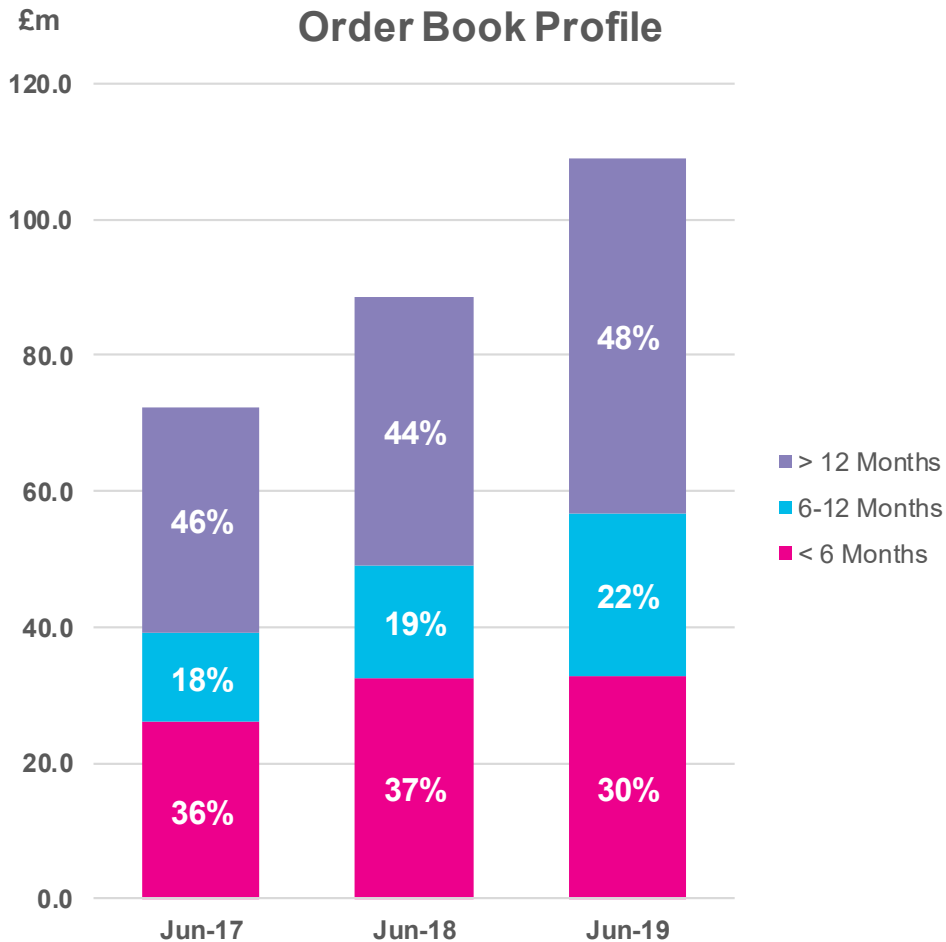


Focus on Rail – Technical Consulting



- 1. Key client 1
- 2. Key client 2
- 3. Key client 3
- 4. Key client 4
- 5. Key client 5
- 6. Key client 6
- 7. Key client 7
- 8. Key client 8
- 9. Key client 9
- 10. Key client 10
- 11. Other Europe clients
- 12. Other Asia clients
- 13. Other UK clients
- 14. Rest of World clients

- Over 1,000 live projects
- No of people – 640
- Revenue of c. £70m



Creating a world fit for the future

Doha Metro Independent Safety Assessment (ISA)

In May 2019 the first section of the Doha Metro entered into passenger service, with the opening of 13 Red Line stations. The full network – to comprise 100 stations on four lines – is expected to be operational by 2026. Capable of speeds of up to 100km/h, the Doha Metro will be one of the fastest driverless systems in the world. Ricardo was appointed as the ISA in 2012, during the early design stages, to help ensure the safety of passengers, staff and the public is accounted for at every stage of the Metro's development.



Creating a world fit for the future

Bombardier AVENTRA

Digital Resilience Assessment (2019)

In partnership with Roke, our rail experts are helping Bombardier's in-house teams undertake an in-depth assessment of the AVENTRA's exposure to a range of possible cyber threats – from espionage to remote hacking – and evaluate their potential impact on the vehicle's operation. Once complete, Bombardier will gain a full risk-based assessment of the AVENTRA, with recommendations for reducing vulnerabilities.



Creating a world fit for the future

Spanish High-Speed Network *Interoperability Verification*

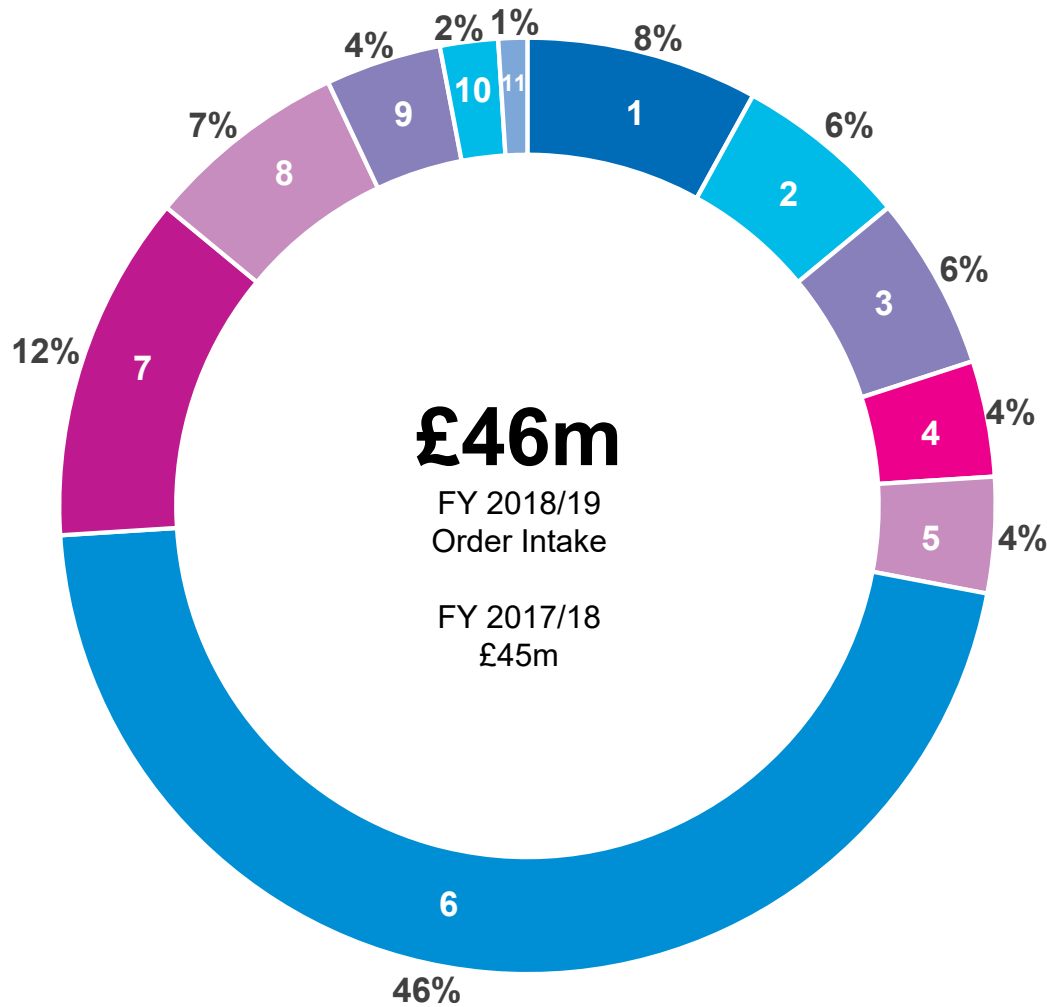
Our Madrid team is supporting Spanish infrastructure manager, Adif, with Verification of Interoperability services on the works to increase capacity between Madrid and Torrejón de Velasco. The improvements include widening the section from two to four tracks, plus new viaducts, and overpasses, to increase traffic between the capital and cities such as Barcelona, Valencia and Sevilla. Ricardo joined the project in April 2018 and will help ensure the new infrastructure meets EU interoperability requirements.



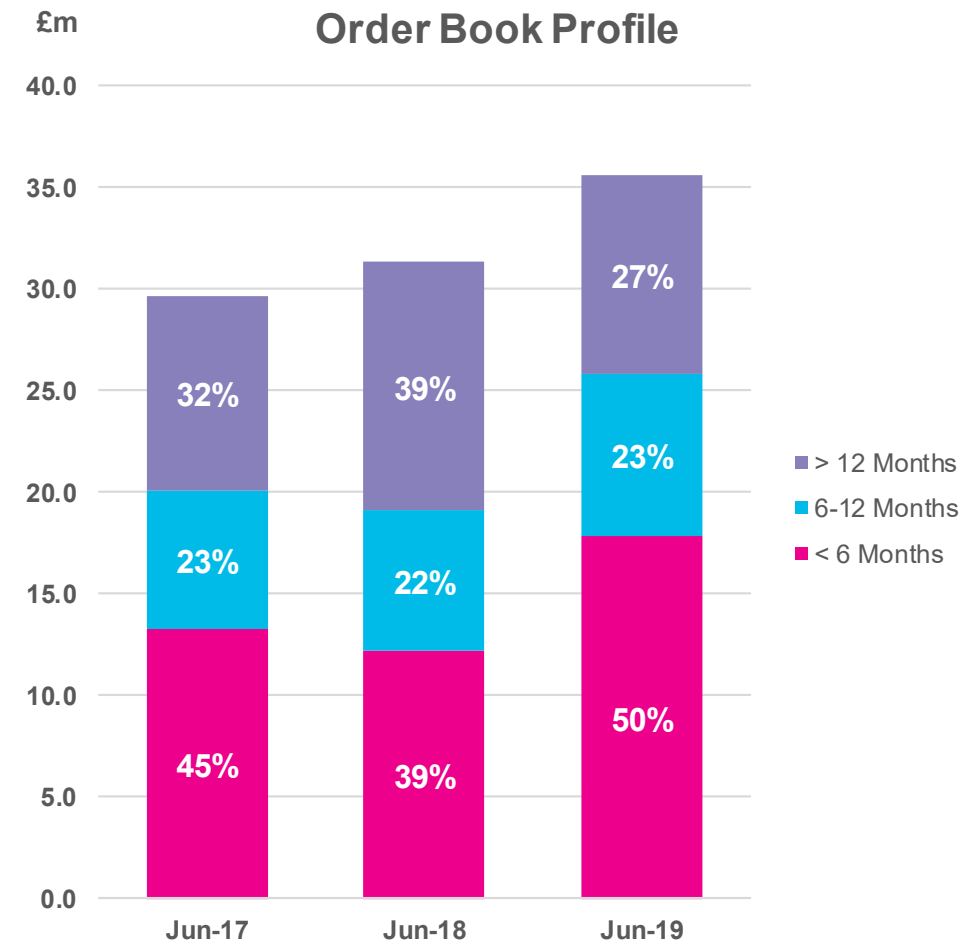
Focus on Energy and Environment – Technical Consulting



- Over 1,100 live projects
- No of people – 490
- Revenue of c. £45m



- | | |
|-----------------|---------------------------------|
| 1. Key client 1 | 6. Other UK clients |
| 2. Key client 2 | 7. Other UK Gov clients |
| 3. Key client 3 | 8. Other Europe clients |
| 4. Key client 4 | 9. Other Rest of World clients |
| 5. Key client 5 | 10. Other North America clients |
| | 11. Other Asia clients |





Creating a world fit for the future

Low Emission Strategies and Clean Air Zones

Ricardo brings unrivalled understanding of air pollution and low emissions solutions to the problem of poor air quality in urban areas. Our approach recognises the uniqueness of individual cities, and addresses both air and carbon emissions in an integrated way. Our low emission strategies are underpinned by robust evidence and supported by the coherent, compelling, business cases that have secured the investment necessary to reduce pollution and improve the health of millions of city dwellers in the UK and beyond.



Creating a world fit for the future

Delivering innovative waste infrastructure for the Abu Dhabi Government

The Abu Dhabi Government engaged Ricardo to develop the business case and provide detailed technical support to assess the concept feasibility for the development of a series of waste to jet fuel and chemical facilities across Abu Dhabi. The aim of the project is to ensure Abu Dhabi meets its waste diversion targets and offer a sustainable product to support the decarbonising of important regional industries.

Creating a world fit for the future

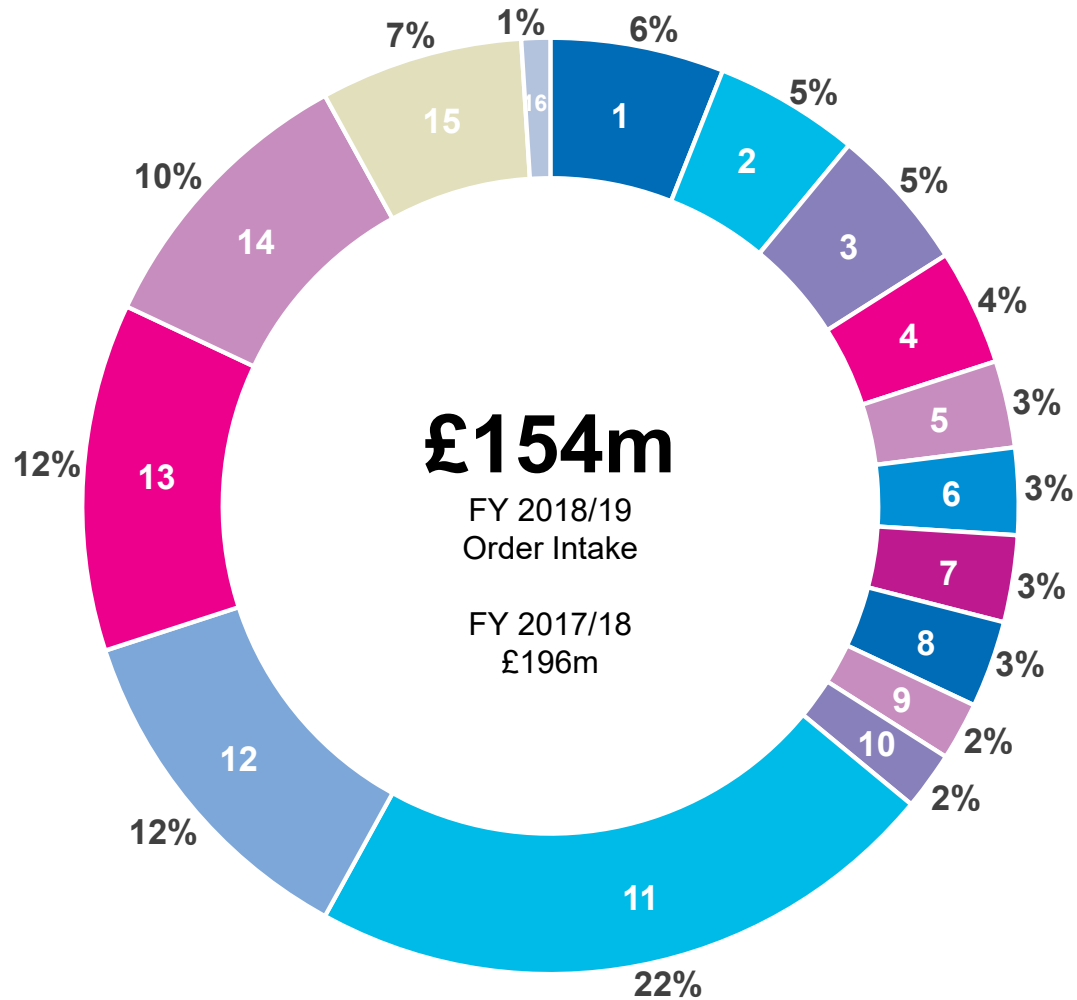
Assessing the National Energy & Climate Plans prepared by EU Member States

National Energy & Climate Plans are being developed by all Member States to set out their strategies for reaching their 2030 energy and climate objectives. Ricardo's policy experts are supporting the European Commission by providing in-depth analysis of the content, consistency and quality of each of these plans and in making recommendations on how the plans can be improved to ensure that the EU achieves its binding 2030 targets on energy efficiency improvements, renewable energy deployment and greenhouse gas emissions reductions.

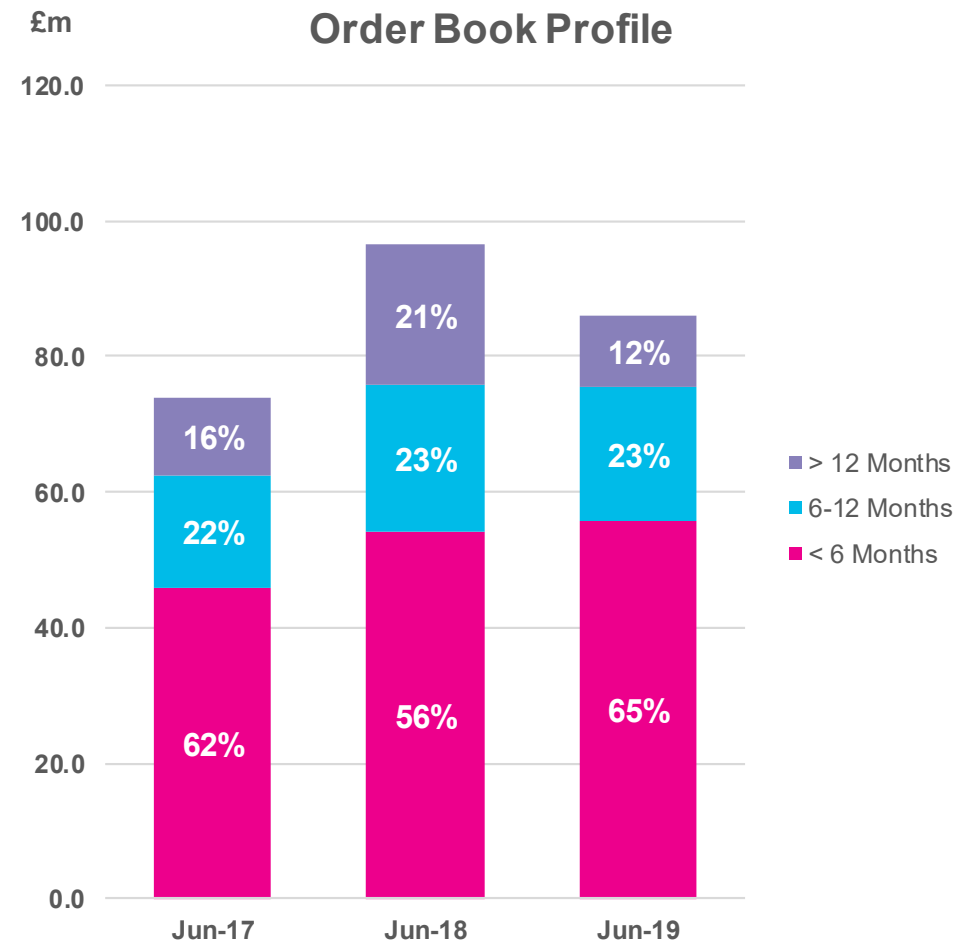
Focus on Automotive, Industrial and Other – Technical Consulting



- Over 500 live projects
- No of people – 1,380
- Revenue of c. £160m



- | | | |
|-----------------|-------------------|---------------------------------|
| 1. Key client 1 | 6. Key client 6 | 11. Other Asia clients |
| 2. Key client 2 | 7. Key client 7 | 12. Other North America clients |
| 3. Key client 3 | 8. Key client 8 | 13. US Defence |
| 4. Key client 4 | 9. Key client 9 | 14. Other UK clients |
| 5. Key client 5 | 10. Key client 10 | 15. Other Europe clients |
| | | 16. Rest of World clients |





Creating a world fit for the future

BMW Mid-Sized Scooters *Smart, urban – and every inch a BMW*

Building on more than a decade of co-operation with BMW Motorrad, Ricardo Motorcycle has partnered with the premium bikemaker to develop a new generation of mid-sized scooters that distil the qualities of the highly successful C650 maxi-scooters, also co-developed with Ricardo, into the smaller and more accessible C400 series.

Creating a world fit for the future

Software aims to reduce motion sickness in autonomous vehicles

Ricardo engineers have been working to identify the causes of motion sickness – as well as creating a software package that aims to minimise this condition in the passengers of both autonomous and conventional vehicles.

Creating a world fit for the future

Electronic Maintenance System

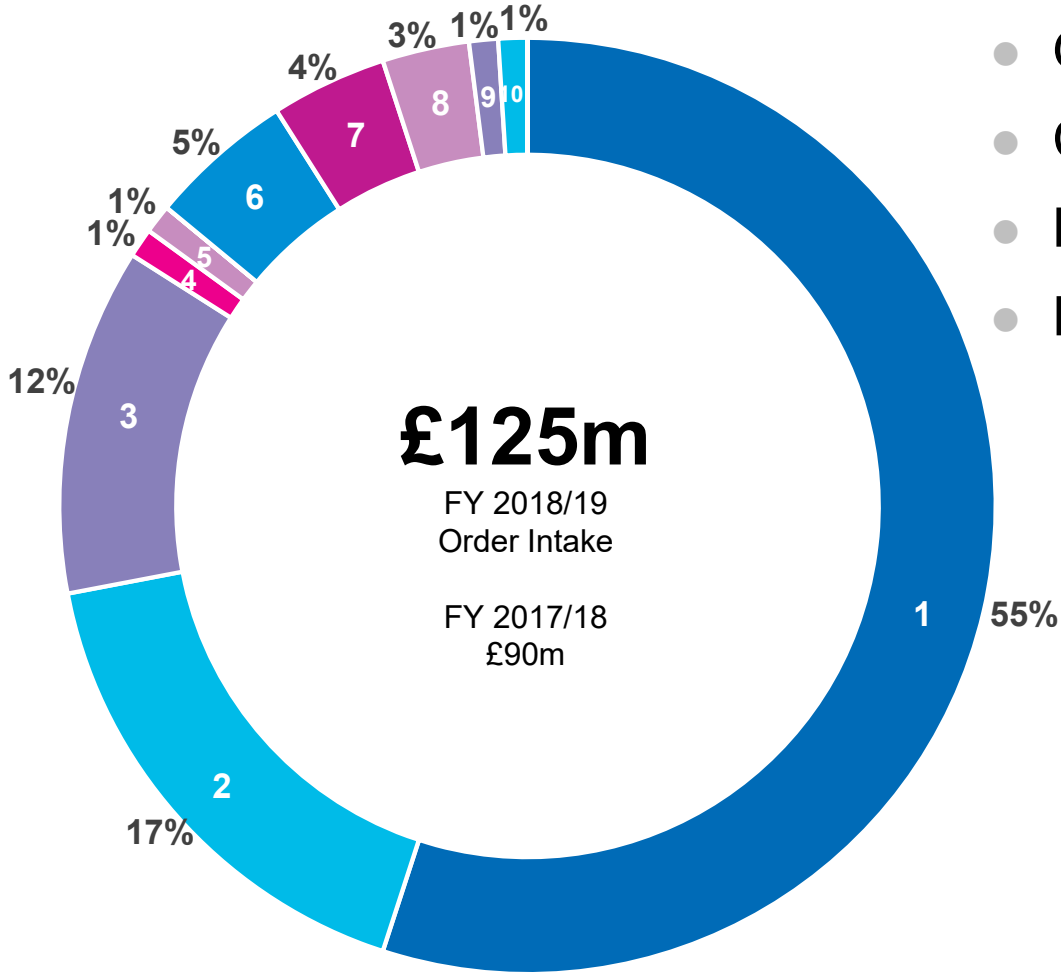
Ricardo Defense provides sustainment of a suite of software tools that are used by platform original equipment manufacturers and vehicle program offices to produce and utilise Interactive Electronic Technical Manuals (IETMs). Sustainment and modernisation of this suite of tools is realised by incorporating state of the art software technologies on software products, some developed over twenty years ago. Incorporation of these technologies results in a software suite that can be more readily maintained and upgraded in the future at a lower cost.

The appearance of U.S. Department of Defense (DoD) visual information does not imply or constitute DoD endorsement.

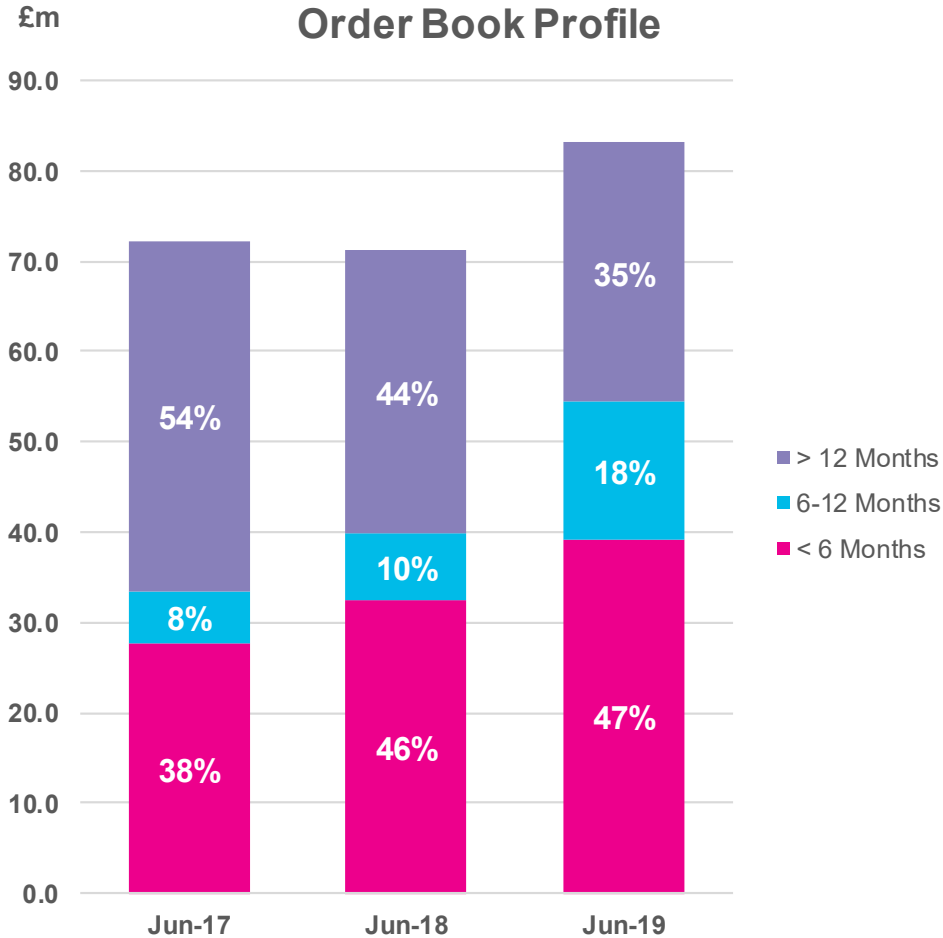
Focus on Performance Products



- Over 20 live projects
- Contracts outside of order book is > £100m
- No of people – 420
- Revenue of c. £110m



- | | |
|-----------------|---------------------------------|
| 1. Key client 1 | 6. UK Defence |
| 2. Key client 2 | 7. Other Asia clients |
| 3. Key client 3 | 8. Other UK clients |
| 4. Key client 4 | 9. Other Europe clients |
| 5. Key client 5 | 10. Other North America clients |



Creating a world fit for the future

Formula E Development

2019 marks Ricardo's third year of development activity in the exciting world of Formula E. This all electric racing championship places extreme demands on the drivetrain to which Ricardo are called upon by major constructors to apply their expertise and knowledge in the development of some of the world's most efficient mechanical transmissions.



Creating a world fit for the future

CVR(t) Final Drive Manufacture

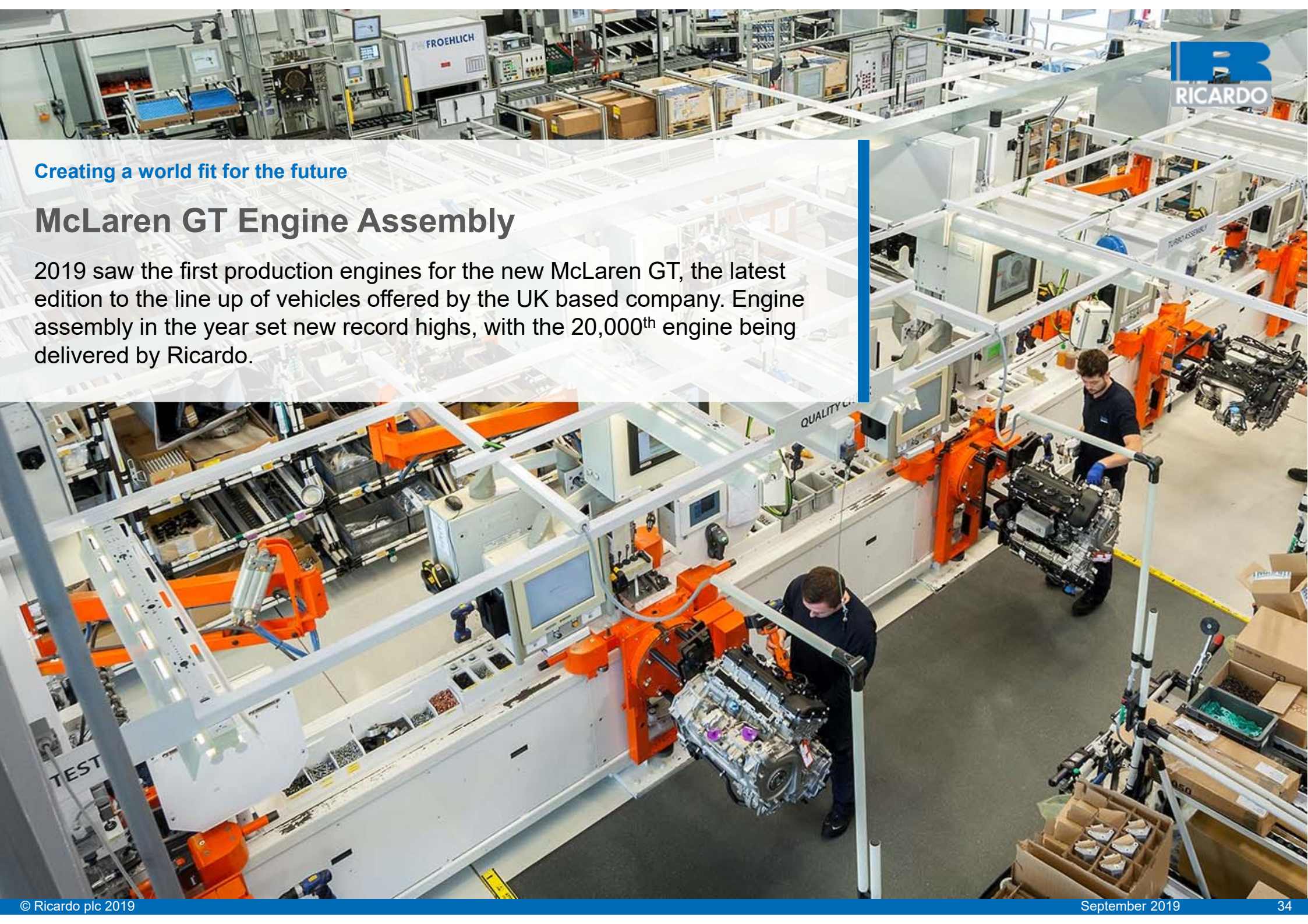
Ricardo's extensive experience in transmission manufacturing was recognised by the UK Ministry of Defence in November 2018 with the award of the contract to strip-down, assess, and re-manufacture the final drive units on this important defence asset. This programme is supported by Ricardo's significant production and supply chain management teams in Leamington Spa.

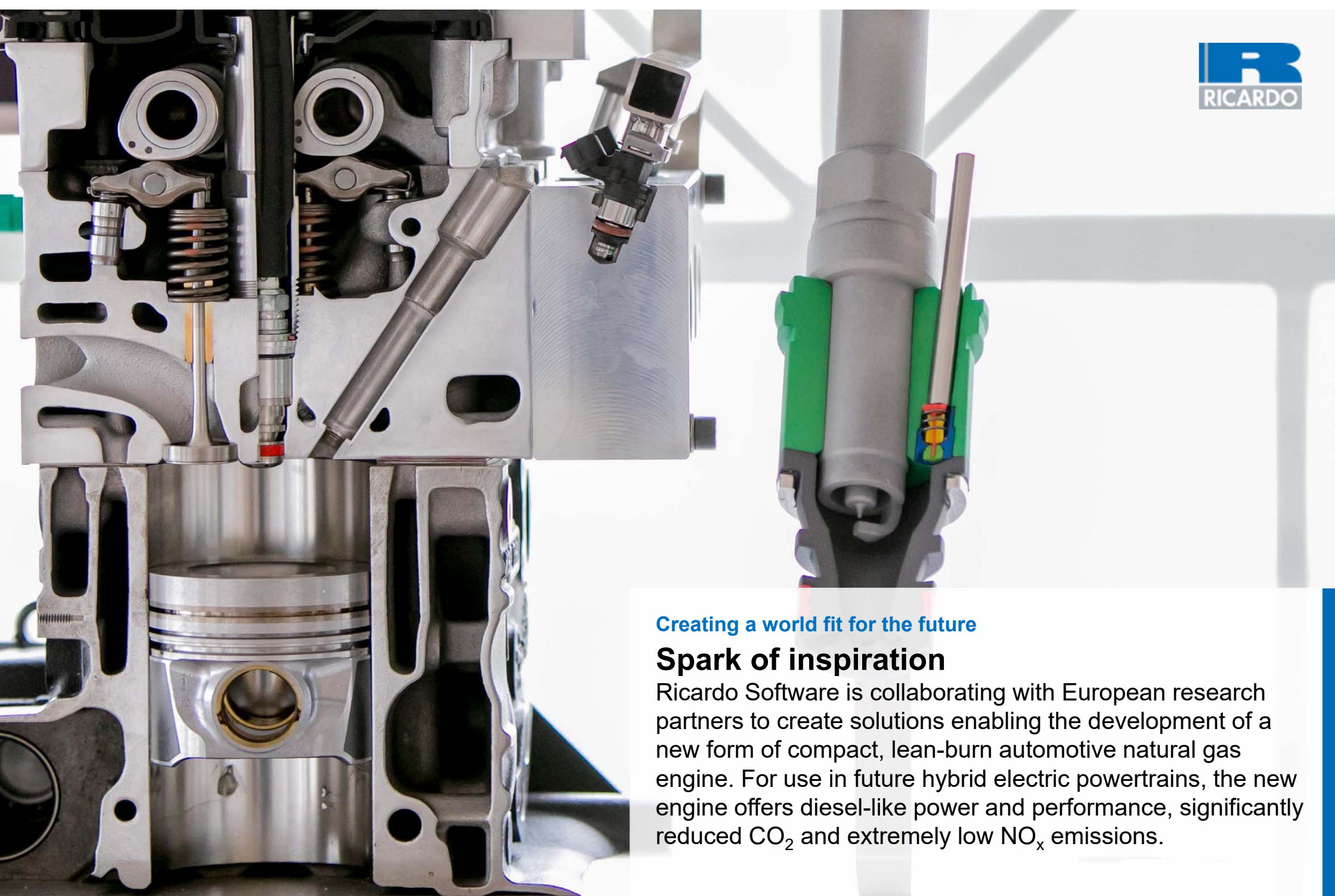


Creating a world fit for the future

McLaren GT Engine Assembly

2019 saw the first production engines for the new McLaren GT, the latest edition to the line up of vehicles offered by the UK based company. Engine assembly in the year set new record highs, with the 20,000th engine being delivered by Ricardo.





Creating a world fit for the future

Spark of inspiration

Ricardo Software is collaborating with European research partners to create solutions enabling the development of a new form of compact, lean-burn automotive natural gas engine. For use in future hybrid electric powertrains, the new engine offers diesel-like power and performance, significantly reduced CO₂ and extremely low NO_x emissions.

HIGHLIGHTS – for the year ended 30 June 2019



- A resilient performance, demonstrating the development of the business and the success of diversification across sectors and geographies
- Strong growth in Performance Products and Energy & Environment in particular, offsetting a very challenging year in our European and US Automotive businesses
- Order intake robust at £386m, compared to £413m in FY 2017/18 and £366m in FY 2016/17
- Order book increased to £314m, up £19m on June 2018
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- Dividend increased by 4% to 21.28p from 20.46p
- Current political and economic uncertainties aside, we are well positioned for growth from a strong, diversified order book and pipeline, recurring revenue from long-term production programmes and the benefit of recent acquisitions

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Delivering Excellence Through
Innovation & Technology



Appendix

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Income statement – Underlying and total Group



| £m | Year ended 30 June | | | | | | Year on Year growth | |
|-----------------------|--------------------|---|---------|---------------------|---|---------------------|---------------------------|-------|
| | 2019 | 2019 | 2019 | 2018 ⁽¹⁾ | 2018 ⁽¹⁾ | 2018 ⁽¹⁾ | Underlying ⁽²⁾ | Total |
| | Underlying | Specific adjusting items ⁽²⁾ | Total | Underlying | Specific adjusting items ⁽²⁾ | Total | | |
| Revenue | 384.4 | - | 384.4 | 378.5 | - | 378.5 | 2% | 2% |
| Gross profit | 134.9 | - | 134.9 | 142.7 | - | 142.7 | (5)% | (5)% |
| Administration costs | (95.3) | (10.5) | (105.8) | (103.0) | (10.5) | (113.5) | (7)% | (7)% |
| Operating profit | 39.6 | (10.5) | 29.1 | 39.7 | (10.5) | 29.2 | - | - |
| Net finance costs | (2.6) | - | (2.6) | (2.2) | - | (2.2) | 18% | 18% |
| Profit before tax | 37.0 | (10.5) | 26.5 | 37.5 | (10.5) | 27.0 | (1)% | (2)% |
| Taxation charge | (8.2) | 1.6 | (6.6) | (8.0) | (1.3) | (9.3) | 2% | (29)% |
| Profit for the period | 28.8 | (8.9) | 19.9 | 29.5 | (11.8) | 17.7 | (2)% | 12% |

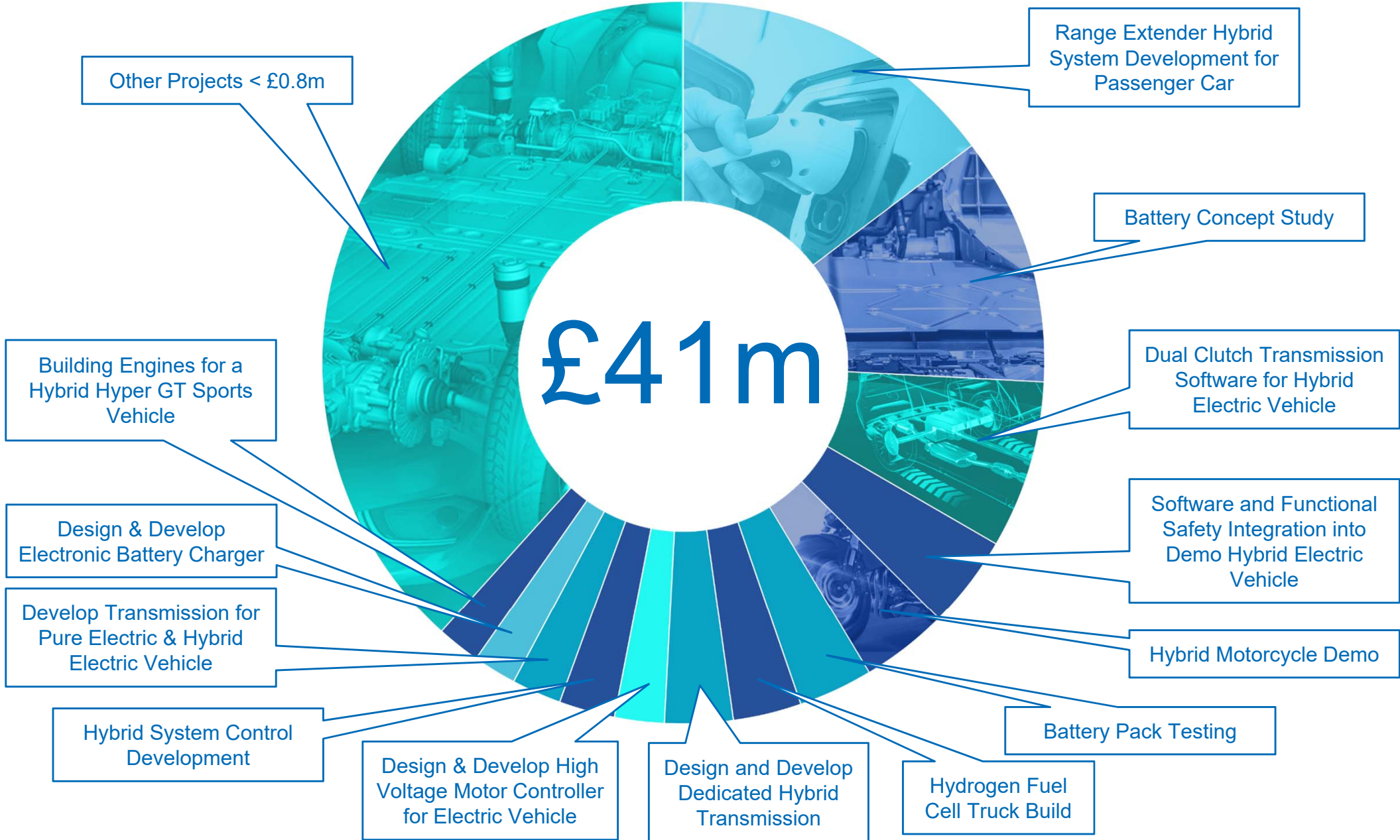
(1) the prior period has been restated due to the impact of IFRS 15 'Revenue from contracts with customers' on a like-for-like basis with the current period. Comparative information has also been re-presented to reclassify certain indirect payroll and depreciation costs from cost of sales to administrative expenses in a manner that is consistent with their classification in the current period.

(2) specific adjusting items comprise amortisation of acquired intangible assets, acquisition-related expenditure, reorganisation costs and non-recurring items.

Specific adjusting items

| £m | Year ended 30 June | |
|---|--------------------|-------------|
| | 2019 | 2018 |
| Amortisation of acquisition-related intangible assets | 4.0 | 4.3 |
| Acquisition-related expenditure | 1.8 | 1.4 |
| Reorganisation costs | 3.4 | 4.8 |
| Guaranteed minimum pensions ('GMPs') equalisation | 1.3 | - |
| Total before tax | 10.5 | 10.5 |
| Tax credit on specific adjusting items | (1.6) | (0.9) |
| Derecognition of net deferred tax assets | - | 2.2 |
| Total after tax | 8.9 | 11.8 |

Order intake relating to electric or hybrid vehicles is £41m



Considerations regarding Brexit



- Key mitigating actions we have taken include:

- **Performance Products**

- ✓ McLaren – Supply chain on notice to increase inventory in support of engine production. Currently jointly monitoring the situation with McLaren;
- ✓ Bugatti – Supply chain on notice to increase inventory in support of transmission production. Currently jointly monitoring the situation with Bugatti;
- ✓ Export Systems and Compliance Documentation updated to accommodate a No Deal scenario.

- **Technical Consulting**

- ✓ We hold licences for our Rail Certification business in Utrecht to provide certification services throughout the EU;
- ✓ We continue to bid for and are contracting with European customers from our Utrecht offices;
- ✓ We have the ability to deliver some Automotive projects within the EU using our Prague technical centre (260 engineers).

- Brexit strategy is to mitigate, where possible, the impact of Brexit whilst avoiding unnecessary cost.



Global tailpipe and CO₂ emissions legislation adherence are “must haves” in the development budget of many of our clients



| Vehicle Type | Region | 2010 | 2015 | 2020 | 2025 | |
|---|----------------|--|--|--|--|---------------------------|
| Automotive & LCV | EU | Euro 5 | Euro 6a Euro 6b Passenger cars: 130 gCO ₂ /km | Euro 6d-TEMP (WLTP & RDE) | Euro 6d - ISC - FCM (new ISC procedure and monitoring of fuel consumption) Passenger cars: 95 gCO ₂ /km 15% reduction 2021 target | |
| | US (49 States) | Tier 2 | 2012-2016 standards | Tier 3 2017-2025 standards - proposed amended standards for 2021-2026 | | |
| | California | LEV II LEV II standards (2009-2016) | LEV III | LEV III (2017-2025, consistent with original EPA standards) | | |
| | China | China IV (Euro 4) | China 5 (Euro 5) | China 6a (WLTP & RDE) | China 6b (WLTP & RDE) | |
| | India | Bharat Stage IV (Euro 4 equivalent) | Phase 3 | Phase 4 New LCVs standards | Phase 5 (proposed) | |
| | Japan | Post New Long-Term standards 2010 standards | 2015 standards | WLTP based standards | RDE method being developed 2022 LCVs standards | 2030 standards (proposed) |
| | India | | 2017 standards | | 2022 standards | |
| Motorcycle & Personal Transportation | EU | Euro 3 | Euro 4 | Euro 5 | | |
| | US (49 States) | Tier 2 (Class III); Tier 1 (Classes I and II) - harmonised with California | | | | |
| | California | California Motorcycle limits: Tier 2 Class III; Tier 1 (Classes I and II) | | | | |
| | China | China III China IV (WMTC) | | | | |
| | India | Bharat Stage III | Bharat Stage IV | Bharat Stage VI | | |
| | Japan | 2010 standards Euro 4 based standards (WMTC) | | | | |
| Commercial Vehicles (Medium- & Heavy-Duty Trucks) | EU | Euro V | Euro VI | Euro VI E (proposed) | Monitoring and reporting CO ₂ emissions 15% reduction 2019-2020 emissions | |
| | US (49 States) | EPA 10 Phase 1 federal standards Phase 2 (2018-2027) federal standards Compliance of older vehicles to EPA 10 - optional low NOx limits | | | | |
| | California | EPA 10 Phase 1 federal standards Phase 2 (2018-2027) federal standards | | | | |
| | China | China IV | China V | China VIa | China VIb | |
| | India | Bharat Stage IV | Phase 1 standards | Phase 2 standards | Phase 3 standards Bharat Stage VI | |
| | Japan | Post New Long-Term standards | 2016 standards | Phase 1 standards | Phase 2 standards | |
| | India | | 2015 standards | | 2025 standards | |
| Off-Highway | EU | Stage IIIB | Stage IV | Stage V | | |
| | US | Tier 4 Interim Tier 4 Final | | | | |
| | China | Stage II | Stage III (Nationwide) | Stage IV (Beijing) | Stage IV Nationwide (revised - proposed) | |
| | India | Bharat Stage III - Tractors and CEV Bharat Stage IV - Tractors and CEV Bharat Stage V - Tractors and CEV | | | | |
| | Japan | 2006 Non-road standards 2011 Non-road standards 2014 Non-road standards | | | | |
| Rail | EU | Stage IIIA | Stage IIIB | Stage V (Locomotives and railcars) | | |
| | US | Tier 2 | Tier 3 | Tier 4 Switch & line locomotives | | |
| | India | Proposed standards under consideration | | | | |
| | Australia | Code of practice - PM standards | | | | |

Source: Ricardo EMLEG Emissions Legislation database www.emleg.com