

Comparison of EFT v10 with EFT v9

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Experts in air quality
management & assessment

Prepared by: Ricky Gellatly

Approved by: Dr Ben Marnier

1 Introduction

- 1.1 Defra issued its Emissions Factors Toolkit (EFT) v9 in May 2019 and Air Quality Consultants used this tool, alongside previous versions, to compare the reductions in NO_x emissions over time as predicted by the EFT to the reductions in measured road-NO_x concentrations at roadside sites across the UK¹. It was concluded that the EFT over-predicted the rate of reduction in NO_x emissions up to 2016 and under-predicted the rate of reduction since 2016. Wider consideration of the assumptions built into the EFT v9 suggested that, on balance, the EFT was unlikely to over-state the rate at which NO_x emissions decline in the future at an ‘average’ site in the UK. It was judged that an emissions-based sensitivity test was no longer necessary and that the EFT may be relied upon to predict the most likely, or potentially conservative, situation in the future, provided that the assessment is verified against measurements made in the year 2016 or later.
- 1.2 In August 2020, Defra issued EFT v10. This note provides an initial comparison of how the two different versions of the EFT compare, and whether the conclusions of the analysis described in Paragraph 1.1 remain valid if using EFT v10.

¹ AQC (2020) Performance of Defra’s Emission Factor Toolkit 2013-2019, Available: <https://www.aqconsultants.co.uk/CMSPages/GetFile.aspx?guid=7fba769d-f1df-49c4-a2e7-f3dd6f316ec1>.

2 Emissions Comparison

- 2.1 All of the emissions calculations are based on a road carrying 1,000 vehicles per day (AADT) with an average speed of 30, 50 or 90 kph, and have been run using the “basic fleet split” option with a range of proportions of Heavy Duty Vehicles (HDVs): 0%, 1%, 5%, 10%, 15% and 20%. The gradient and HDV-load functionalities of the EFT have not been used.
- 2.2 Figure 1 shows the evolution of NO_x emissions over time (assuming no change in AADT or %HDV) for an urban road in England (not London) with 5% HDVs and an average speed of 50 kph. Figure 3 presents the same information for a road in Inner London. Figure 2 and Figure 4 present equivalent information, but with the emission rates normalised to 2018 so that a direct comparison of the rate of reduction can be made.
- 2.3 Graphs for all of the fleet categories: ‘central London’; ‘inner London’; ‘outer London’; ‘motorway London’; ‘England (not London) urban’; ‘England (not London) rural’ and ‘England (not London) motorway’ for all of the fleet compositions and speeds described in Paragraph 2.1 are presented in Appendix A1. The patterns are all broadly similar to those presented in Figure 1 and Figure 3. Graphs showing the normalised rate of reduction for ‘England (not London) urban’ and ‘inner London’ are presented in Appendix A2; it was not considered necessary to present more than two sets of normalised figures, as there is little difference between the various road types within London or outside of London.

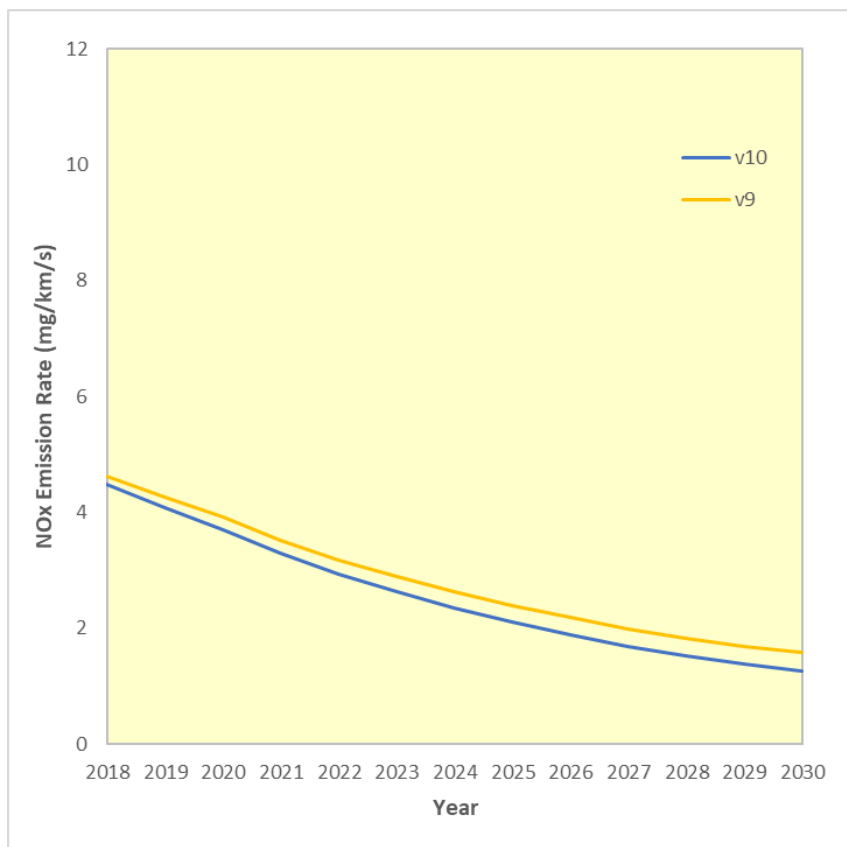


Figure 1: NO_x Emissions over Time – ‘England (not London) urban’, 5% HDV at 50 kph.

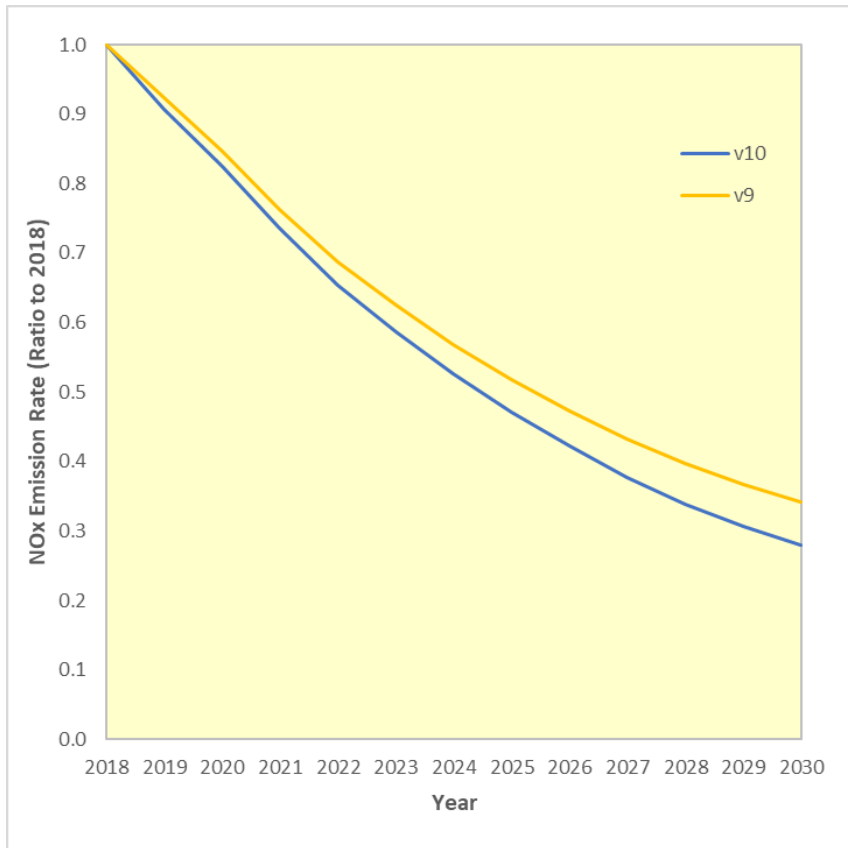


Figure 2: NO_x Emissions over Time – Normalised to 2018 - ‘England (not London) urban’, 5% HDV at 50 kph.

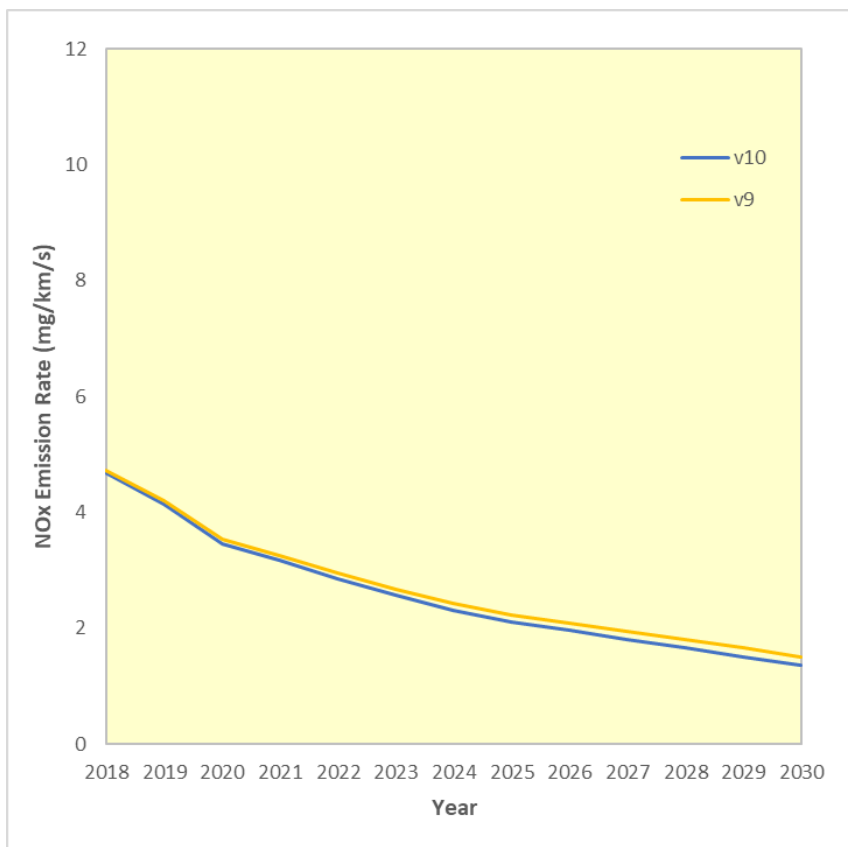


Figure 3: NO_x Emissions over Time – ‘Inner London’, 5% HDV at 50 kph.

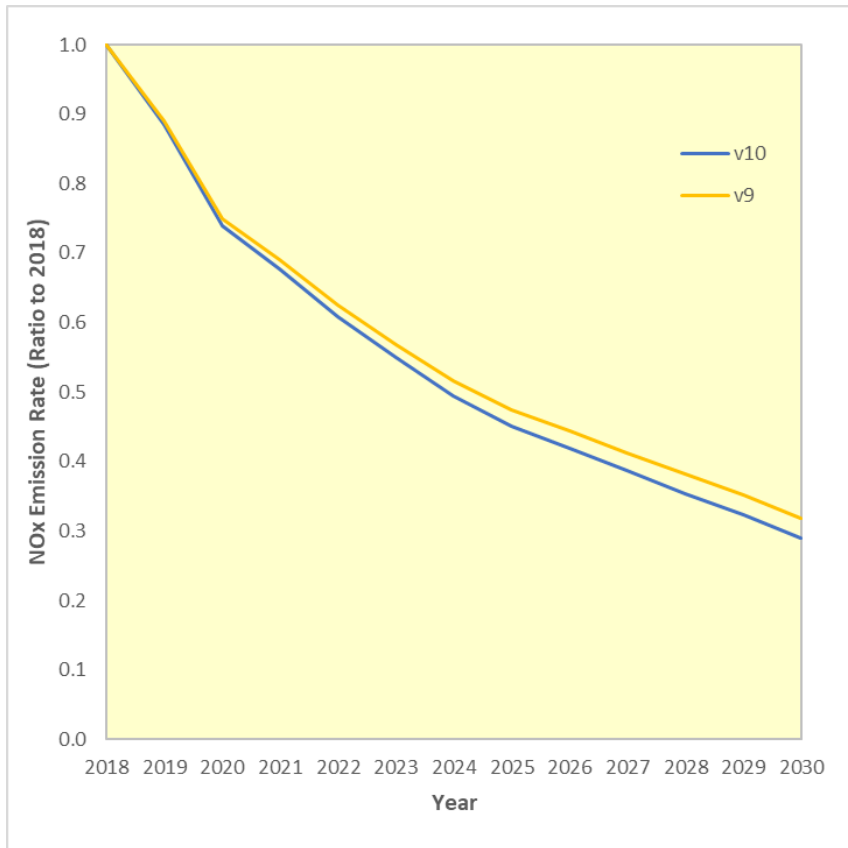


Figure 4: NO_x Emissions over Time – Normalised to 2018 - ‘Inner London, 5% HDV at 50 kph.

3 Discussion

- 3.1 Figure 1 and Figure 3 (and the figures in Appendix A1) demonstrate that the NO_x emissions predicted by EFT v10 are generally lower than those in EFT v9, albeit only slightly. The difference is greater outside London. The only scenario in which emission factors are higher in EFT v10 is with a London Motorway at the lower speeds (30 kph and 50 kph) and this is only the case for the years 2018 to 2025. In London, EFT v10 emission rates in 2018 are no less than 97% of those from EFT v9, and no less than 81% in 2030. Outside of London, the minimum ratios are 93% for motorways, 94% for rural roads and 96% for urban roads in 2018, and 67% for motorways, 67% for rural roads and 72% for urban roads in 2030. In all cases the average ratio is much closer to 1 than these minima.
- 3.2 Figure 2 and Figure 4 (and the figures in Appendix A2) demonstrate a marginally quicker reduction over time in EFT v10 when compared to EFT v9, again with the difference being greater outside London. By 2030, the emission rate predicted by EFT v9 for 'England (not London) urban' is 34% of that in 2018. Using EFT v10, the emission rate in 2030 is 28% of that in 2018; meaning a 6% greater reduction over 12 years. The difference is considerably smaller in earlier years (3% in 2022, for example). In Inner London, the 2030 emission rate predicted by EFT v9 is 32% of that in 2018, while using EFT v10 it is 29%, a difference of only 3%. The difference in 2022 is less than 2%. The scale of the differences is such that they would be very unlikely to significantly change the conclusions of an air quality assessment.
- 3.3 AQC previously demonstrated that the EFT has done a good job of predicting the rate of reduction in emissions in recent years¹. There is nothing in EFT v10 to suggest that this does not remain the case; the emission rates in this latest version for the years 2018 and 2019 are only very slightly lower than in v9, and would not invalidate the conclusion that the EFT has tended to under-predict the rate of reduction in Road-NO_x since 2016. If anything, the changes are likely to have brought the EFT closer to reality over this period, reasonably accurately predicting the reductions outside of London, but still under-predicting those within London.
- 3.4 Appendix 1 of AQC's analysis of the performance of EFT v9¹ presented a number of reasons why the EFT might over-estimate emissions. One related to the proportion of diesel cars; it was noted that EFT v9 assumed that the proportion of diesel cars in the fleet (outside of London) had risen consistently since 2013, and would continue to do so until at least 2022. In EFT v10, the proportions of diesel vehicles are smaller than those in EFT v9 in all years from 2013, and peak in 2018 (outside of London), which more closely represents the observations made in AQC's analysis of EFT v9¹.
- 3.5 EFT v9 also predicted that only 2.1% of vehicle-kilometres travelled by cars on England's urban roads in 2030 would be by fully electric² vehicles, with this reducing to 0% on rural roads and motorways. By comparison, EFT v10 predicts that 7.5% of car vehicle-kilometres on England's urban roads in 2030 will be by fully electric vehicles, with the equivalent values for rural roads

² As distinct from hybrids and plugin hybrids.

and motorways being 7.2% and 6.8% respectively. The observation made in AQC's analysis of EFT v9, that the assumed uptake of electric vehicles does not appear to reflect the Government's climate change ambitions, remains valid. If the uptake of fully electric vehicles is more rapid than assumed in the EFT, then NOx emissions will fall more quickly than predicted.

4 Conclusion

- 4.1 EFT v10 generally predicts lower NO_x emissions than EFT v9. It also predicts a greater reduction in emissions over time into the future. Differences are, however, sufficiently small that AQC's previous work validating the use of the EFT remains valid. There remains no justification for the use of sensitivity tests assuming higher NO_x emissions in the future than EFT v10 predicts.

A1 Emissions Comparisons Under Different Fleet Mixes and Speeds

England (not London) urban

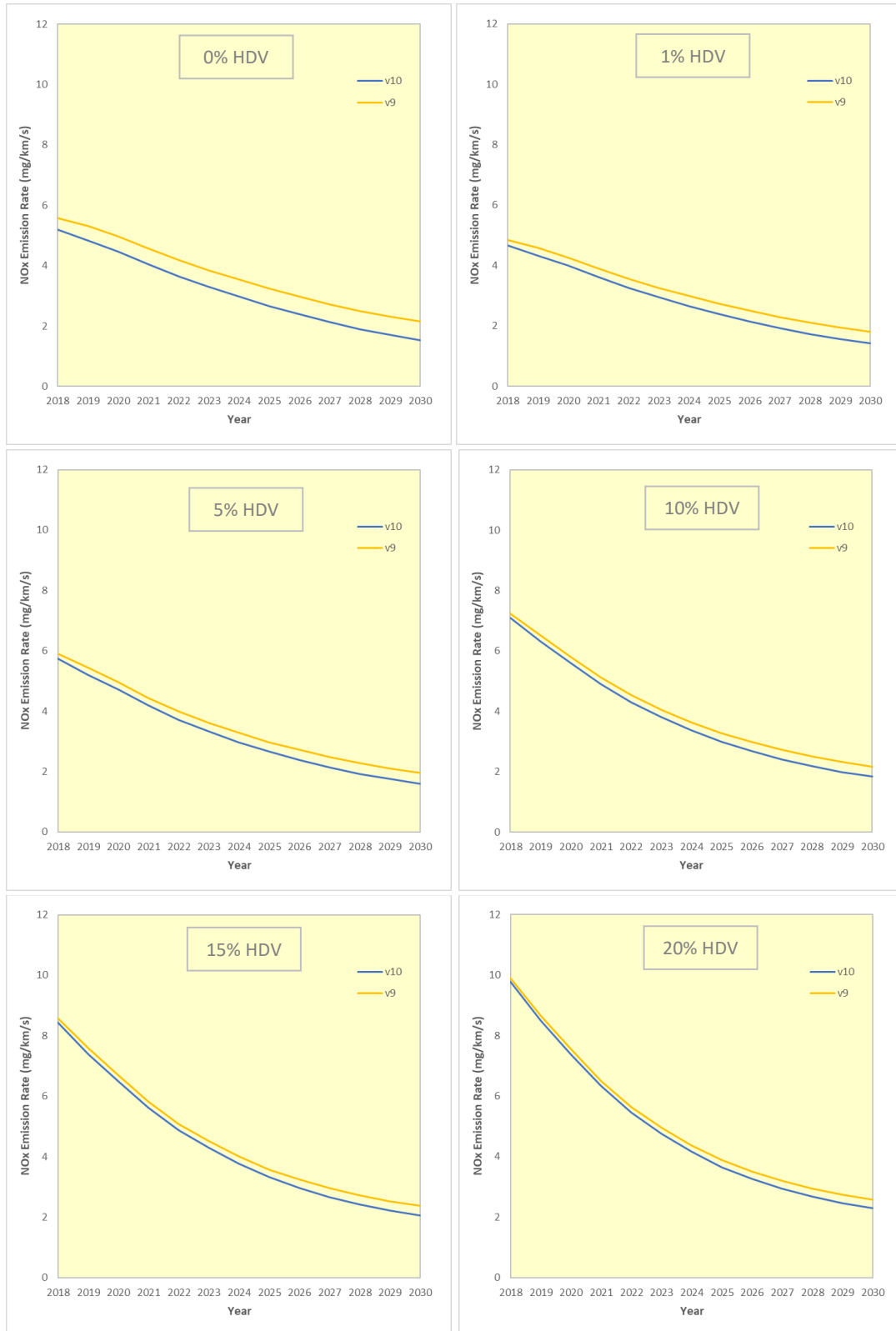


Figure A1.1: Emissions at 30 kph with varying Fleet Mixes

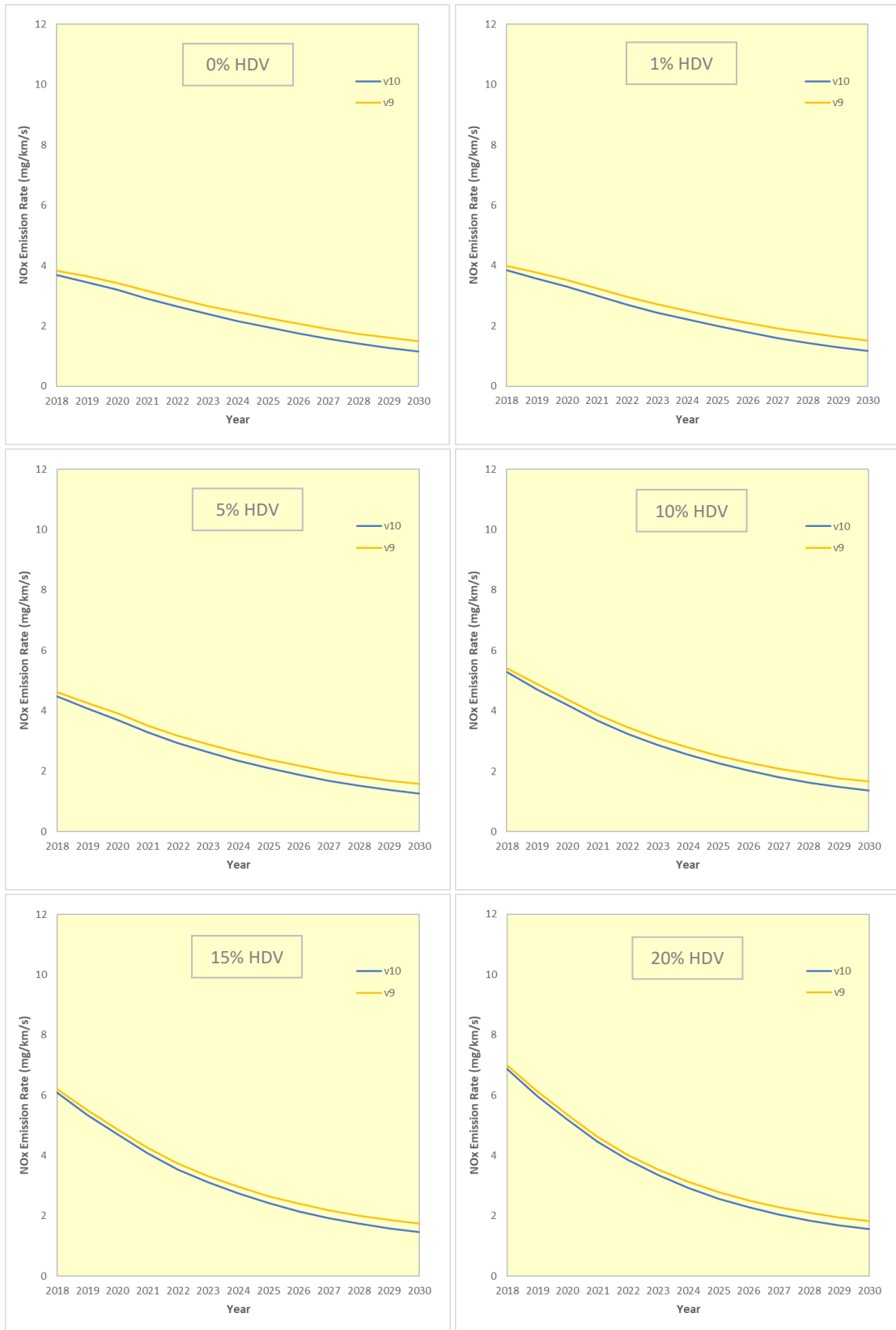


Figure A1.2: Emissions at 50 kph with varying Fleet Mixes

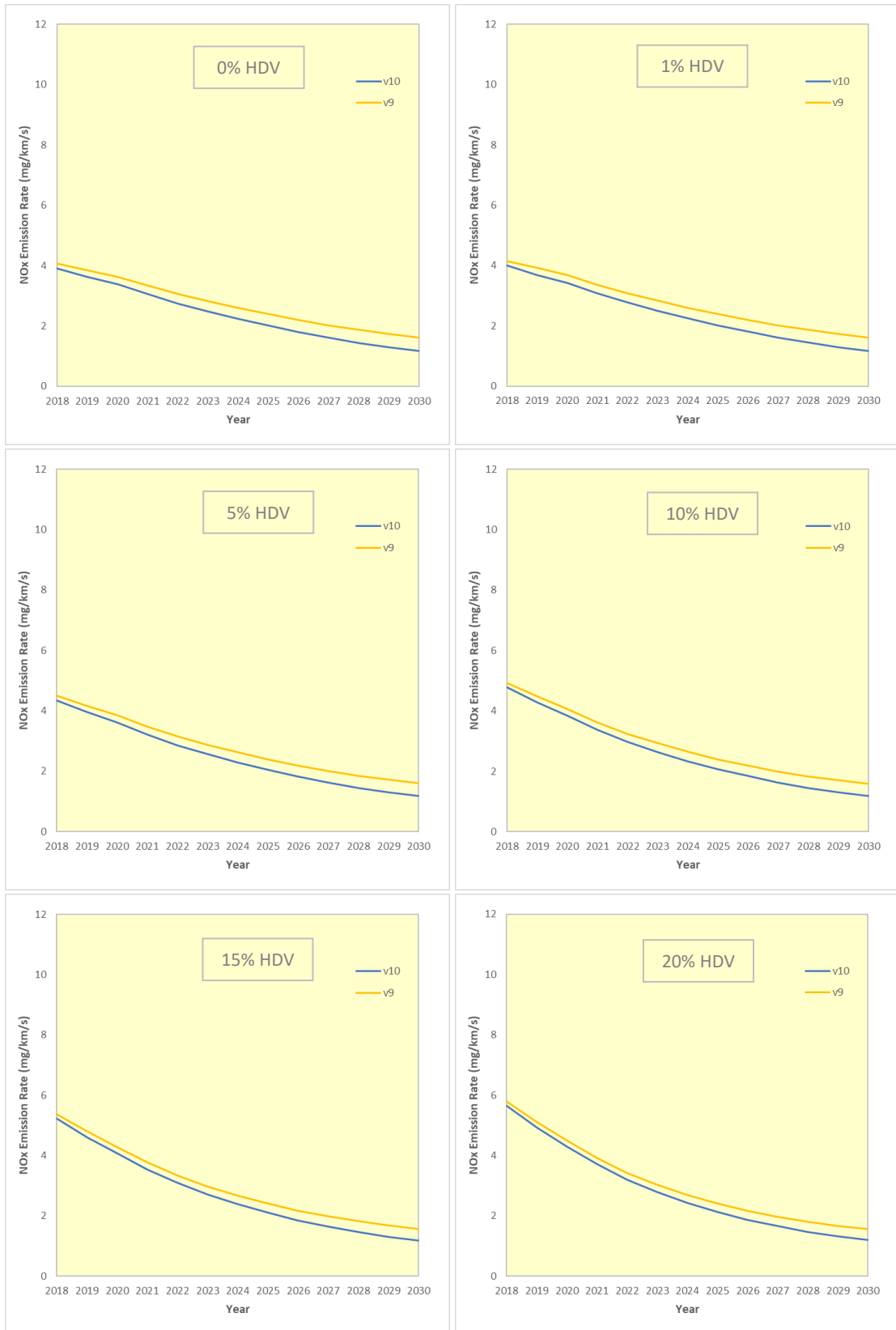


Figure A1.3: Emissions at 90 kph with varying Fleet Mixes

England (not London) rural

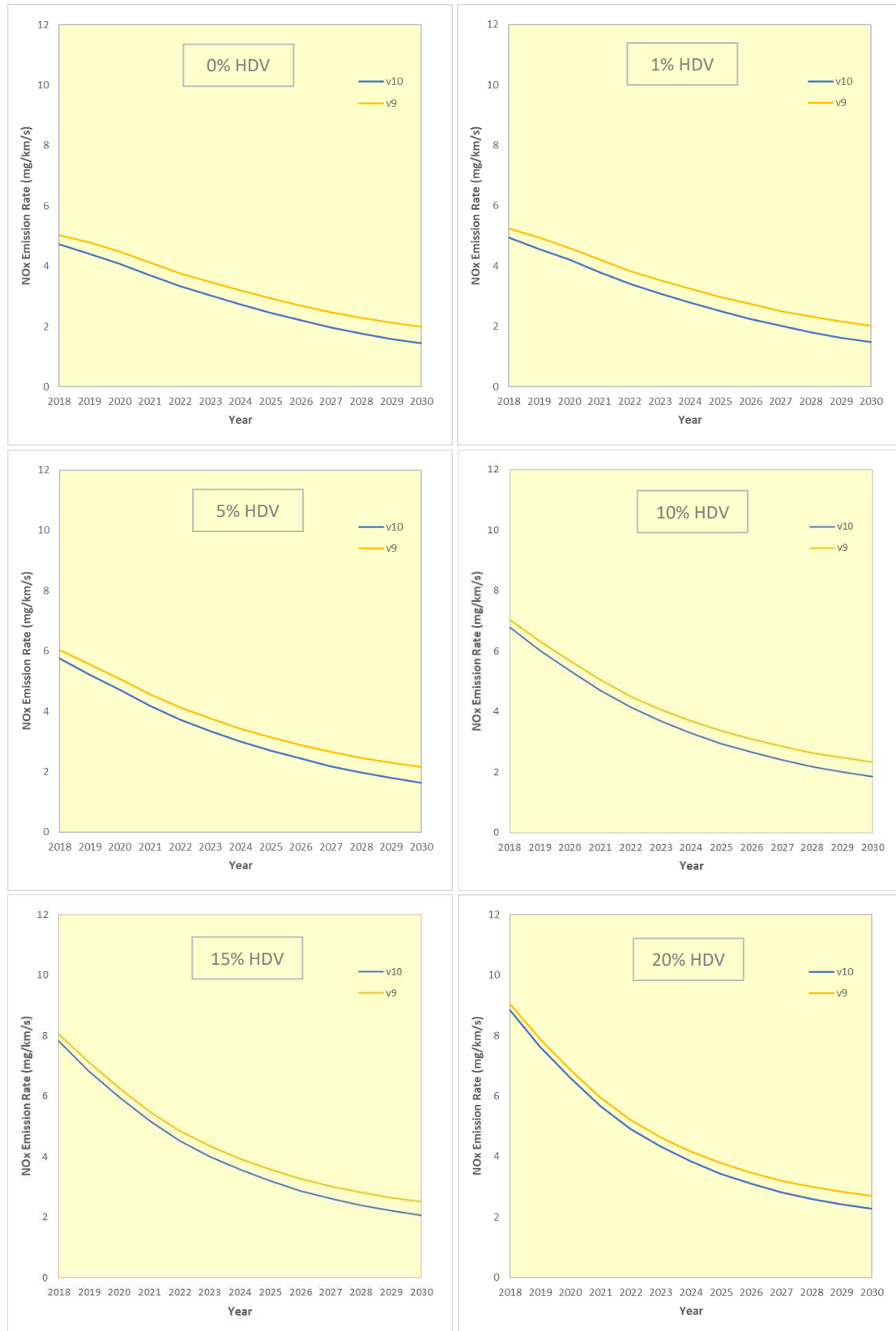


Figure A1.4: Emissions at 30 kph with varying Fleet Mixes

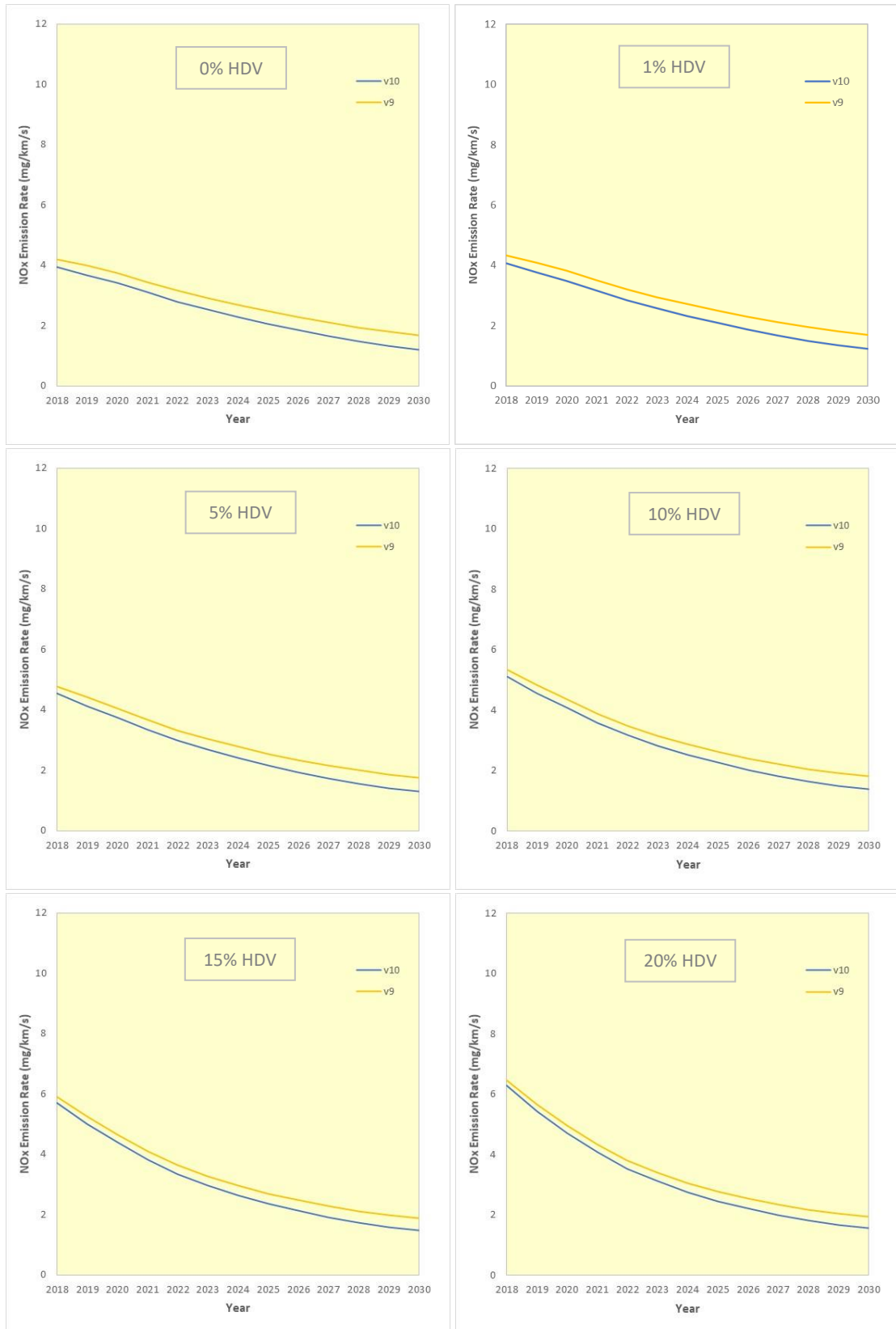


Figure A1.5: Emissions at 50 kph with varying Fleet Mixes

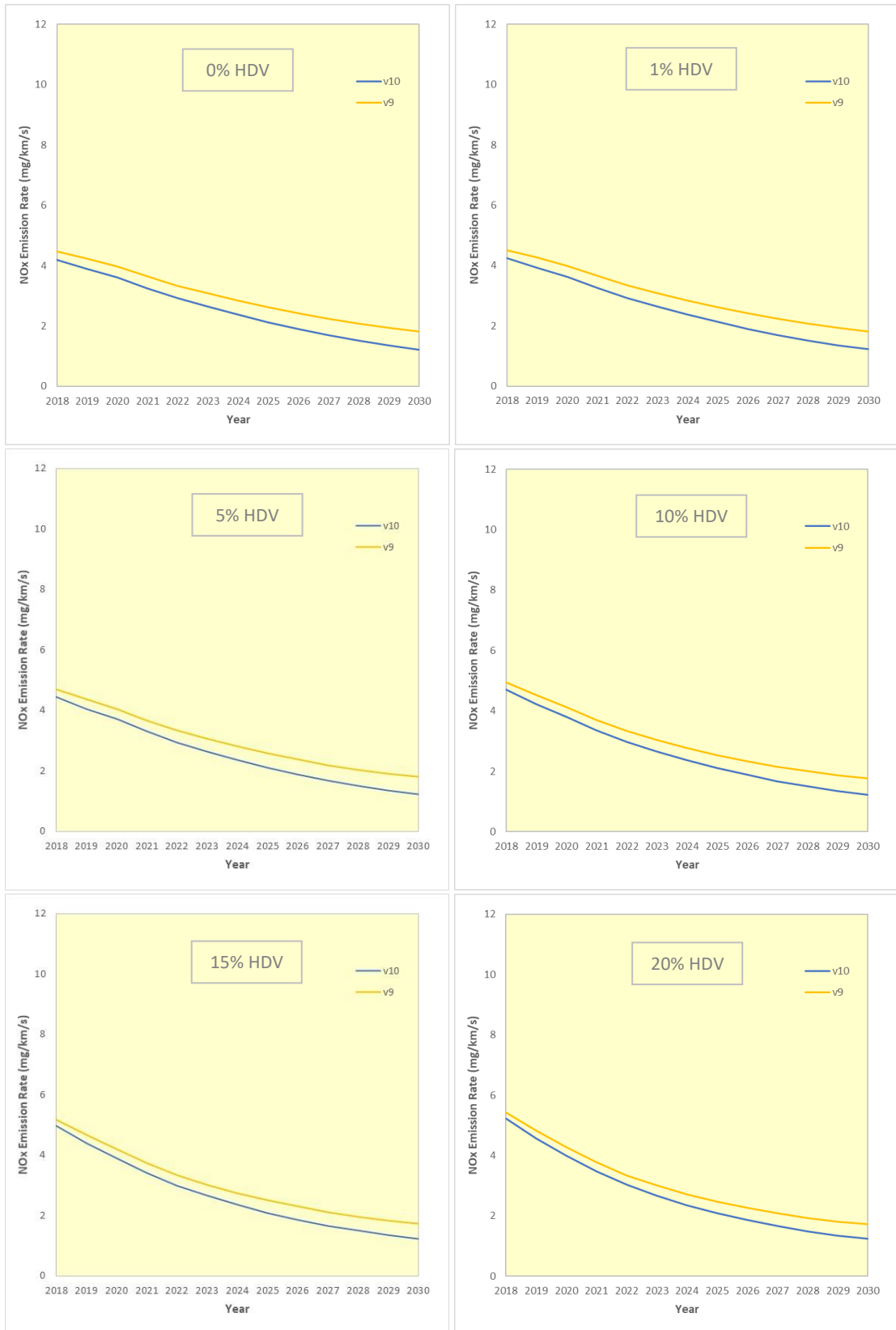


Figure A1.6: Emissions at 90 kph with varying Fleet Mixes

England (not London) motorway

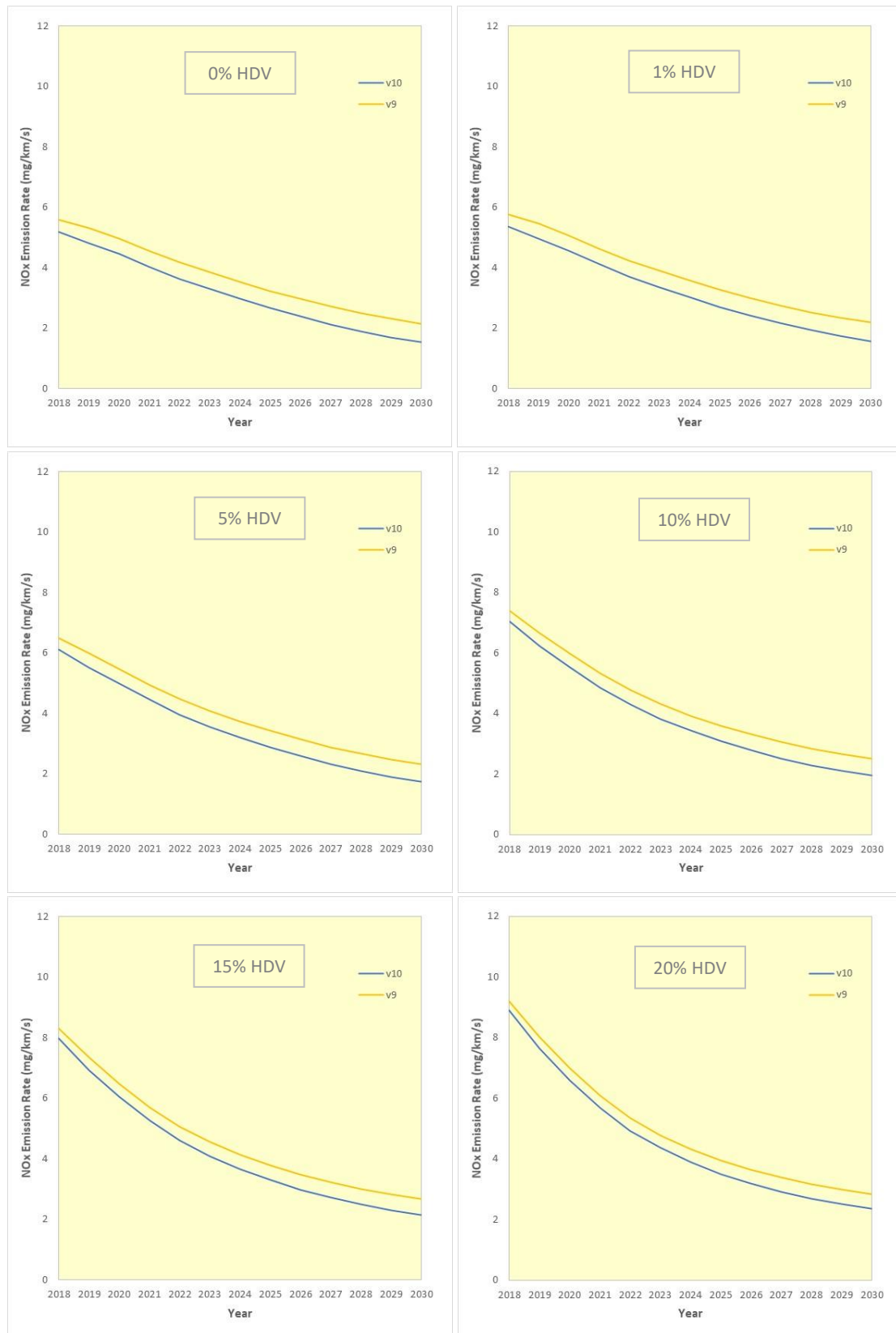


Figure A1.7: Emissions at 30 kph with varying Fleet Mixes

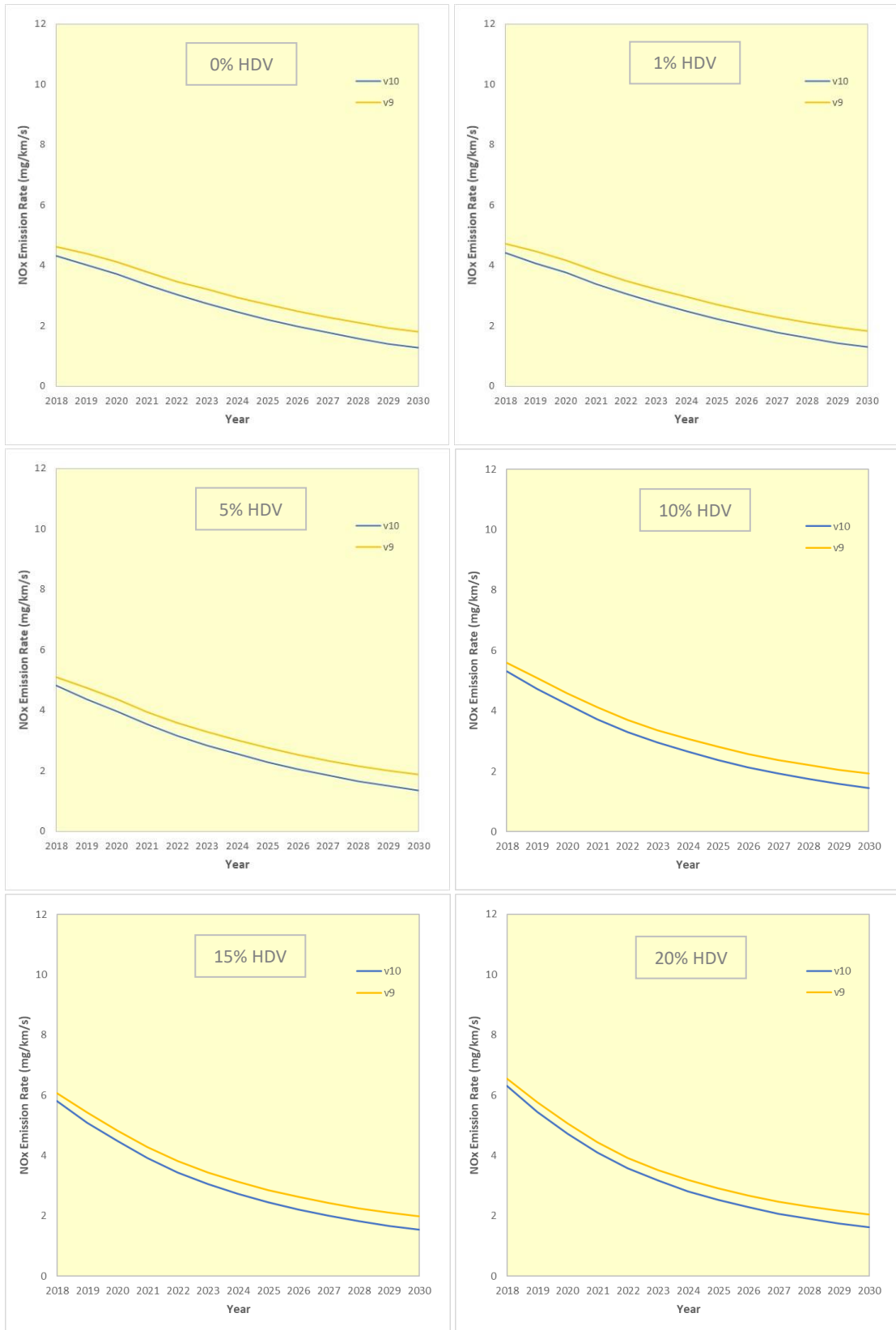


Figure A1.8: Emissions at 50 kph with varying Fleet Mixes

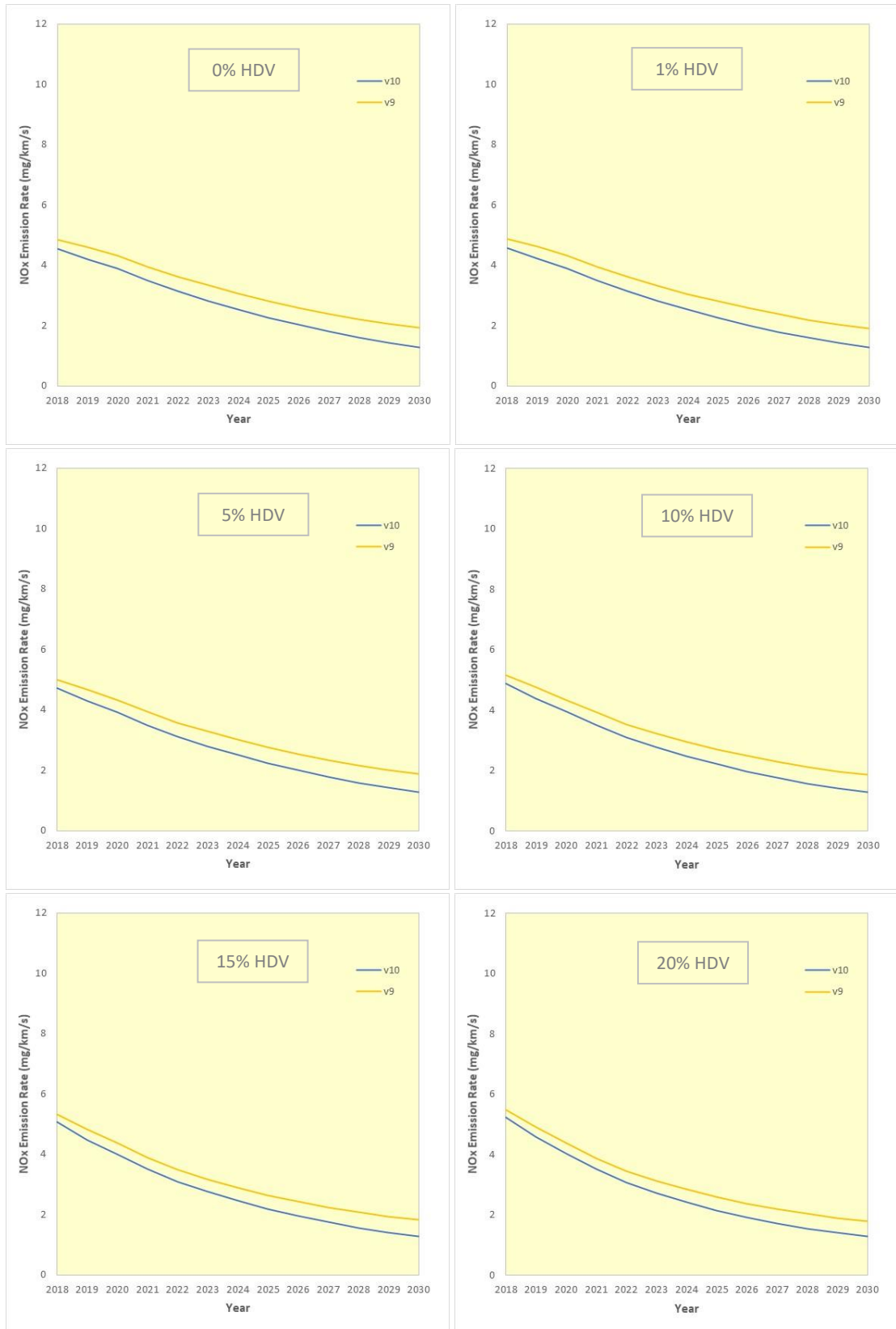


Figure A1.9: Emissions at 90 kph with varying Fleet Mixes

Central London

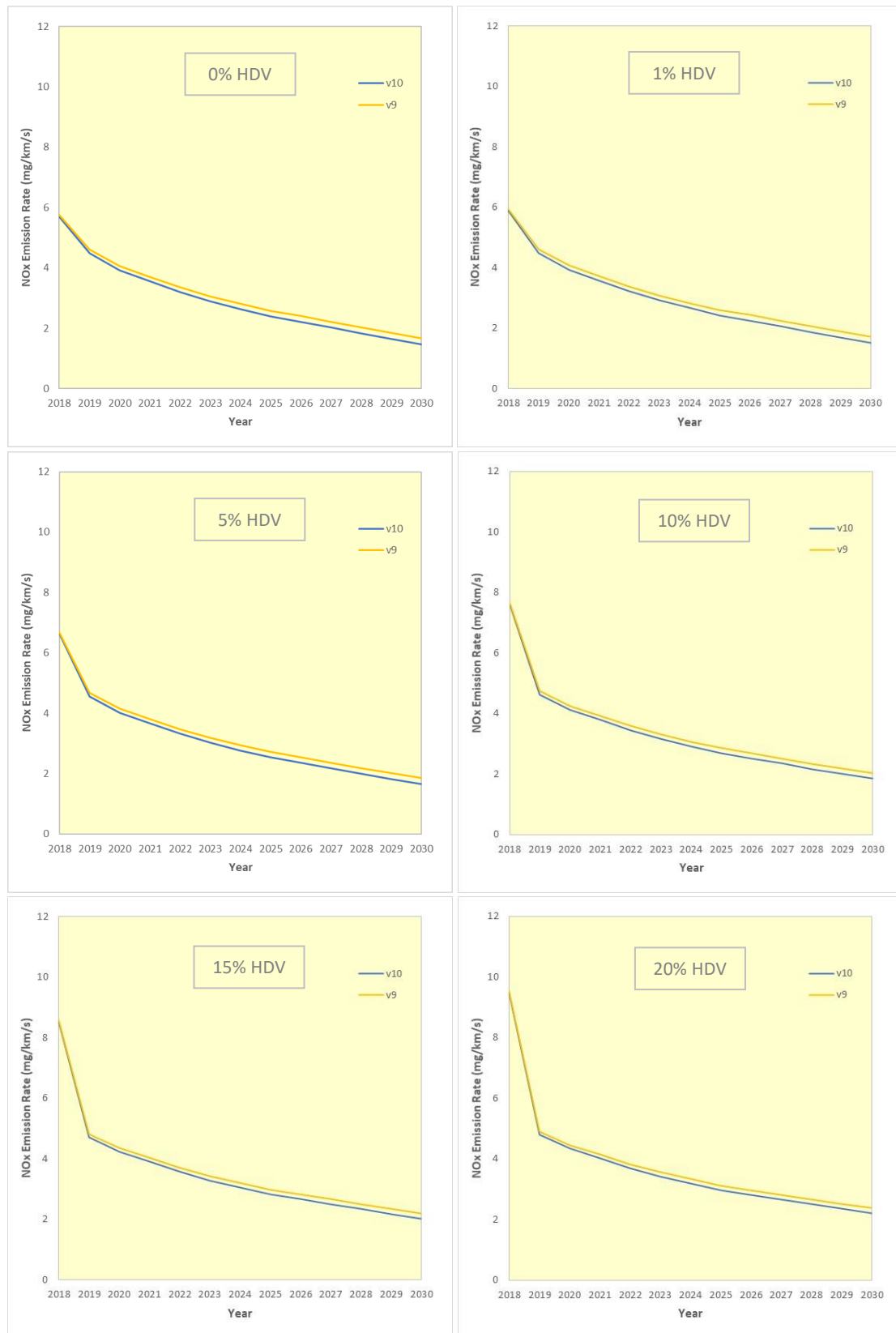


Figure A1.10: Emissions at 30 kph with varying Fleet Mixes

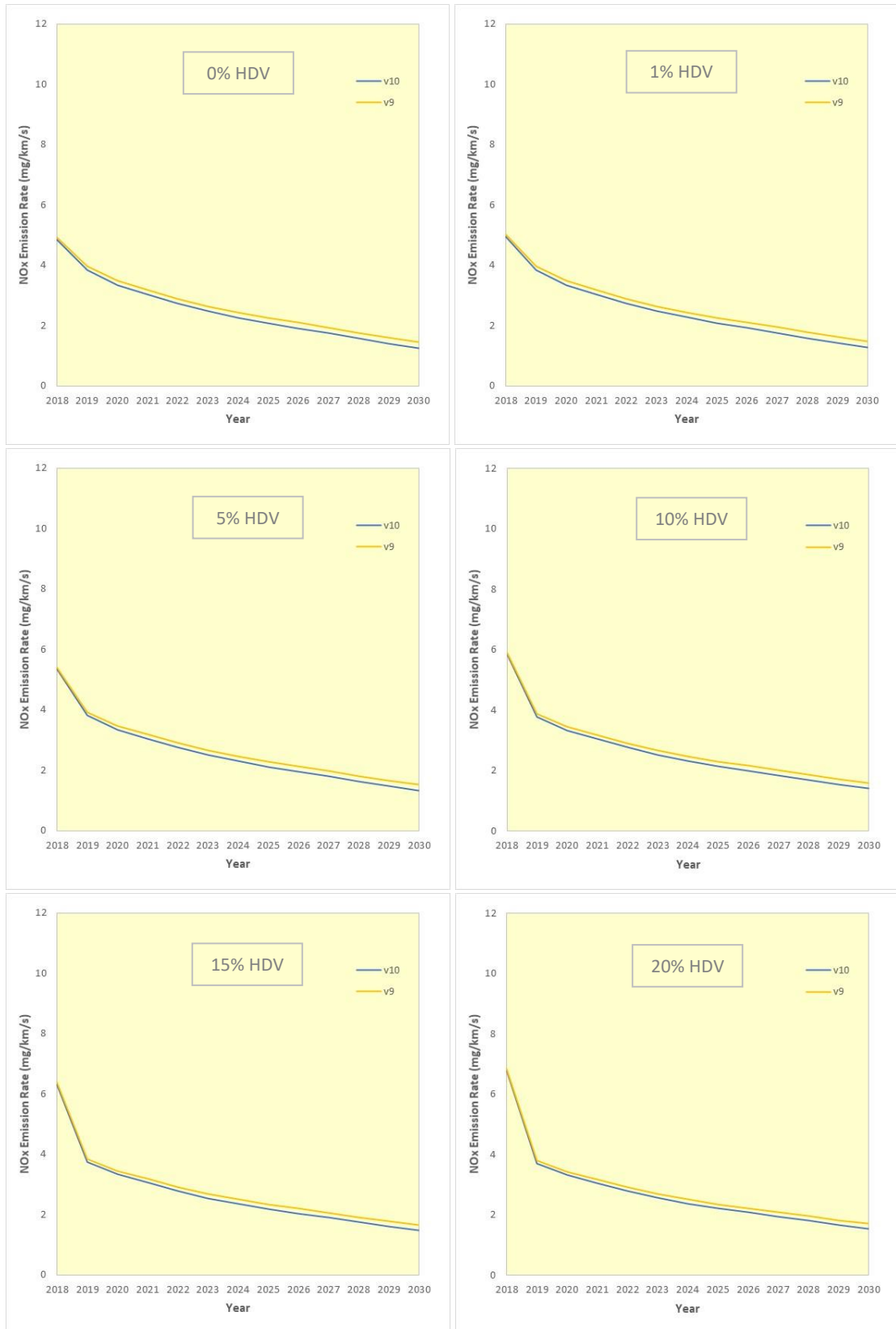


Figure A1.11: Emissions at 50 kph with varying Fleet Mixes

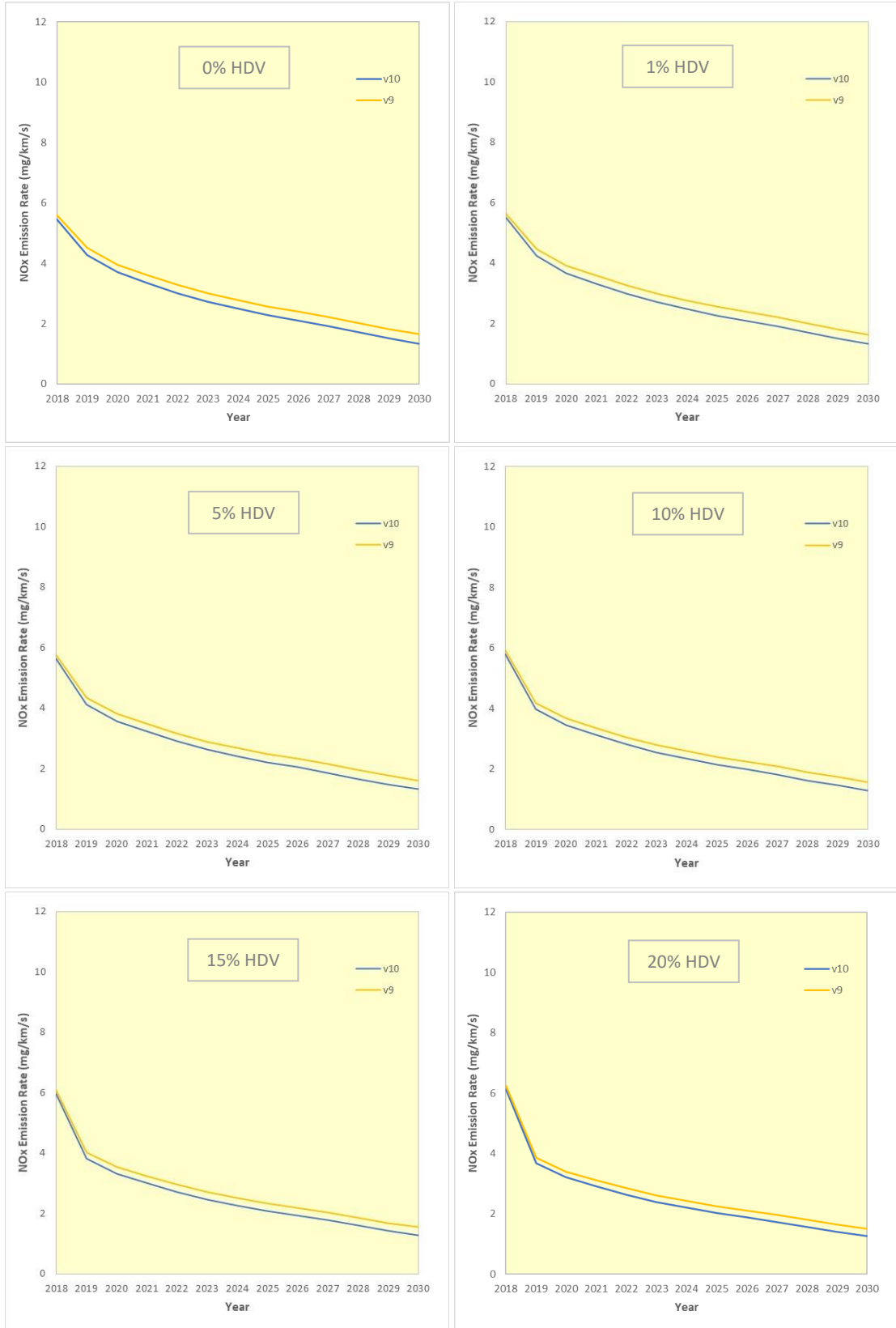


Figure A1.12: Emissions at 90 kph with varying Fleet Mixes

Inner London

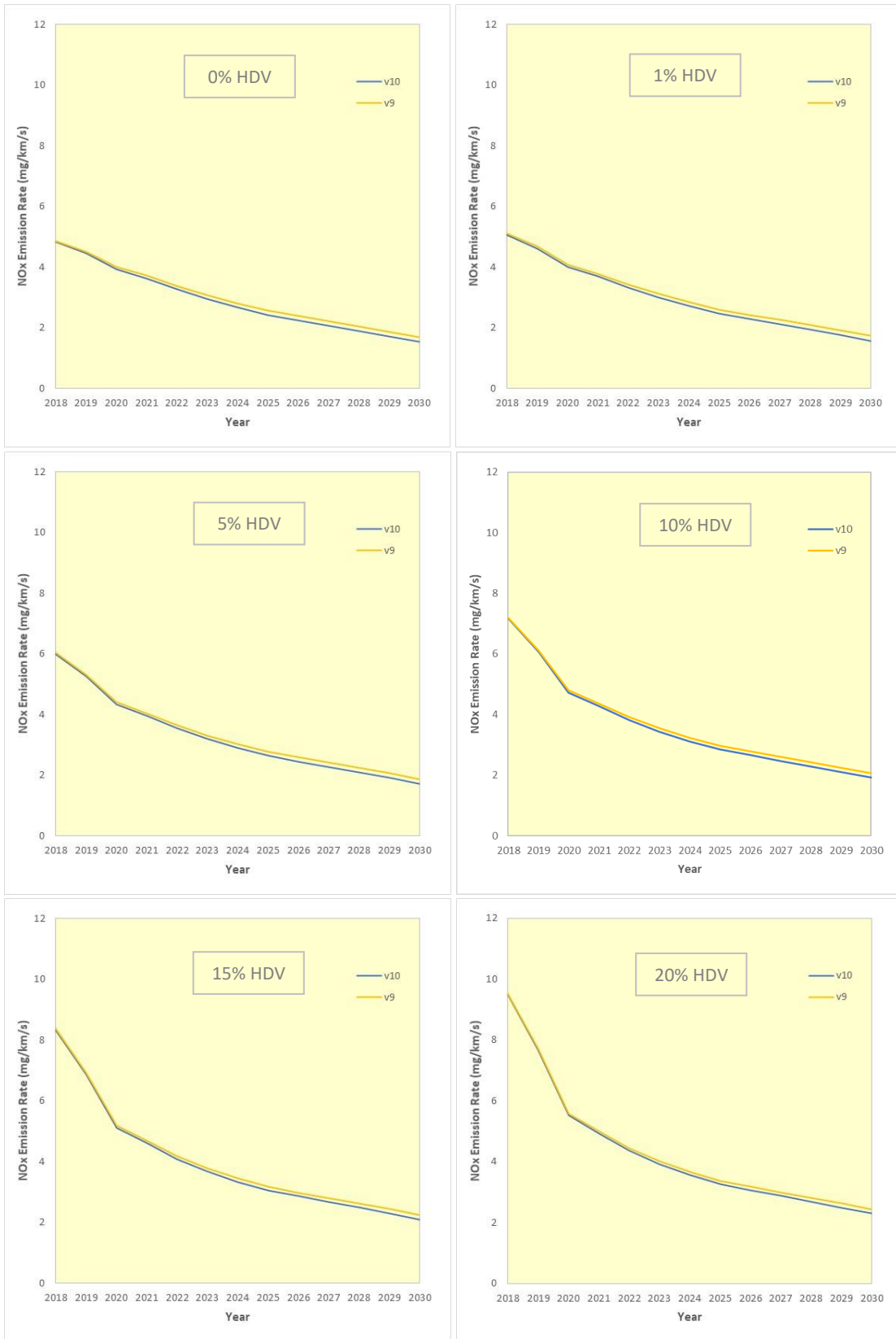


Figure A1.13: Emissions at 30 kph with varying Fleet Mixes

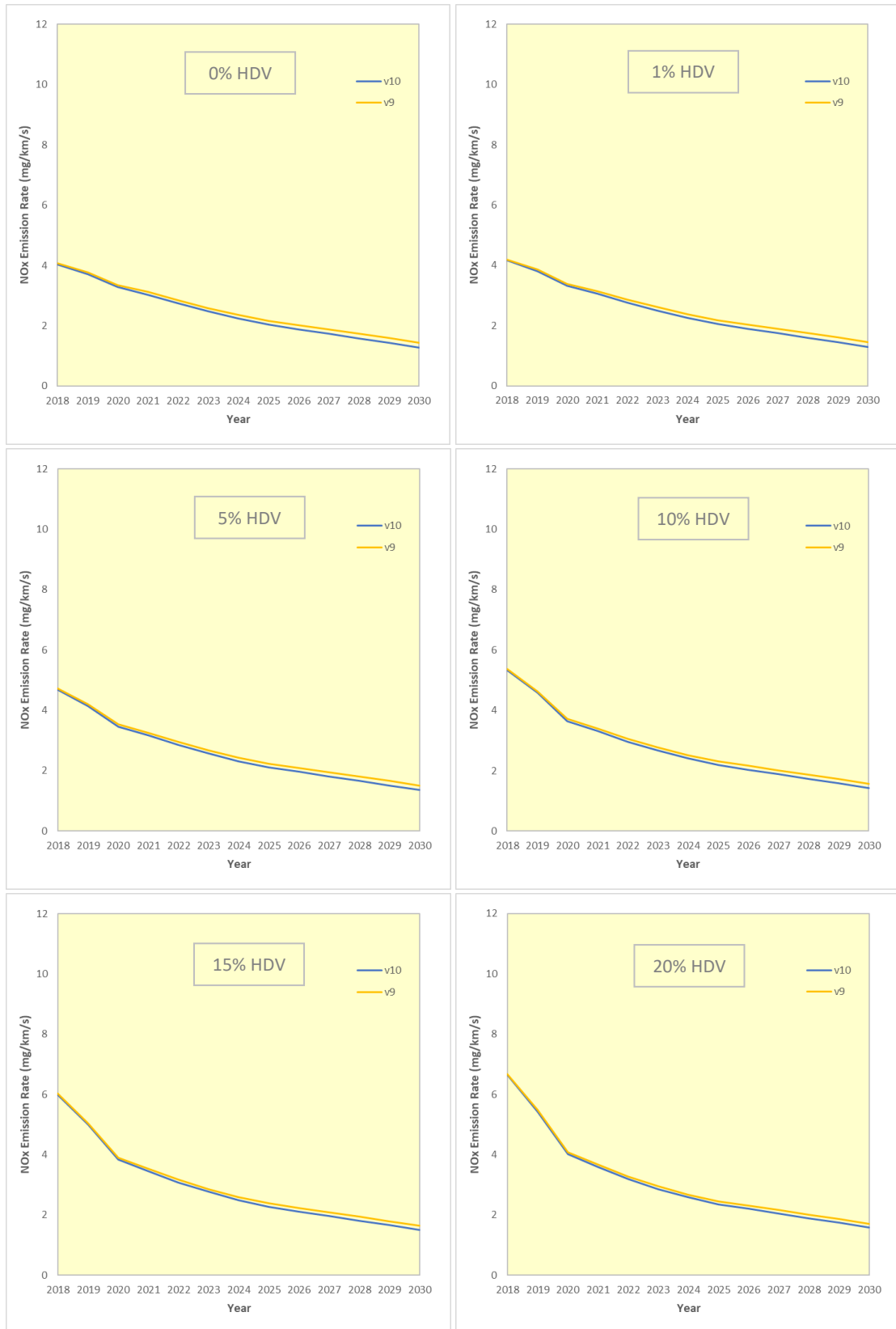


Figure A1.14: Emissions at 50 kph with varying Fleet Mixes

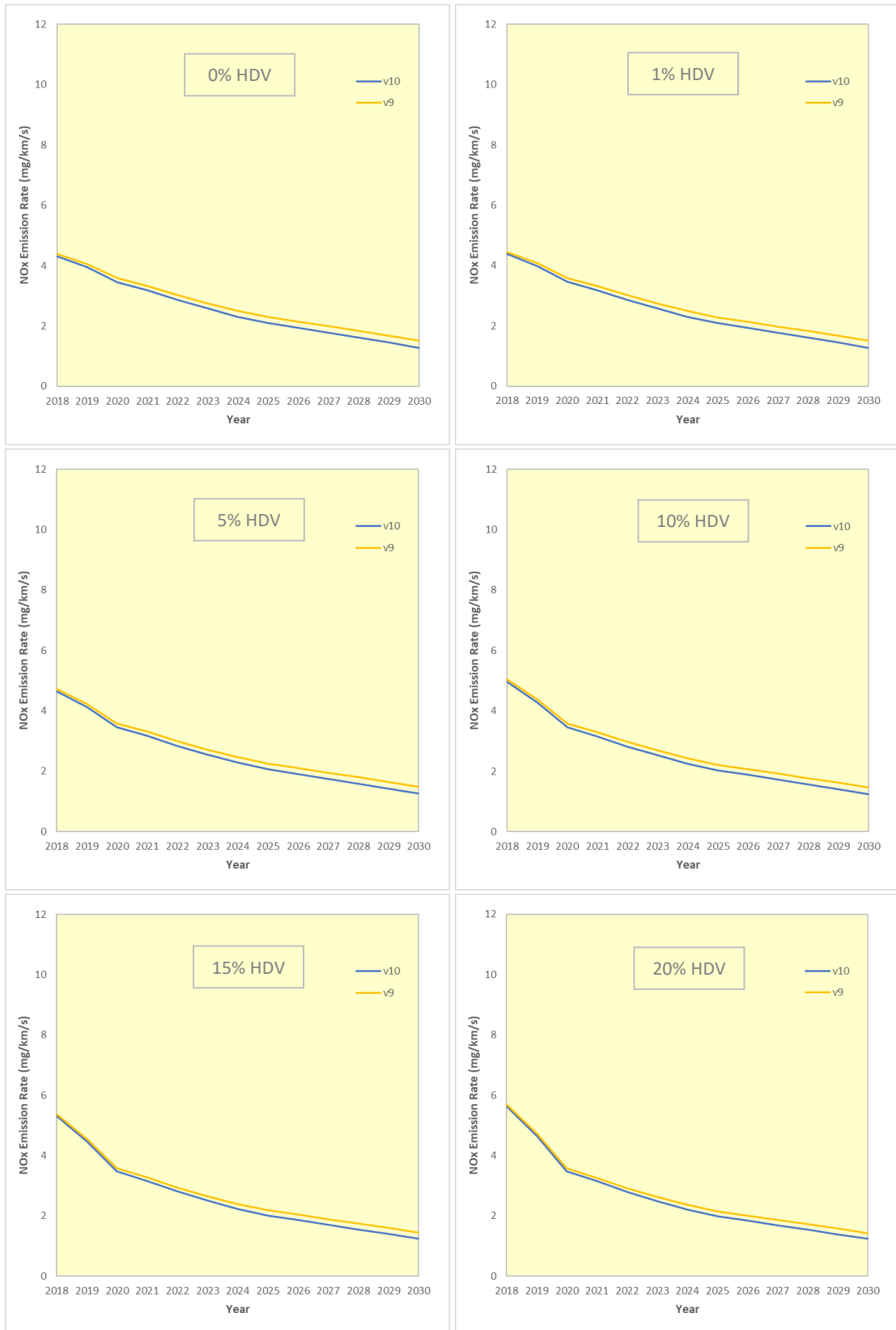


Figure A1.15: Emissions at 90 kph with varying Fleet Mixes

Outer London

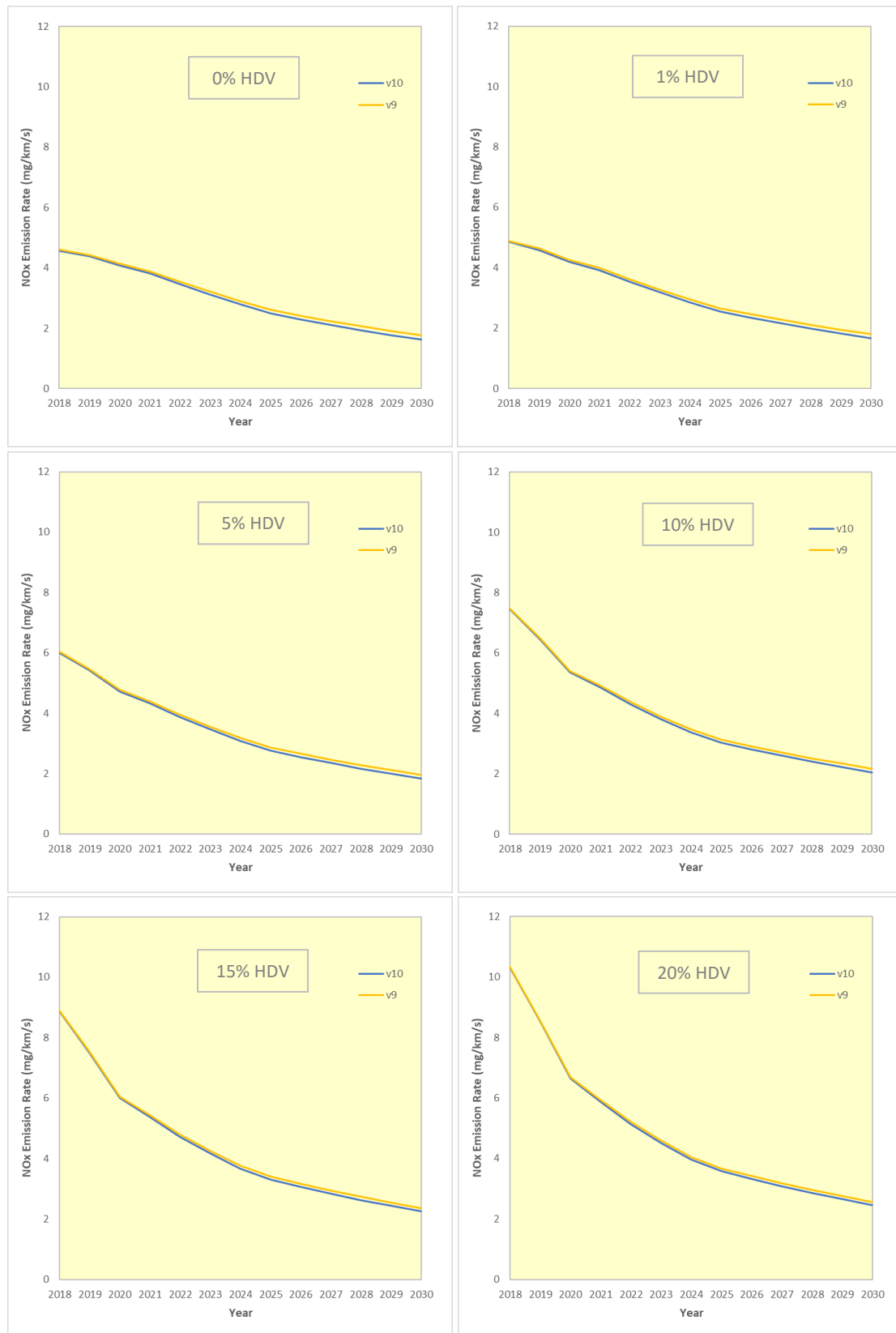


Figure A1.16: Emissions at 30 kph with varying Fleet Mixes

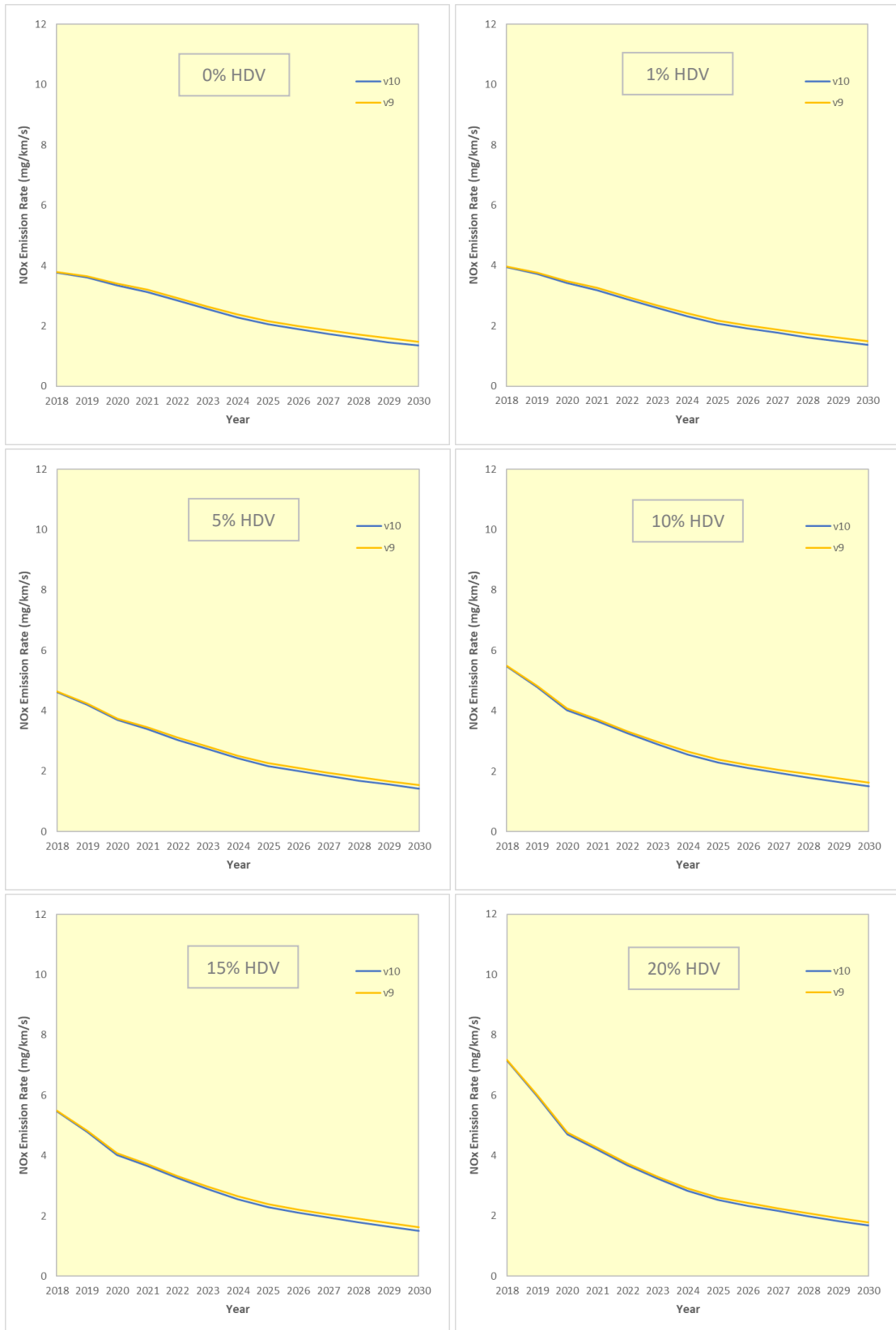


Figure A1.17: Emissions at 50 kph with varying Fleet Mixes

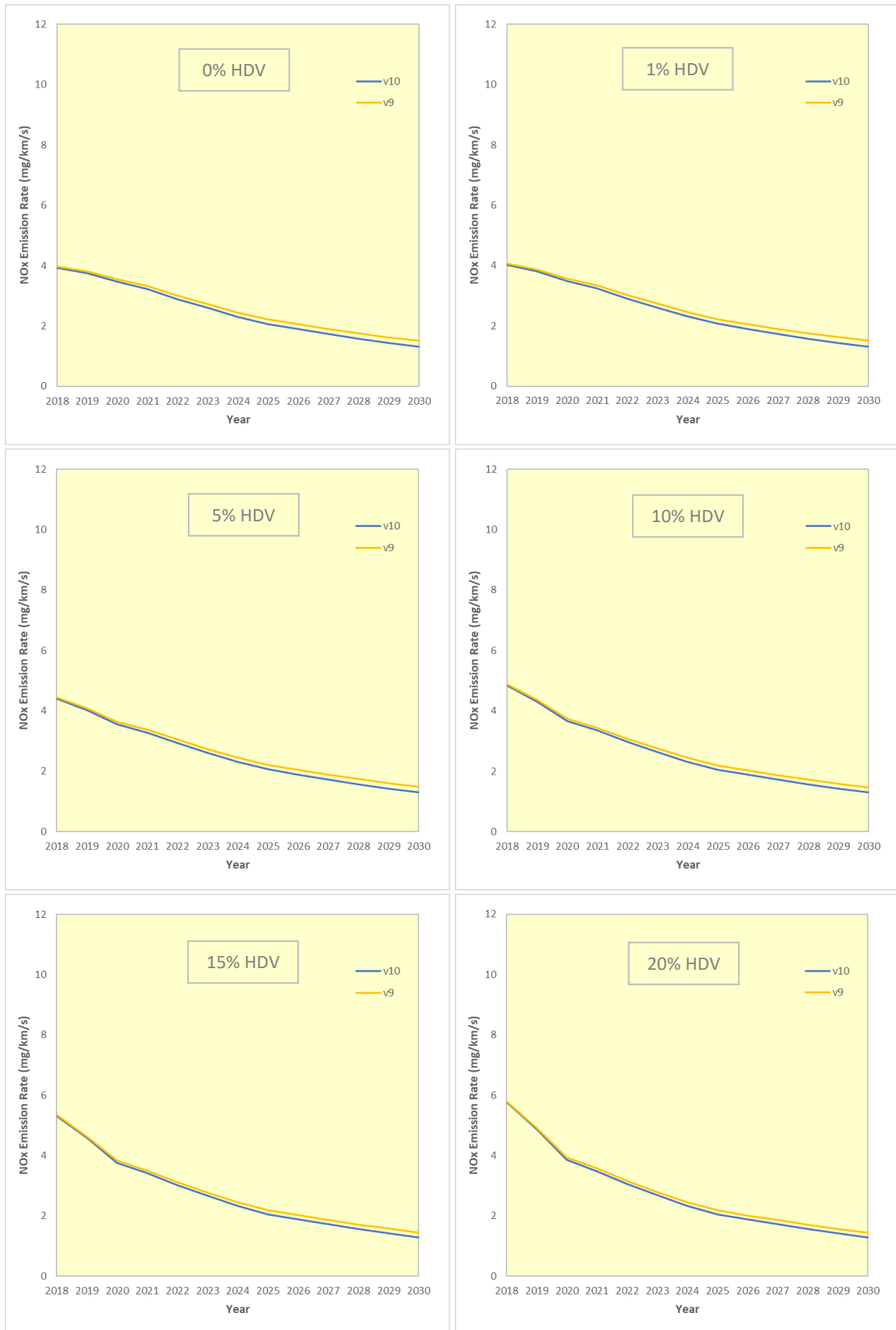


Figure A1.18: Emissions at 90 kph with varying Fleet Mixes

London motorway

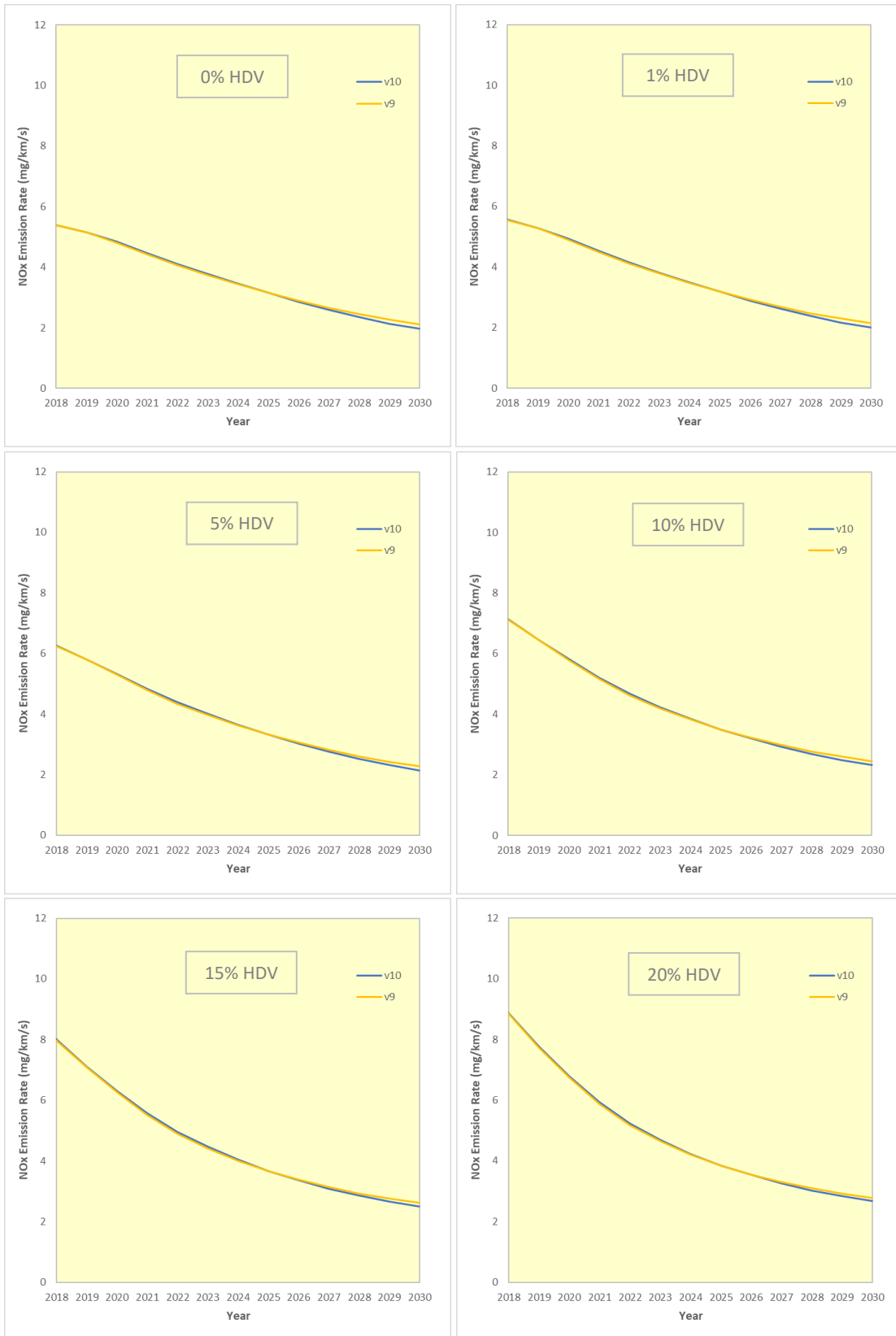


Figure A1.19: Emissions at 30 kph with varying Fleet Mixes

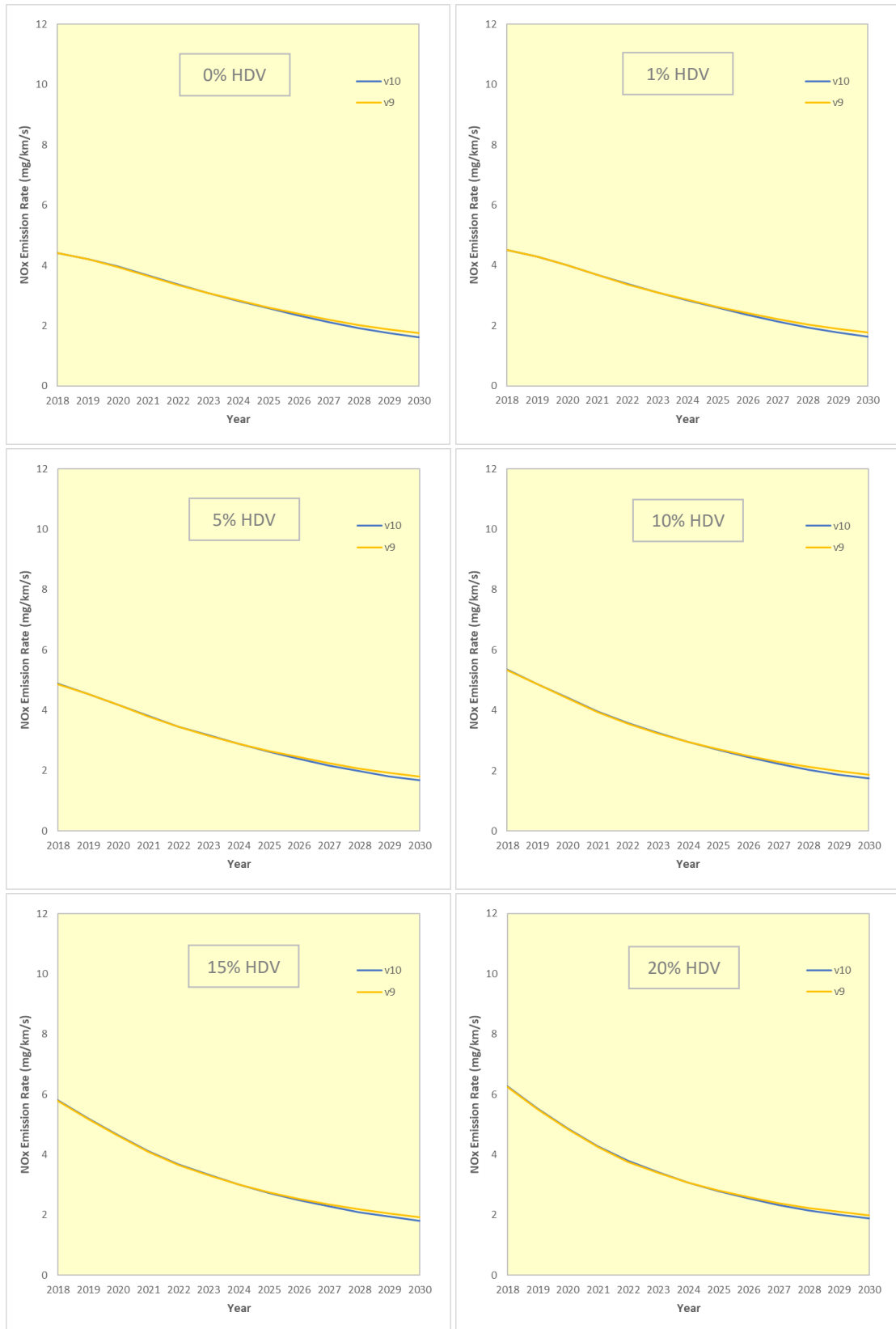


Figure A1.20: Emissions at 50 kph with varying Fleet Mixes

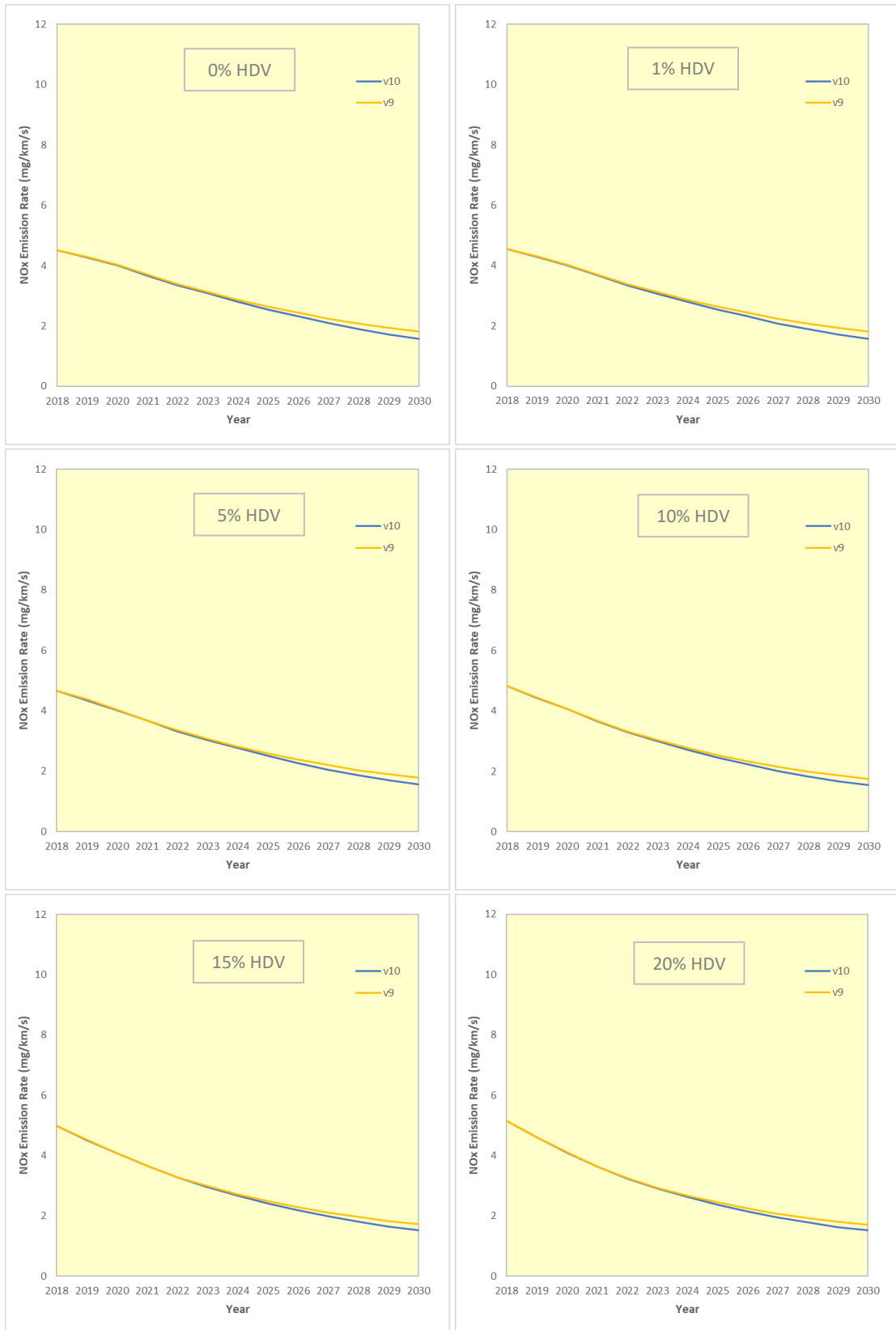


Figure A1.21: Emissions at 90 kph with varying Fleet Mixes

A2 Normalised Emissions Comparisons

England (not London) urban

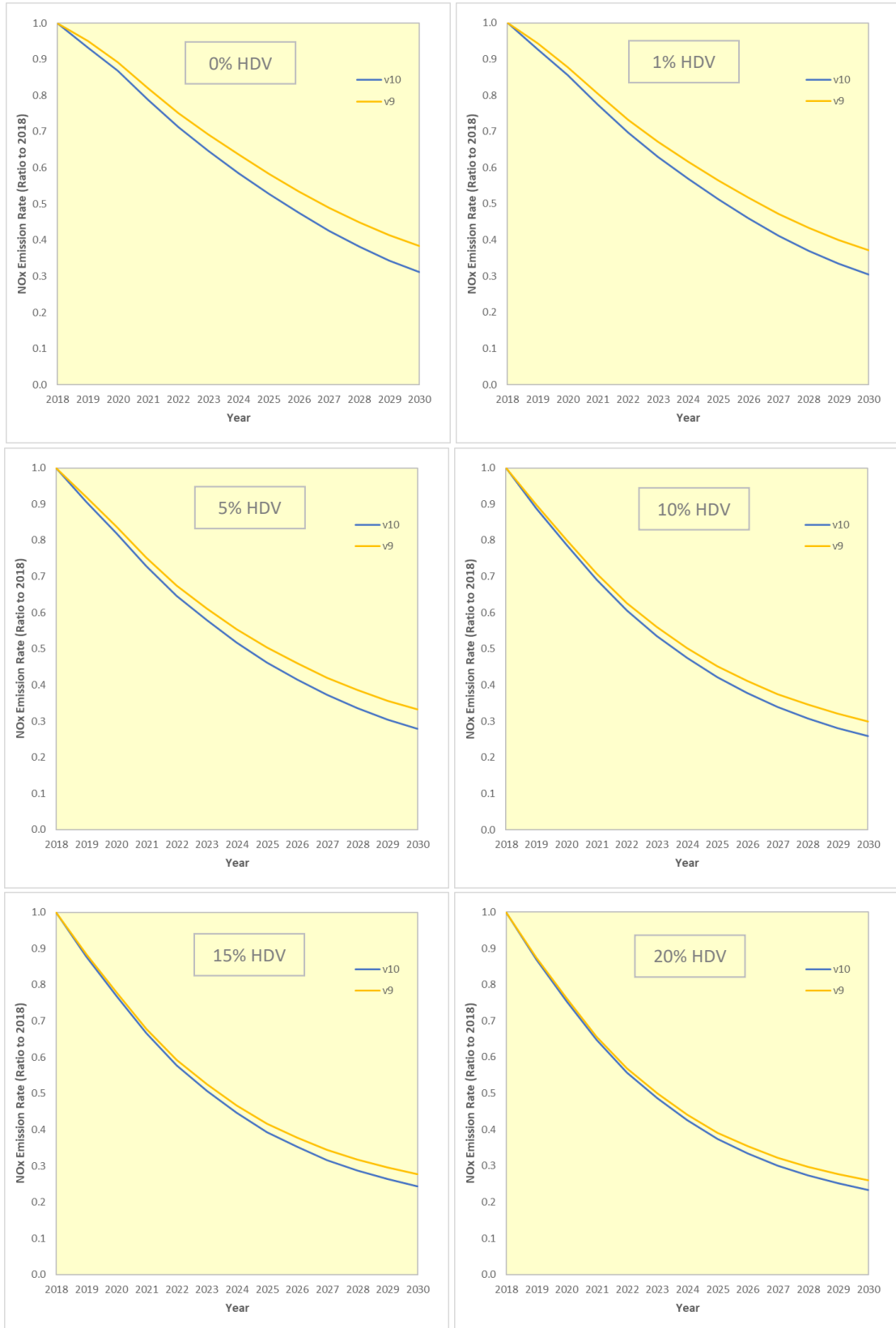


Figure A2.1: Emissions at 30 kph with varying Fleet Mixes Normalised to 2018

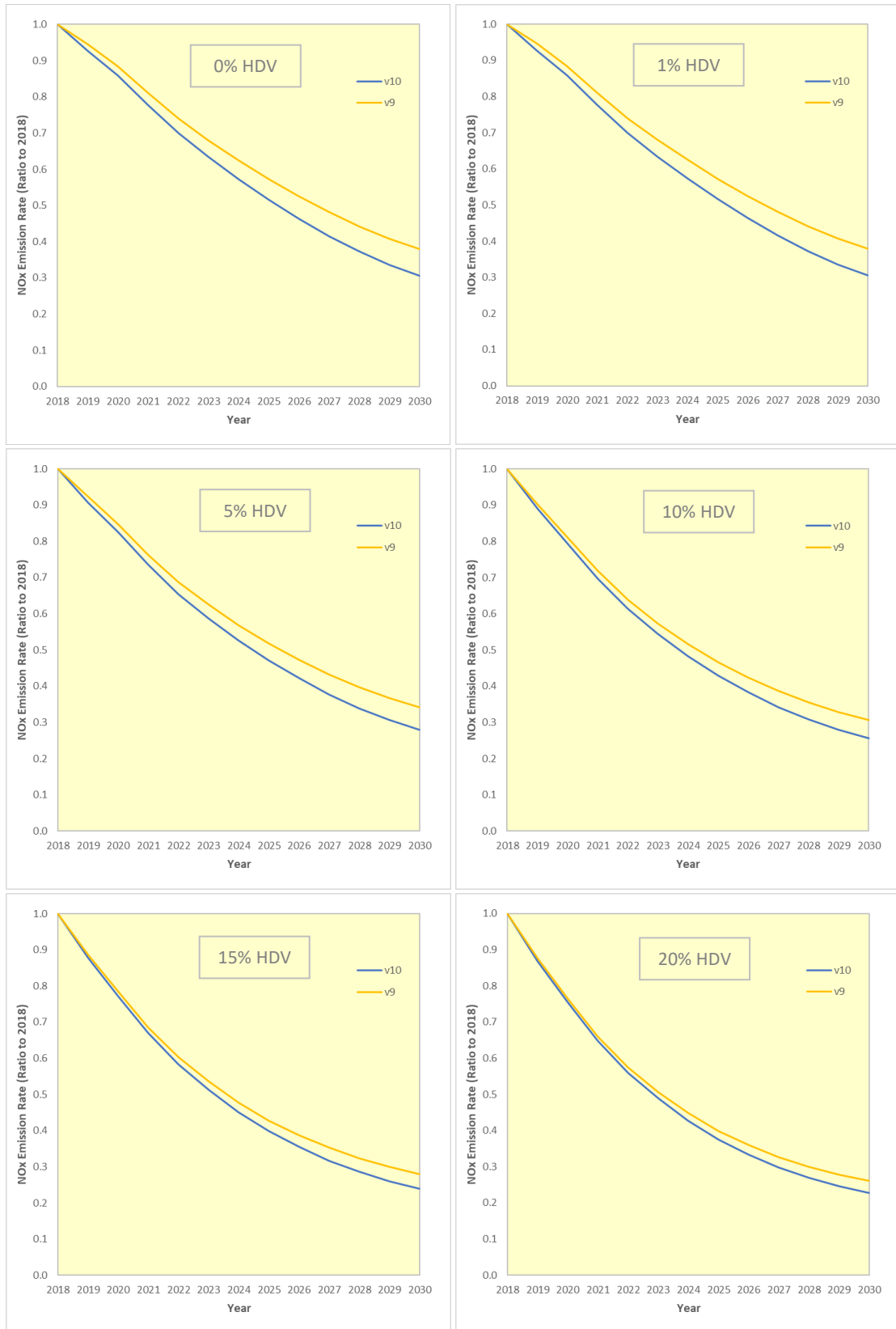


Figure A2.2: Emissions at 50 kph with varying Fleet Mixes Normalised to 2018

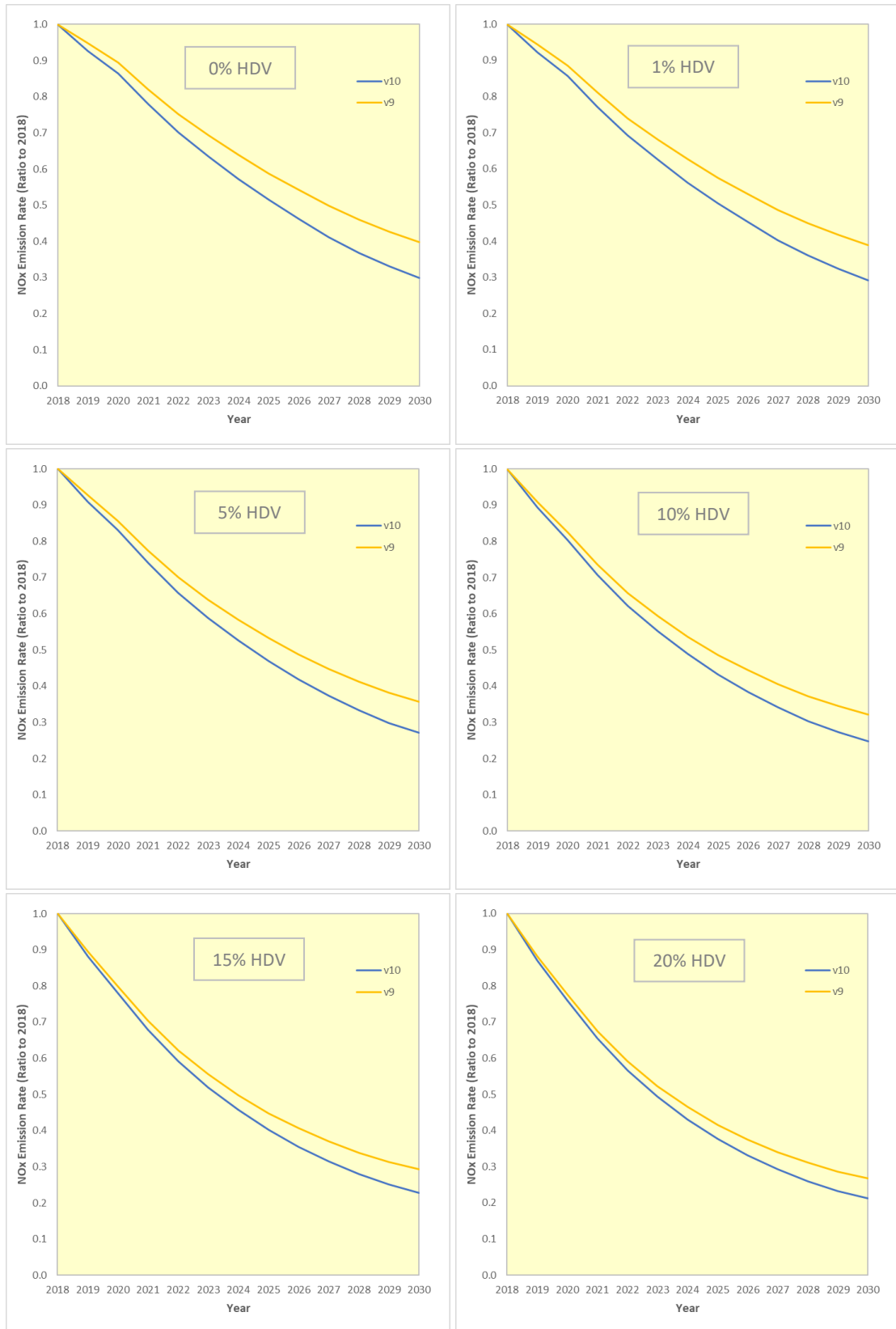


Figure A2.3: Emissions at 90 kph with varying Fleet Mixes Normalised to 2018

Inner London

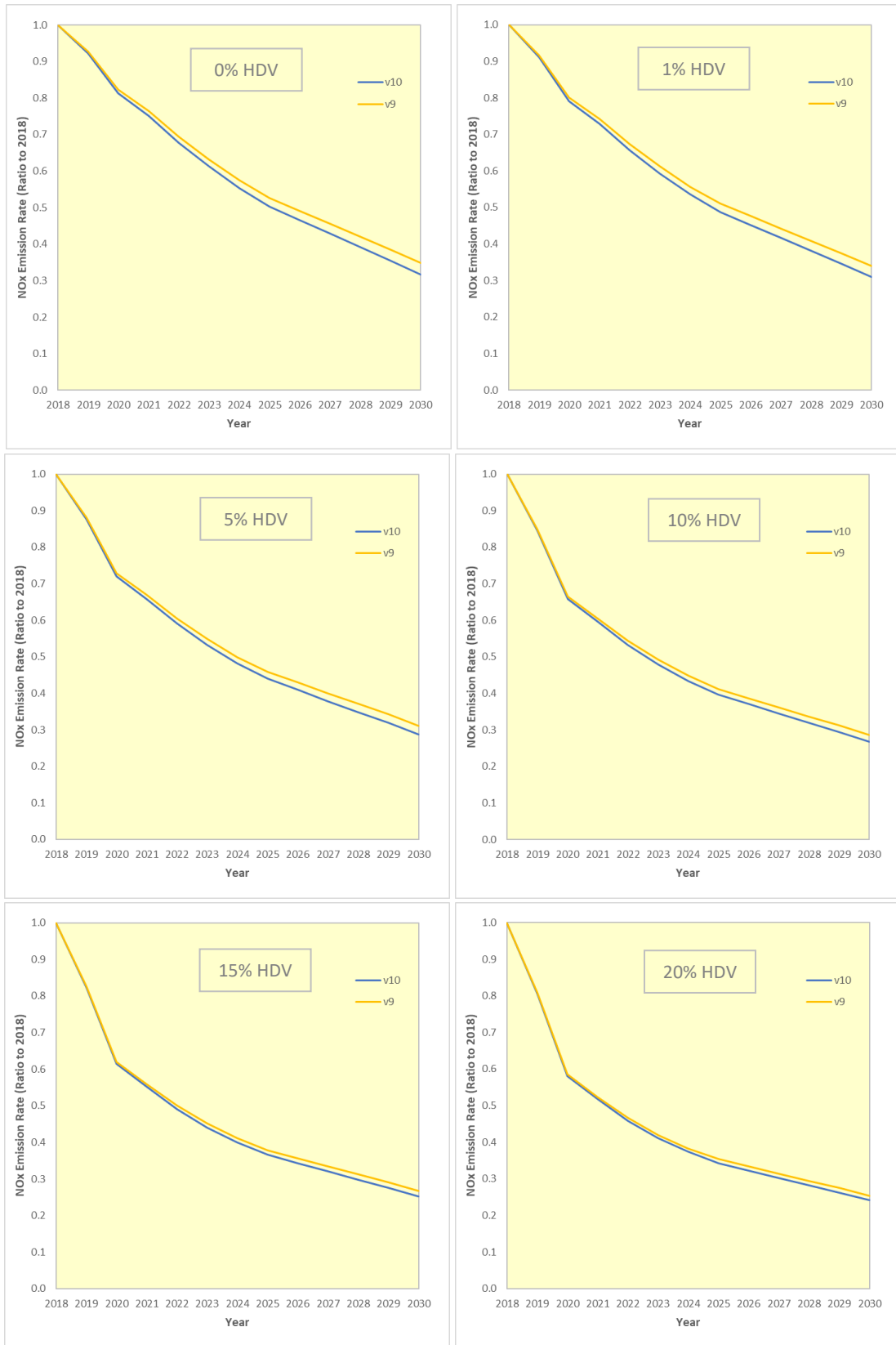


Figure A2.4: Emissions at 30 kph with varying Fleet Mixes Normalised to 2018

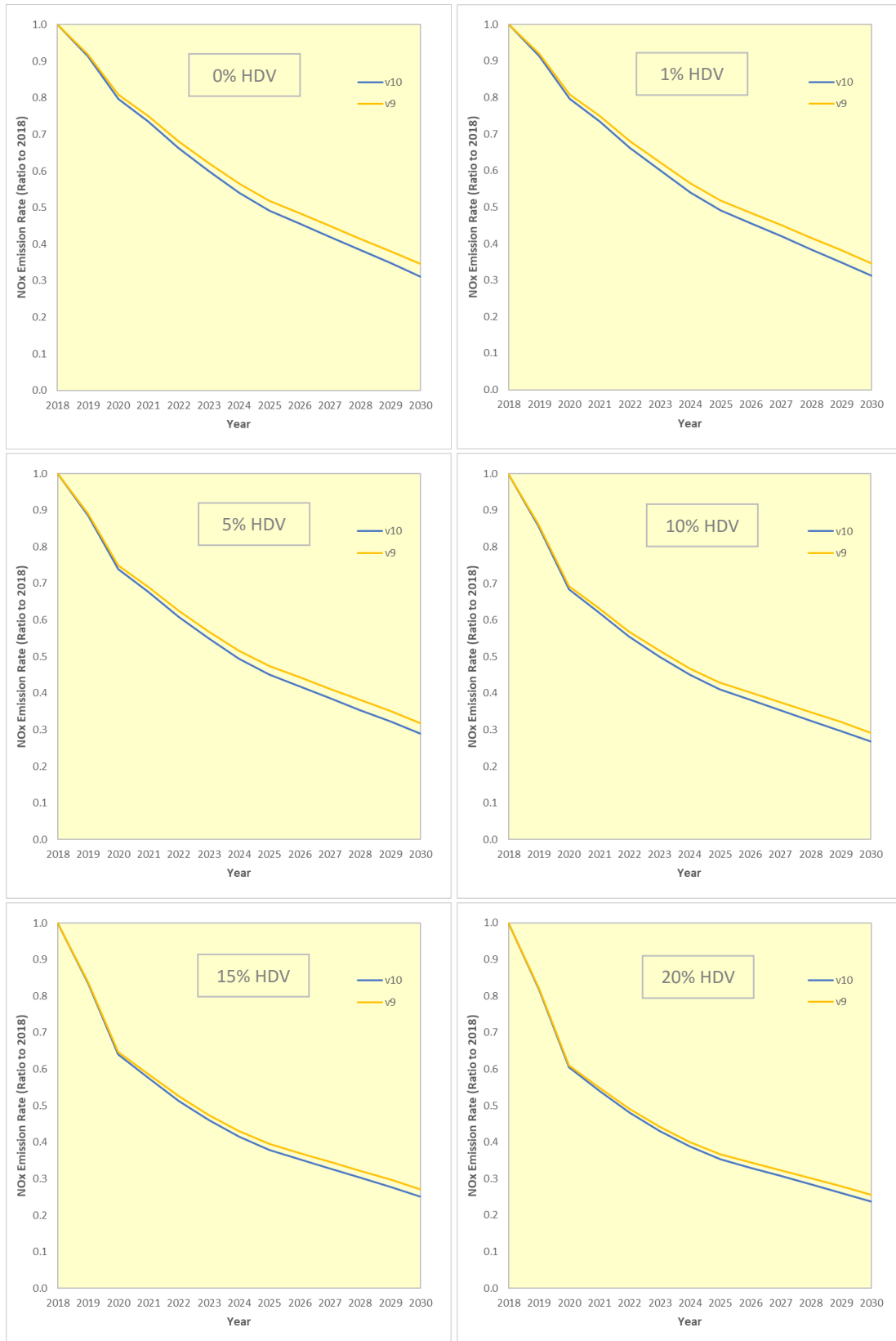


Figure A2.5: Emissions at 50 kph with varying Fleet Mixes Normalised to 2018

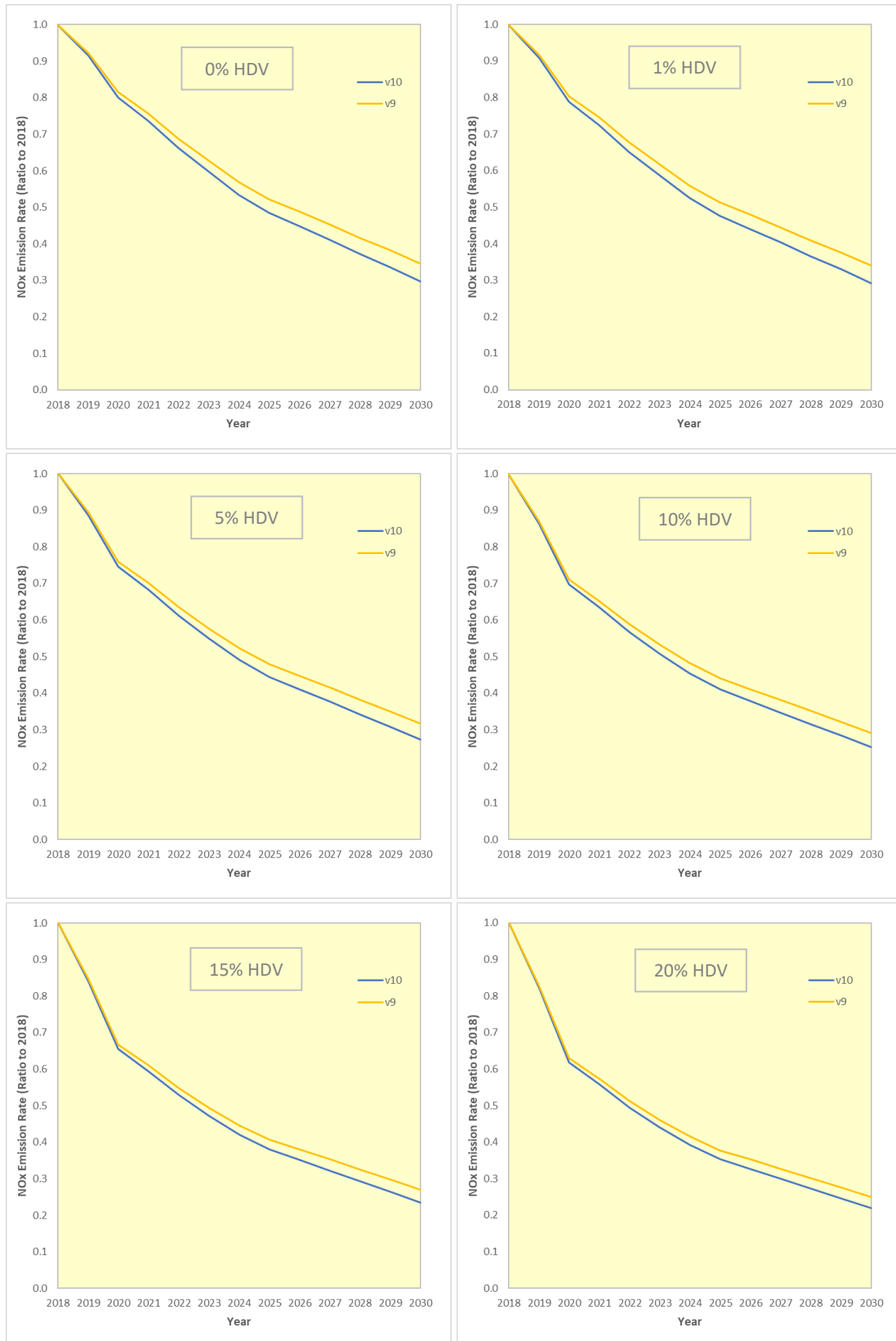


Figure A2.6: Emissions at 90 kph with varying Fleet Mixes Normalised to 2018