

Appendices

- A. Overall Initial Test and After-Repairs (Retest) Results by Test Type
 - B. Test Results by Test Type
 - C. Visual (Catalytic Converter) Results by Test Type
 - D. Functional (Fuel Cap Test) Results by Test Type
 - E. OBD Malfunction Indicator Light (MIL) and Associated Diagnostic Trouble Codes (DTCs)
 - F. OBD Readiness and Associated Monitors
 - G. OBD and Functional (Fuel Cap Test) Results
 - H. First After-Repairs (Retest) Results by Test Type
 - I. Second/Subsequent After-Repairs (Retest) Results by Test Type
 - J. Vehicles with Initial Fail Result that Receive Repair Waiver
 - K. Summary of Waivers Processed & Referee Tests Performed
 - L. Audit Activity
 - M. Covert Audits Conducted by Inducement and Test Type
 - N. Covert Audits Conducted Resulting in a False Pass by Test Type
 - O. Inspection Station Information by Test Type
 - 1. Test Type: OBD
 - 2. Test Type: ASM
 - 3. Test Type: TSI
 - P. Vehicle Outcome by Test Type and Vehicle Class
 - Q. Most Common Repairs and Associated Emissions Benefit
 - XYZ. Additional Analysis for Georgia's 2015 I/M Program Annual Operation Report
-

Appendix A

Overall Initial Test and After-Repairs (Retest) Results by Test Type

Overall Initial Test and After-Repairs (Retest) Results by Test Type (12 tables) illustrates the overall initial and after-repairs (retest) results by test type, OBD, ASM and TSI, and vehicle class for inspections performed on passenger vehicles and trucks. Note: The Georgia inspection procedure allows inspectors the option to replace failing fuel caps before the conclusion of the inspection; hence there are two (2) separate sections in the initial inspection table to account for this option.

The first six (6) tables provide overall results for initial tests, while the latter six (6) tables provide overall results for after-repairs tests (retests) performed after the vehicle was repaired. The data on 12 all tables is presented in the same format as follows:

- Section A provides the model year of the vehicles tested.
- Section B: "Results for Vehicles as Presented for Inspection", displays the overall pass and fail statistics, number and percentage, and the sum of the pass and fail results.
Note: In this section, if the fuel cap replacement option was exercised during the initial inspection, it was counted as a fail result.
- Section C: "Fuel Cap Pass", takes into account vehicles that pass the initial test, plus those that pass the test after the fuel cap replacement option is exercised or the vehicle is tested again. $((\text{Pass} + \text{Replaced} + \text{Tested Again}) / (\text{Grand Total} - \text{Abort})) = \text{total for calculating the pass percentage.}$
- Section D: "Fuel Cap Fail", takes into account vehicles missing (who do not replace) the gas cap, combined with the fail results to arrive at the fail percentage. $((\text{Fail} + \text{Missing Not Replaced}) / (\text{Grand Total} - \text{Abort})) = \text{total for calculating the fail percentage.}$
- Section E provides the total for tests with an "Unknown" result.
- Section F provides the total for tests with an "Fuel Cap Not Tested" result.
- Section G provides the total for tests with an "Abort" result.
- Section H provides the "Grand Total" which represents the sum of either section C, D, E, F and G or Sections E, G, and the "Pass/Fail Total" from Section B.

The bottom row of each table summarizes the total number and overall percentage of each column accordingly.

Note: All percentages are rounded to one (1) decimal place. As a result, not all percentage columns may total to exactly 100%.

Appendix B

Test Results by Test Type

Test Results by Test Type (six (6) tables) illustrates both initial and after-repairs (retest) results by test type, OBD, ASM and TSI, and vehicle class for inspections performed on passenger vehicles and trucks. Tables one (1) and two (2) display results for passenger vehicles and trucks, respectively, receiving an OBD test; tables three (3) and four (4) display results for passenger vehicles and trucks, respectively, receiving an ASM test; and tables five (5) and six (6) display results for passenger vehicles and trucks, respectively, receiving a TSI test.

The first column on all tables - Section A - provides the "Model Year" of the vehicles tested.

The results for "Initial Tests" are presented in Section B of each table. Pass and fail statistics, number and percentage, as well as the number of tests with and "Unknown" result are displayed. The "Total" in Section B is a sum of the pass, fail and unknown results combined.

The "After-Repairs Tests" (retest) results are presented in Section C of each table. Pass and fail statistics, number and percentage, as well as the number of tests with and "Unknown" result are displayed. The "Total" in Section C is a sum of the pass, fail and unknown results combined.

Section D provides the "Grand Total" and represents the sum of pass, fail and unknown test results for both initial and after-repairs inspections combined.

The bottom row of each table summarizes the total number and overall percentage of each column accordingly.

Note: All percentages are rounded to one (1) decimal place. As a result, not all percentage columns may total to exactly 100%.

Appendix C

Visual (Catalytic Converter) Results by Test Type

Visual (Catalytic Converter) Results by Test Type (six (6) tables) illustrates both initial and after-repairs (retest) results for the visual inspection for presence of the catalytic converter. The Results are presented by test type, OBD, ASM and TSI, and vehicle class for inspections performed on passenger vehicles and trucks. Tables one (1) and two (2) display the visual results for passenger vehicles and trucks, respectively, receiving an OBD test; tables three (3) and four (4) display the visual results for passenger vehicles and trucks, respectively, receiving an ASM test; and tables five (5) and six (6) display the visual results for passenger vehicles and trucks, respectively, receiving a TSI test.

The first column on all tables, Section A, provides the "Model Year" of the vehicles tested.

The results for "Initial Tests" are presented in Section B of each table. Pass and fail statistics, number and percentage, as well as the number of tests with and "Unknown" result are displayed. The "Total" in Section B is a sum of the pass, fail and unknown results combined.

The "After-Repairs Tests" (retest) results are presented in Section C of each table. Pass and fail statistics, number and percentage, as well as the number of tests with and "Unknown" result are displayed. The "Total" in Section C is a sum of the pass, fail and unknown results combined.

Section D provides the "Grand Total" and represents the sum of pass, fail and unknown test results for both initial and after-repairs inspections combined.

The bottom row of each table summarizes the total number and overall percentage of each column accordingly.

Note: All percentages are rounded to one (1) decimal place. As a result, not all percentage columns may total to exactly 100%.

Appendix D

Functional (Fuel Cap Test) Results by Test Type

Functional (Fuel Cap Test) Results by Test Type (12 tables) illustrates the initial and after-repairs functional (fuel cap test) results by test type, OBD, ASM and TSI, and vehicle class for inspections performed on passenger vehicles and trucks. Note: The Georgia inspection procedure allows inspectors the option to replace failing fuel caps before the conclusion of the inspection; hence there are two (2) separate sections in the initial inspection table to account for this option.

The first six (6) tables provide functional results for initial tests; while the latter six (6) tables provide overall results for retests performed after the vehicle was repaired. The first column on all tables, Section A, provides the "Model Year" of the vehicles tested.

On all tables, the "Results for Vehicles as Presented for Inspection", Section B, displays the actual pass and fail statistics, number and percentage, and the sum of the pass and fail results. Note: In this section, if the fuel cap replacement option is exercised during the initial inspection, it is counted as a Fail result.

The first six (6) tables (initial results) also contain a section for "Final Results Utilizing the Fuel Cap Replacement Option", Section C, which takes into account test results when the fuel cap is replaced during the initial inspection, as well as results for vehicles tested again. Both the pass and fail statistics, number and percentage, are displayed, however in this section, if the fuel cap replacement option is exercised during the initial inspection or the vehicle is tested again and passes, those results are combined with the fuel cap pass results, when calculating the pass percentage. (Pass + Replaced + Tested Again = total for calculating the pass percentage.)

Further, the results for vehicles missing (who do not replace) the gas cap are combined with the fail results to arrive at the fail percentage. (Fail + Missing Not Replaced = total for calculating the fail percentage.)

Tables one (1) through six (6) (initial results) also include Section D that represents the number of tests with an "Unknown" result; Section E for inspections where the "Fuel Cap Not Tested"; Section F for tests with an "Abort" result; and Section G for the "Grand Total" which represents the combined total of either the Section F and the "Pass/Fail Total" from Sections B or Sections C and F.

Tables seven (7) through 12 (after-repairs results) also include Section C that represents the number of tests with an "Unknown" result; Section D for tests with an "Abort" result; and Section E for the "Grand Total" which represents the combined total of Sections C, D and the "Pass/Fail Total" of Section B.

The bottom row of each table summarizes the total number and overall percentage of each column accordingly.

Note: All percentages are rounded to one (1) decimal place. As a result, not all percentage columns may total to exactly 100%.

Appendix E

OBD Malfunction Indicator Light (MIL) and Associated Diagnostic Trouble Codes (DTCs)

OBD Malfunction Indicator Light (MIL) and Associated Diagnostic Trouble Codes (DTCs) (two (2) tables) presents results from both initial and after-repairs OBD tests performed on passenger vehicles (Table one (1)) and trucks (Table two (2)). Tests with an "Abort" or "Unknown" result were excluded.

The first column on both tables, Section A, provides the "Model Year" of the vehicles tested.

Sections B through E present statistics demonstrating the correlation between the MIL being commanded on or not and the presence of DTCs. The appropriate heading represents each column for inspections occurring with the MIL Commanded on and DTCs stored, MIL Commanded on and no DTCs stored, MIL Commanded off and no DTCs stored, and MIL Commanded off and DTCs stored. Georgia does not perform a Key On Engine Running (KOER) as part of the test sequence.

Sections B and C provide DTC results, number and percentage, for when the MIL is commanded on, whereas Sections D and E provide results, number and percentage, for when the MIL is not commanded on. Note: According to EPA guidance, if the MIL is not commanded on, the test system should not query for DTCs. The final Georgia software version follows this guidance.

The number of "Total OBD Tests" performed for each model year is presented in Section F. The total is the sum of each of the numbers producing results presented in Sections B, C, D and E.

The bottom row of each table summarizes the total number and overall percentage of each column accordingly.

Note: All percentages are rounded to one (1) decimal place. As a result, not all percentage columns may total to exactly 100%.

Appendix F

OBD Readiness and Associated Monitors

OBD Readiness and Associated Monitors (two (2) tables) presents results from both initial and after-repairs OBD tests performed on passenger vehicles (Table one (1)) and trucks (Table two (2)). Tests with an "Abort" or "Unknown" result were excluded.

Data is presented on both tables as follows:

- Section A provides the "Model Year" of the vehicles tested.
- Section B presents the OBD Readiness fail results, number and percentage.
- Section C presents the number of monitors "not ready" for both passing and failing vehicles. The section is broken down to provide statistics for inspections where one (1) through six (6) or more monitors are not ready. Note: Model years 1996 - 2000 are allowed to have up to and including two (2) readiness monitors not set, without failing for OBD Readiness. Model years 2001 and newer are allowed to have only one (1) readiness monitor not set.
- Section D represents the "Total OBD Tests" performed for each model year; it is the sum of the results provided in Section C.

The bottom row of each table summarizes the total number and overall percentage of each column accordingly.

Note: All percentages are rounded to one (1) decimal place. As a result, not all percentage columns may total to exactly 100%.

Appendix G

OBD and Functional (Fuel Cap Test) Results

OBD and Functional (Fuel Cap Test) Results (two (2) tables) illustrates the fuel cap results for passenger vehicles (Table one (1)) and trucks (Table two (2)) that passed and failed the OBD inspections. This data includes results from both initial and after-repairs inspections, but excludes tests with an "Abort" or "Unknown" result.

Data is presented on both tables as follows:

- Section A provides the "Model Year" of the vehicles tested.
- Section B presents fuel cap results for vehicles that pass the OBD test.
- Section C presents fuel cap results for vehicles that fail the OBD test.
- Section D represents the "Total OBD Tests" performed for each model year; it is the sum of the results provided in Sections B and C.

The fuel cap results are presented in Sections B and C, number and percentage, as follows:

- Pass
- Fail
- Missing Not Replaced
- Replaced During the Inspection Process
- Tested Again and Passed
- Other (this includes null and previous pass results)

The bottom row of each table summarizes the total number and overall percentage of each column accordingly.

Note: All percentages are rounded to one (1) decimal place. As a result, not all percentage columns may total to exactly 100%.

Appendix H

First After-Repairs (Retest) Results by Test Type

First After-Repairs (Retest) Results by Test Type (12 tables) illustrates the first retest results for passenger vehicles and trucks by test type, OBD, ASM or TSI.

- Tables one (1) through six (6) provide results using the overall test results by test type. Within each test type, the results are presented by vehicle class, with passenger vehicles presented first, followed by trucks.
- Tables seven (7) and eight (8) provide visual (catalytic converter) overall results for first retests performed on passenger vehicles and trucks, respectively, receiving an OBD, ASM or TSI test.
- Tables nine (9) and 10 provide functional (fuel cap test) overall results for first retests performed passenger vehicles and trucks, respectively, receiving an OBD, ASM or TSI test.
- Tables 11 and 12 provide overall results for first retests performed on passenger vehicles and trucks, respectively, receiving an OBD, ASM or TSI test.

Data is presented on all tables as follows:

- Section A provides the "Model Year" of the vehicles tested.
- Section B presents pass and fail results, number and percentage.
- Section C presents the "Pass/Fail Total".
- Section D provides the number of test that received an "Unknown" result.
- Section E provides the "Grand Total" which is the sum of the results provided in Sections C and D.

The bottom row of each table illustrates and summarizes the total number and percentage of each column accordingly.

Note: All percentages are rounded to one decimal place. As a result, not all percentage columns may total to exactly 100%.

Appendix I

Second/Subsequent After-Repairs Test Results by Test Type

Second/Subsequent After-Repairs Test Results by Test Type (12 tables) illustrates the second or subsequent retest results for passenger vehicles and trucks by test type, OBD, ASM or TSI.

- Tables one (1) through six (6) provide results using the overall test results by test type. Within each test type, the results are presented by vehicle class, with passenger vehicles presented first, followed by trucks.
- Tables seven (7) and eight (8) provide visual (catalytic converter) overall results for first retests performed on passenger vehicles and trucks, respectively, receiving an OBD, ASM or TSI test.
- Tables nine (9) and 10 provide functional (fuel cap test) overall results for first retests performed passenger vehicles and trucks, respectively, receiving an OBD, ASM or TSI test.
- Tables 11 and 12 provide overall results for first retests performed on passenger vehicles and trucks, respectively, receiving an OBD, ASM or TSI test.

Data is presented on all tables as follows:

- Section A provides the "Model Year" of the vehicles tested.
- Section B presents pass and fail results, number and percentage.
- Section C presents the "Pass/Fail Total".
- Section D provides the number of test that received an "Unknown" result.
- Section E provides the "Grand Total" which is the sum of the results provided in Sections C and D.

The bottom row of each table illustrates and summarizes the total number and percentage of each column accordingly.

Note: All percentages are rounded to one decimal place. As a result, not all percentage columns may total to exactly 100%.

Appendix J

Vehicles with Initial Fail Result that Receive Repair Waiver

Vehicles with Initial Fail Result that Receive a Repair Waiver (one (1) table) illustrates by model year and vehicle class, passenger vehicles and trucks, the statistics for repair waivers that were both "Approved" (number and percentage) and "Declined" (number only). The percentage approved is achieved by taking the number of "Approved" repair waivers for passenger vehicles and trucks and dividing it by the total number of passenger vehicles and trucks, respectively, with an initial fail result.

The number of failing initial inspections is taken from the tables in Appendix A. Note: The Georgia inspection procedure allows inspectors the option to replace failing fuel caps before the conclusion of the initial inspection. Fuel caps replaced under this option are counted as failing the initial inspection for the purposes of calculations in this table.

Section D provides the "Total Vehicles" that received an initial fail result. This is the sum of the passenger vehicles (first column of Section B) and trucks (first column of Section C) that received an initial fail result.

The bottom row of the table illustrates and summarizes the total number and percentage of each column accordingly.

Note: All percentages are rounded to one decimal place. As a result, not all percentage columns may total to exactly 100%.

It should be noted that the number of repair waivers shown in Appendix J does not always equal the number of repair waivers shown in Appendix K. Due to VIN mismatches, there are a few occasions where a repair waiver cannot be connected to an initial inspection; only those repair waivers that can be tied to an initial inspection are accounted for in Appendix J. Appendix K is an accurate accounting of all Repair Waivers processed.

Appendix K

Summary of Waivers Processed & Referee Tests Performed

Summary of Waivers Processed & Referee Tests Performed (three (3) tables) illustrates the summary of all waivers issued and referee tests observed. The first two (2) tables provide information on waivers process, while the third table provides information about referee tests.

Summary of Waivers Processed (two (2) tables) provides the summary of all waivers, extensions and exemptions (collectively referred to as "waivers") processed during the monthly reporting period. The totals represent work-throughput, not a separate accounting for an individual vehicle's status. As such, duplicates waivers processed for the same vehicle are counted on this report and may be counted more than one time.

The first table displays information on waivers, extensions and exemptions "Approved" during the reporting period; the second page of the report displays information on waivers, extensions and exemptions "Denied" during the month.

The first column on both tables provides the "Model Year" of the vehicles for which the waivers were processed. The second column represents the "Grand Total" of waivers processed during the reporting period; it is the sum total of all waivers presented in the remaining columns of the tables.

The bottom row of each table summarizes the total number of each column accordingly.

Referee Tests Performed (one (1) table) illustrates, by model year, the number of referee tests performed during the reporting period and the results of each.

The first column on the table provides the "Model Year" of the vehicles for which the referee tests were performed. The second column represents the "Total" number of referee tests performed during the reporting period. The remaining columns display the actual pass and fail results in both number and percentage. The number of referee tests shown in the table only includes pass and fail test results. Aborted tests are not included.

The bottom row of the table illustrates and summarizes the total number and percentage of each column accordingly.

Note: All percentages are rounded to one decimal place. As a result, not all percentage columns may total to exactly 100%.

It should be noted that the number of repair waivers shown in Appendix K does not always equal the number of repair waivers shown in Appendix J. Due to VIN mismatches, there are a few occasions where a repair waiver cannot be connected to an initial inspection; only those repair waivers that can be tied to an initial inspection are accounted for in Appendix J. Appendix K is an accurate accounting of all Repair Waivers.

Appendix L

Audit Activity

Audit Activity (one (1) table provides a breakdown on the number of overt and covert audits performed by type on a monthly basis. The report is presented in cumulative format for the calendar year.

The bottom row of each table summarizes the total number of each column accordingly.

Appendix M

Covert Audits Conducted by Inducement and Test Type

Covert Audits Conducted by Inducement and Test Type (one (1) table) illustrates the number of covert audits performed by inducement and test type, OBD, ASM and TSI.

The last column represents the "Total" number of covert audits conducted by inducement type. The types of inducements include:

- Emissions Failure
- Functional Failure
- Visual Failure
- No Failure
- OBD Bulb Check Failure
- OBD MIL Commands/Codes
- OBD Readiness Failure
- OBD Non-Communication
- OBD Failure

The bottom row of each table summarizes the total number of each column accordingly.

Appendix N

Covert Audits Conducted Resulting in a False Pass by Test Type

Covert Audits Conducted Resulting in a False Pass by Test Type (one (1) table) illustrates the number of covert audits performed that resulted in a false pass. The information is presented by test type, OBD, ASM and TSI.

The last column represents the "Total" number of covert audits resulting in a by false pass by inducement type. The types of false pass inducements include:

- Emissions False Pass
- Functional False Pass
- Visual False Pass
- No False Pass
- OBD Bulb Check False Pass
- OBD MIL Commands/Codes
- OBD Readiness False Pass
- OBB Non-Communication
- OBD False Pass

The bottom row of each table summarizes the total number of each column accordingly.

Appendix O

Inspection Station Information by Test Type

Inspection Station Information by Test Type (three (3) major sections) present station information, and initial test and fail results by test type and model year, OBD, ASM or TSI.

The station information provided includes:

- Station ID
- Name
- Address
- City
- Zip
- County
- Technician Count (number of inspectors, which includes only those inspectors that actually performed emissions tests for the station during the reporting period)
- Audit Count (number of equipment audits, which includes certification audits, complete audits and 5-gas audits)

For each station, by test type, the "Total" number of initial tests performed and the fail results, both number and percentage, are provided by model year.

The bottom of each table illustrates the summary for the particular station detailing the total number and overall percentage of each individual column.

Appendix P

Vehicle Outcome by Test Type and Vehicle Class

Vehicle Outcome by Test Type and Vehicle Class (three (3) base tables, with 10 supporting tables for a total of 13 tables) is provided to analyze the fleet emissions impact of vehicles for which there is no know final outcome (no final pass ("NFP")). NFP vehicles are those that receive one (1) or more failed emissions tests, but never meet the I/M program requirements by ultimately passing the emissions test or receiving a waiver*, designated or classified as F/F/ below. For this analysis, each vehicle tested in 2016 will be presented by test type: OBD, ASM and TSI, then vehicle class: passenger vehicle or truck, and ultimately assigned to one (1) of four (4) categories described below, based on its sequence of inspection results:

- Pass/Pass (P/P): These vehicles pass their emissions inspection, thereby completing their inspection sequence, on the first attempt.
- Fail/Pass (F/P): These vehicles fail their initial emissions inspection, and then report for one or more subsequent inspections (presumably following repairs) until they ultimately achieve a passing result, thereby completing their inspection sequence.
- Fail/Waiver (F/W): These vehicles fail their initial emissions inspection, and then report for one or more subsequent inspections (presumably following repairs), however they are not able to achieve a passing result. Ultimately they meet the repair requirements and are issued a waiver, thereby completing their inspection sequence.
- Fail/Fail (F/F): These vehicles fail their initial emissions inspection and any subsequent retests. Therefore these vehicles never complete their inspection sequence by either passing the emissions inspection or receiving a waiver.

These categories provide for the comparison of emissions results from the initial versus subsequent emissions inspections (ultimately the emissions reductions) of vehicles as they proceed through the I/M program.

For vehicles that received an ASM or TSI emissions test, the average initial and final emissions levels were calculated for each of the four (4) categories of test sequences. This provides for the comparison of initial and final emissions levels among the categories which, when considered in the context of the number of vehicles in each category, gives the relative impact on fleet-wide emissions for each category. Results are presented as the measured ASM or TSI emissions concentrations, with all fast pass/fast fail ASM concentrations converted to full ASMs as described in Appendix A. The tables below present details of those results as follows:

- Table P.4 - Average ASM 5015 HC Emissions
 - Table P.5 - Average ASM 5015 CO Emissions
 - Table P.6 - Average ASM 5015 NO Emissions
 - Table P.7 - Average ASM 2525 HC Emissions
 - Table P.8 - Average ASM 2525 CO Emissions
 - Table P.9 - Average ASM 2525 NO Emissions
 - Table P.10 - Average TSI 2500 HC Emissions
 - Table P.11 - Average TSI 2500 CO Emissions
-

- Table P.12 - Average TSI Idle HC Emissions
- Table P.13 - Average TSI Idle CO Emissions

Some trends were observed in tables P.4 through P.13. First, the final passing emissions results of vehicles that failed, and then passed (F/P) were nearly as low as the emissions of the vehicles that initially passed (P/P). This indicates that for the F/P vehicles, the correct repairs were performed properly, bringing the vehicles up to par with the P/P vehicles.

Also observed were the emissions levels of the F/F vehicles changed very little from initial to final inspection. This was most likely in part because the initial inspection WAS the final inspection because no repairs were performed. Additionally, the initial emissions of the F/F vehicles were, in most cases, higher than the initial emissions of the F/P vehicles; this, again, supports that vehicles that fail to get repaired or otherwise meet the program requirements are the highest emitting vehicles.

Finally, in viewing all the tables, we observed while overall there were a small number of vehicles with no known outcome or NFP, those vehicles had a much higher “mean” emissions than vehicles that completed the inspection cycle by achieving a passing inspection result.

Note: Unlike in all other appendices where rounding is to one (1) decimal place, because gas concentrations are reported in small numbers, the percentages reported in the tables are rounded to two (2) decimal places.

Appendix Q

Most Common Repairs and Associated Emissions Benefit

Most Common Repairs and Associated Emissions Benefit (eight (8) tables) is an analysis designed to identify and report the most common repairs performed on vehicles in the I/M program. Further the analysis provides the emissions levels and emissions changes (initial failing emissions compared to final passing emissions results) associated with the repairs.

For vehicles receiving an ASM or TSI test, the initial inspection, final inspection, and change in emissions concentrations were calculated for each of the most common “repair slates” (explained below). For OBD tests, the repair slates were linked to Diagnostic Trouble Codes (DTCs) present at the initial inspection and not present at the final inspection.

When a vehicle receives a retest, following an initial fail result and presumably after being repaired, the inspection technician may enter information about any repairs that were done by entering “Y” or “N” in each of the 10 fields representing different general areas of repair. Herein, we grouped all repairs between an initial failed inspection and a final passed inspection into a single “repair slate” for that inspection cycle. A repair slate consists of 10 characters, each character representing one of the 10 different types of repairs that might be entered. If a given repair was performed in an inspection cycle, the repair slate position for that repair was set to “Y”. Otherwise, the repair slate position for that repair was set as “N”.

Types of Repairs

The first table lists the 10 types of repairs and the repair slate position of each. As an example, a vehicle that received a repair to the EGR system, repair slate position five (5), would have a repair slate of “NNN.NYN.NNNN”, with the “Y” being in the fifth out of the 10 positions.

It should be noted these 10 repair types each cover a fairly broad range of repairs. Consequently this can prevent a very precise relationship between the repair type and emissions inspection result from being developed. For example, an “EXH” repair might involve a repair to the catalyst from which we expect a large emissions benefit, or a repair to the gasoline fill pipe from which we expect no emissions benefit.

Most Common Repair Slates

The most common repair slates for vehicles receiving each type of inspection (OBD, ASM and TSI) are presented in the second table. The top set of repair slates was slightly different for each of the inspection types; since each inspection tests the vehicle somewhat differently, we expect that different types of repairs result. For example, EGR repairs were common for ASM and OBD vehicles, but since the TSI inspection does not test for NOx, EGR repairs did not even make it into the TSI top six (6). The table also provides total number of vehicles that received repairs. The number of vehicles inspected one time and not required to return for a retest is also provided. Finally the total number of vehicles tested is presented; this is the sum of the vehicles repaired vehicles and the single-inspection, non-repaired vehicles.

Analysis for Vehicle Receiving an ASM or TSI Test

For ASM and TSI vehicles, the average emissions concentrations at the initial and final inspections were calculated for each of the most common repair slates. Following is a description of the results presented in the third, fourth, fifth, sixth and seventh tables, all presented by vehicle class, passenger vehicles and trucks:

- Change in ASM5015 HC Emissions Following Most Common Repairs
- Change in ASM5015 CO Emissions Following Most Common Repairs
- Change in ASM5015 NO_x Emissions Following Most Common Repairs
- Change in TSI2500 HC Emissions Following Most Common Repairs
- Change in TSI2500 CO Emissions Following Most Common Repairs

Analysis for Vehicles Receiving an OBD Test

The approach for the analysis of repairs to vehicles that received an OBD inspection (rather than a tailpipe emissions test) is different than that for the ASM/TSI tested vehicles. For OBD vehicles, a failed inspection results from one (1) or more Diagnostic Trouble Codes (DTCs) being set. The DTCs provide information about what type of problem(s) the vehicle has, that may need repairs. Generally, when a vehicle passes an OBD inspection, no DTCs will be set. Therefore, the DTCs set when the vehicle is initially test and no longer set at the time of retest, are compared to the repairs performed.

Since there are far too many possible combinations to create a "DTC slate" analogous to the repair slates, repairs were correlated with DTCs on an individual basis (rather than as slates) for the OBD repair analysis.

The eighth and final table in Appendix Q is entitled "Repair to OBD Vehicles and Associated DTCs". The 10 common repair types are listed horizontally across the top. Vertically, each row of the table represents one DTC. Both the DTC Code (P-Code) and DTC description are provided. The values presented in the table represent the number of times a DTC that was set during the initial inspection, was no longer set upon retest during the same inspection cycle, presumably as a result of the repair designated. Note: Rows with DTCs that relate to similar components or problems are grouped together in the table.

Some consistent trends can be observed. For example, evaporative system DTCs were most often turned off after Fuel/Evap repairs; and EGR DTCs were most often turned off by EGR repairs.

The DTCs listed are the most commonly recorded DTCs, representing about one-third of the total OBD fail/repair/pass inspection cycles.

Appendix XYZ

Additional Analysis for Georgia's 2016 I/M Program Annual Operation Report

Appendix XYZ provides the details from Appendices P and Q as a means to evaluate the effectiveness of the Georgia I/M Program at repairing high-emitting vehicles, thereby reducing fleet-wide mass emissions. In addition to the tables of data provided is a description of how the data is prepared and evaluated, followed by the conclusions drawn.