



VEHICLE HEALTH INDEX™

2018

Introduction

The CarMD® Vehicle Health Index™ reports on the most common check engine light-related problems, repairs and associated costs. CarMD distributes this Index each April during Car Care Awareness Month as a reminder to pay attention to maintenance needs in order to help in avoiding unscheduled repairs and problems that may trigger the check engine light. Published annually since 2011, this Index provides consumers, media, the automotive industry and fleet managers with year-over-year car repair data, shedding light on trends related to the type and cost of repairs. In this Index you will find:

- **The 10 most common check engine-related vehicle repairs in the U.S. – 2017**
- **Most common repair by model year – 2017, 2007, 1997**
- **10-year history of U.S. car repair costs, including parts & labor – 2008 to 2017**
- **Breakdown of car repair issues by region (West, Midwest, Northeast, South) – 2017**
- **The 10 most expensive check engine light repairs – 2017**
- **The 10 check engine light repairs under \$60 – 2017**

What is Distinctive about CarMD's Index?

For nearly two decades, CarMD has been building the most comprehensive database of failures, fixes and repairs related to vehicles' on-board diagnostics (OBD-II or OBD2), which have been required on all cars, light trucks, vans and SUVs sold in the United States since 1996. The system provides health and safety information for roughly 80 percent of a vehicle's systems to trigger the check engine light when a problem is found; alerting the driver to issues that affect emissions, fuel economy, drivability and cost of ownership. CarMD's database stems from the cars themselves and the professionals who service them. Each CarMD® Vehicle Health Index™ draws from this database and CarMD's network of Automotive Service Excellence (ASE)-certified technicians who have validated related failures and fixes. As a result, CarMD is able to provide unbiased data on repair costs and trends in Index form. This 2018 Index statistically analyzes more than 7.1 million failures and recommended repairs for vehicles in the U.S., over the past year.



CarMD also offers a free service called CarMD® Garage to see if your vehicle has any maintenance due, technical service bulletins or upcoming check engine light problems. Available online at: www.carmd.com/garage

Summary of Findings

In 2017, U.S. vehicle owners saw a 10 percent decrease in the cost to repair check engine issues comprised of a 13 percent decrease in labor and an 8 percent drop in average parts costs.

Car repair costs were also down across all four U.S. regions. The oxygen sensor remained the no. 1 most common check engine light culprit, followed by no. 2 ignition coil and spark plugs, no. 3 catalytic converter, no. 4 loose, damaged or missing gas cap and no. 5 EVAP purge control valve.

CarMD looked at the type of repairs needed on NEW, 10- and 20-year old vehicles.

It is not surprising to find that the most common cause for the check engine light on a brand new model year 2017 was a loose or missing gas cap (\$26 on average to replace), while a 2007 vehicle most frequently needs new ignition coils and spark plugs, a repair that cost \$368 on average.

The most expensive repair seen in 2017 by CarMD's network was "replace engine," costing \$7,050.

However, drivers should not panic when their car's check engine light comes on. Some of the least expensive repairs included "replace gas cap," and "replace A/C Compressor Clutch Relay" – which typically cost under \$40.

Dropping in repair frequency this year were

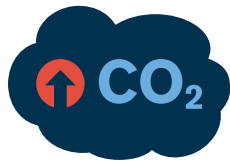
"replace catalytic converter" and "replace thermostat" while "replace ignition coil(s) and spark plug(s)," "replace EVAP purge control valve" and "replace EVAP purge solenoid" continue to rise in frequency. New to the list of 10 most common repairs in 2017 was "replace fuel injectors." Overall, this data indicates that drivers are taking better care of their vehicles, likely paying attention to recommended maintenance and heeding early warning signs before they snowball into more expensive repairs.

Check Engine Light Insight

AT A GLANCE



Ignored Check Engine Light



Increased CO2 and Gas Consumption



Added Problems/Cost Down the Road

The **check engine light** is designed to come on when a vehicle's computer sees a problem that affects emissions or drivetrain issues. It can be caused by something simple like a loose gas cap or severe such as engine failure. If ignored, it will hurt the environment, the car's fuel economy and lead to more problems down the road.

Don't panic when the check engine light comes on, but get it diagnosed as soon as possible. Be aware that a blinking or flashing check engine light can indicate a more serious problem such as an engine misfire that needs immediate attention from roadside assistance.

Get Diagnosed

Diagnostic trouble codes (DTCs) are **5-digit alphanumeric codes** that identify the vehicle's trouble area and can help identify why the check engine light came on.

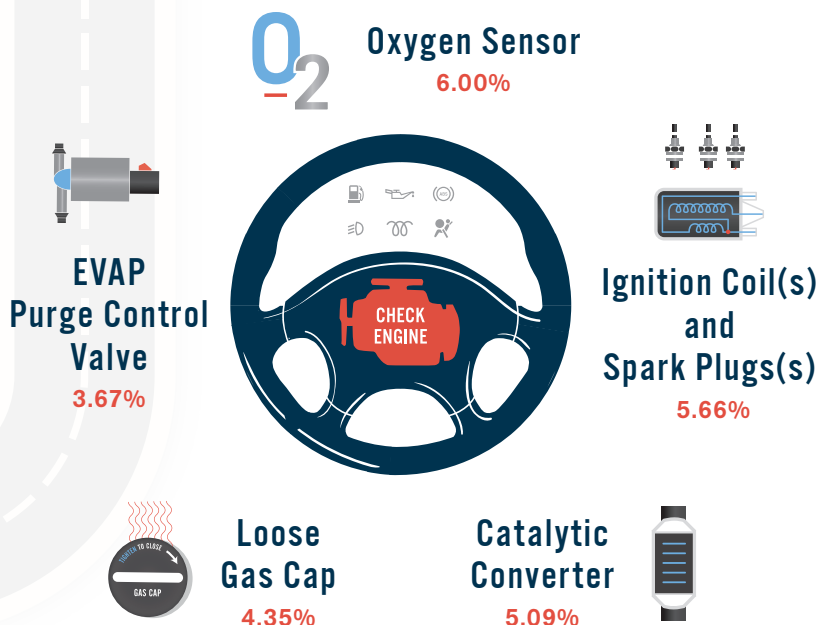


The first character is a letter that defines the main system where the problem occurred. The second character is a number that identifies the type of code. The third IDs the affected system, and the fourth and fifth characters define the section of the system that's malfunctioning.

The most common DTC in 2017 was **P0420**, which indicates Catalyst B1 Deterioration that often signifies a faulty oxygen sensor or catalytic converter.

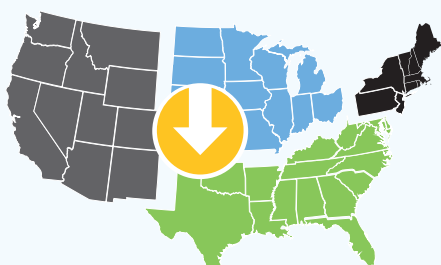
5 Most Common Check Engine Repairs

Percentage of Repairs in 2017



THE GOOD NEWS!

U.S. car repair costs were **down 10%** year-over-year from 2016 to 2017 for cars needing check engine parts and labor. The average cost - \$357



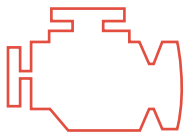
DECREASE IN TOTAL AVERAGE REPAIR COSTS (PARTS AND LABOR)

\$358.05	\$361.11	\$357.71	\$362.17
WEST REGION	MIDWEST REGION	SOUTH REGION	NORTHEAST REGION










For more information about check engine light health, visit www.carmd.com

Source: 2018 CarMD® Vehicle Health Index™; based on 7,167,314 check engine light issues reported to CarMD in calendar year 2017 on 1996-2017 model year vehicles in the U.S.



10 Most Common Check Engine Repairs in the U.S. Calendar Year 2017

RANK	VEHICLE REPAIR	TOTAL AVERAGE REPAIR COST (Parts & Labor)	% 2017 REPAIRS	CHANGE IN RANK SINCE 2016
No.1	Replace Oxygen Sensor(s) (O2S)	\$238.29	5.90%	No Change
No.2	Replace Ignition Coil(s) and Spark Plug(s)	\$367.56	5.66%	3 – 
No.3	Replace Catalytic Converter(s) with new OE Catalytic Converter(s)	\$1,271.01	5.09%	2 – 
No.4	Inspect for Loose Fuel Cap and Tighten or Replace as Necessary	\$26.00	4.35%	No Change
No.5	Replace Evaporative Emissions (EVAP) Purge Control Valve	\$146.65	3.67%	8 – 
No.6	Replace Mass Air Flow (MAF) Sensor	\$340.87	3.63%	5 – 
No.7	Replace Ignition Coil(s)	\$217.69	3.54%	6 – 
No.8	Replace Evaporative Emissions (EVAP) Purge Solenoid	\$151.33	2.92%	10 – 
No.9	Replace Fuel Injector(s)	\$447.03	2.69%	New to Top 10
No.10	Replace Thermostat	\$225.40	2.53%	9 – 

(10 most common vehicle repairs are based on 7,167,314 repairs recommended in calendar year 2017 on 1996-2017 model year vehicles. This data applies to > 85% of cars, light trucks, minivans, SUVs and hybrids on the road in the U.S. – foreign and domestic. Source: CarMD.com Corp.)

Most Common Repairs Calendar Year 2017

1

The most common car repair (5.9%) in 2017 was “replace oxygen sensor.” Important to a car’s engine performance and to the environment, the O2 sensor measures the amount of unburned oxygen in the exhaust and tells a car’s computer when there is either too much, or not enough fuel as compared with oxygen for ideal operation. O2 sensors fail prematurely due to a variety of causes, including lack of maintenance like neglecting oil changes or engine contamination from internal coolant leaks. A faulty O2 sensor costs about \$240 to fix but can lead to as much as a 40% reduction in gas mileage if ignored. Many drivers ignore the O2 sensor because their car often seems like it’s driving just fine, but in reality it’s reducing your fuel economy and slowly doing more damage to your car.

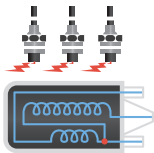
- The average cost to replace an O2 sensor in 2017 was \$238.



2

“Replace ignition coil and spark plugs” was the second most common repair, accounting for 5.66% of recommended repairs in 2017 and moving up from the third most common repair the previous year. This is an example of how ignoring a smaller problem like a spark plug can snowball into the need for more than one repair. Spark plugs and ignition coils work together to help the engine start, and keep running. Faulty spark plugs can trigger ignition coil failure, which is why they are often replaced simultaneously. High underhood temperatures and age can also cause them to fail.

- The cost to replace ignition coil(s) and spark plug(s) in 2017 was \$367.



3

The third most common repair, “replace catalytic converter(s),” accounted for 5.09% of repairs in 2017, dropping from the second most common repair and 6.75% of repairs in 2016. In most cases, a catalytic converter won’t fail unless a related root cause – such as a faulty spark plug – is ignored for too long.

- The average cost to replace a catalytic converter in 2017 was \$1,271.



4

“Tighten or replace fuel cap” was the fourth most common repair. It accounted for 4.35% of repairs in 2017. Missing or damaged gas caps can cost time and money, triggering the check engine light and a repair shop visit. If left unchecked, a gas cap problem can cause reduced fuel economy and harm the environment.

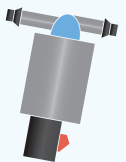
- The average cost to replace a loose gas cap is \$26, and most can be purchased at the local auto parts store or from an online retailer.



5

The fifth most common check engine-related repair was “replace evaporative emissions (EVAP) purge control valve, which was no. 8 last year, no. 9 the previous year and no. 14 in 2014. This valve is part of the car’s EVAP system, which prevents fuel tank vapors from escaping into the atmosphere. When the engine is warmed up, its computer gradually opens the purge valve to allow fuel vapor to be moved from the charcoal canister to be burned in the engine. If the purge flow is less or more than is expected, the car’s computer turns on the “check engine” light. When purge valves get stuck they often need to be replaced, which is a fairly simple fix.

- The average cost to replace an EVAP purge control valve is \$146.

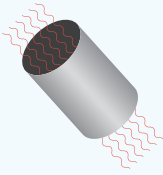


Most Common Repairs Calendar Year 2017

6

“Replace Mass Airflow Sensor” is the sixth most common repair (3.63%). The MAF is responsible for metering the air coming into a car's engine and determining how much fuel to inject into the engine. When malfunctioning, it can lower fuel economy by 10% to 25%.

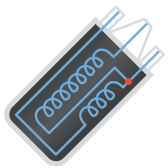
- It costs on average \$340 on average to repair, but is vital to saving dollars at the pump.



7

The no. 7 most common repair (3.54%) in 2017 was “replace ignition coil(s). Ignition coils help the engine start and keep running. They take the battery's 12-volt current and step it up to ignite the spark plugs. Your car may have only one ignition coil, or as many as it has cylinders. Several conditions can contribute to its failure, including faulty spark plugs, high underhood temperatures and age. A driver should pay attention to possible symptoms surrounding engine coil failure as it will soon affect other vehicle systems, such as the costly catalytic converter, and can leave them stranded by the roadside.

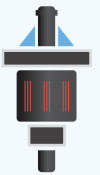
- The cost to replace ignition coil(s) in 2017 was \$218.



8

The eighth most frequent check engine repair (2.92%) in 2017 was “replace evaporative emissions (EVAP) purge solenoid.” It helps control how much fuel vapor escapes into the atmosphere from your car. The purge solenoid is controlled by the engine control module or powertrain control module. It operates on a duty cycle and could be left partially open.

- The average cost to replace an EVAP purge solenoid, including parts and labor, in 2017 was \$151.



9

The no. 9 most frequent repair in 2017 (2.69%) was “replace fuel injector(s), which is new to CarMD's list of 10 most common check engine repairs. Fuel injectors help make sure the car's fuel comes out as a fine mist so it can mix with the air passing through into the cylinder. Some vehicles have more than one fuel injector, which is called multi-point fuel injection. A failing fuel injector can cause engine performance issues, poor idling, engine misfires and reduced fuel economy. According to CarMD technicians, the rise in fuel injector failure is due in part to more vehicle manufacturers having switched to direct injection (DI) fuel systems. DI fuel systems use a high pressure injector that's placed directly into the combustion chamber. It is more efficient resulting in better fuel economy, increased power and lower emissions but it is more susceptible to fail due to carbon buildup in the combustion chamber. As a result, some manufacturers recommend that DI system owners only use top-tier fuels to prevent injector issues.

- The average cost to replace fuel injector(s) on a vehicle in 2017 was \$447.



10

The tenth most common repair was “replace thermostat” (2.91%) moving down from no. 5 in the previous CarMD Index. The car's thermostat regulates the engine coolant temperature to warm and cool to ideal “operating temperature.” It opens and closes as needed to regulate temperature. When a thermostat fails, it often gets stuck open. If the vehicle's computer doesn't see the engine coolant temperature rise to “operating temperature” within a fixed amount of time, it will set the check engine light. A vehicle's thermostat can rust and fail if the coolant is not changed at recommended mileage intervals, or the vehicle is subjected to extreme temperatures.

- The average cost to replace a thermostat was \$225 in 2017.



Most Common Check Engine Light Repair by Model Year 1997, 2007, 2017

Many factors contribute to the type and cost of repairs a vehicle needs, including driving conditions, owner upkeep, type of vehicle and age.

- For instance, the most common reason the check engine light illuminates on a brand new 2017 model year vehicle is a loose or missing gas cap. New owner error is often the cause and the cost to repair is typically around \$25 if you have to replace it. The fix is usually just filling up the gas tank and tightening the gas cap.
- For a 10-year-old model year 2007 vehicle, the most common check engine light repair is to replace the ignition coils and/or spark plugs, which can fail due to age, or build up from dust, dirt and wear and tear. The cost for this repair average \$368, including parts and professional labor.
- The most common repair on a 20-year old 1997 model year vehicle is “replace oxygen sensor,” which costs on average \$228.

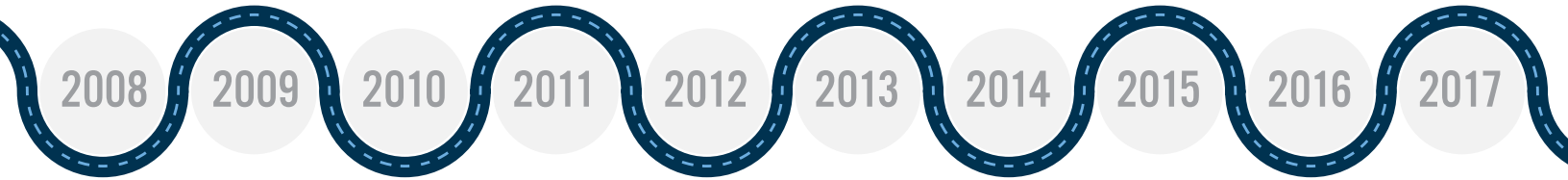
MODEL YEAR	MOST COMMON CHECK ENGINE LIGHT PROBLEM/REPAIR	AVERAGE COST (PARTS & LABOR) FOR MOST COMMON CEL REPAIR
1997	Replace Oxygen Sensor	\$228
2007	Replace Ignition Coil(s) and Spark Plug(s)	\$368
2017	Replace Loose or Missing Gas Cap	Around \$25





National Repair Cost Trends

In 2017, we saw national labor, parts and total check engine light repair costs trend down after 2016 hit a 10-year high in each category. Labor costs were down 13 percent year-over-year from 2016 to 2017. **Parts costs were down 8 percent,** and **total average repair cost was down 10 percent** from \$397.87 in 2016 to \$357.45 in 2017; this is still 7 percent above the low of \$333.93 in 2011.

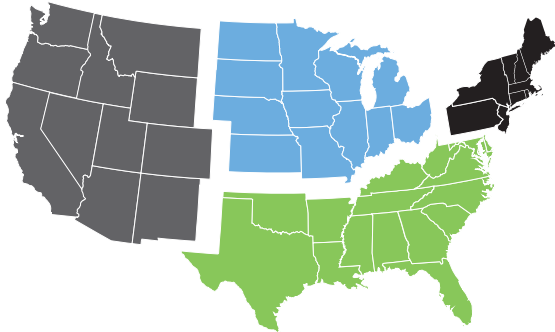


U.S. Average Car Repair Cost Trends 2008-2017 (10-Year History)

YEAR	LABOR	PARTS	TOTAL AVERAGE REPAIR COST
2017	\$141.16	\$216.29	\$357.45
2016	\$162.46	\$235.41	\$397.87
2015	\$155.15	\$232.16	\$387.31
2014	\$161.61	\$228.77	\$390.38
2013	\$157.23	\$235.26	\$392.49
2012	\$138.96	\$228.88	\$367.84
2011	\$118.61	\$215.32	\$333.93
2010	\$143.61	\$212.44	\$356.05
2009	\$138.37	\$221.13	\$359.50
2008	\$135.21	\$220.98	\$356.19

Source: CarMD.com Corp.

Repair Costs & Regional Data



In 2017, the national average for automotive repair labor costs decreased 13% to \$141.16 from \$162.46 the previous year. Parts costs were down 8% from \$235.61 in 2016 to \$216.29.

- Repair costs were down across all regions of the U.S., with the south seeing the largest drop at 10.5 percent and vehicle owners in the Midwest enjoying only a 6.3 percent decrease.
- Vehicle owners in the Northeast paid the most for check engine-related car repairs (\$362.17) – just 1.3 percent or \$4.46 more on average than drivers in the South, who paid the least (\$357.71).






U.S. National & Regional Average Check Engine-Related Repair Costs 2017 vs. Previous Year

REGION	TOTAL AVERAGE REPAIR COSTS (2016)	TOTAL AVERAGE REPAIR COSTS (2017)	% INCREASE / DECREASE FROM 2016 TO 2017
U.S.	\$397.87	\$357.45	↓ Down 10.1%
South	\$399.95	\$357.71	↓ Down 10.5%
West	\$398.95	\$358.05	↓ Down 10.2%
Midwest	\$385.40	\$361.11	↓ Down 6.3%
Northeast	\$401.22	\$362.17	↓ Down 9.7%

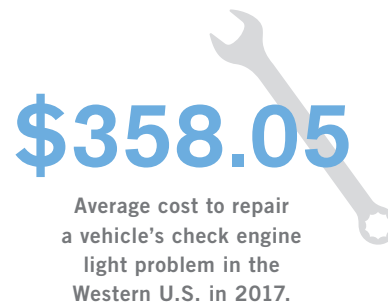
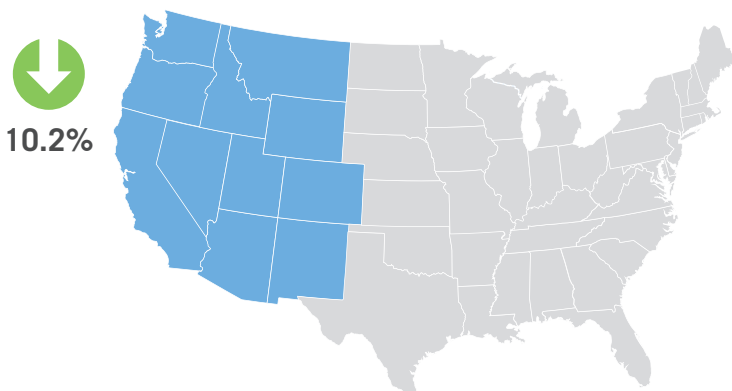
Source: CarMD.com Corp.

Western Repair Costs & Data

The 10 Most Common Check Engine Vehicle Repairs in the Western U.S. – 2017







RANK	VEHICLE REPAIR	TOTAL AVERAGE REPAIR COST (Parts & Labor)	% 2017 Western U.S. Repairs	Change In Western Rank Since 2016
No.1	Replace Oxygen Sensor(s) (O2S)	\$240.88	5.90%	No Change
No.2	Replace Ignition Coil(s) and Spark Plug(s)	\$367.65	5.33%	3 – 
No.3	Replace Catalytic Converter(s) with new OE Catalytic Converter(s)	\$1,256.92	5.25%	2 – 
No.4	Inspect for Loose Fuel Cap and Tighten or Replace as Necessary	\$25.57	4.57%	No Change
No.5	Replace Mass Air Flow (MAF) Sensor	\$341.16	3.83%	No Change
No.6	Replace Ignition Coil(s)	\$217.96	3.63%	No Change
No.7	Replace Evaporative Emissions (EVAP) Purge Control Valve	\$146.62	3.59%	8 – 
No.8	Replace Evaporative Emissions (EVAP) Purge Solenoid	\$150.71	2.89%	10 – 
No.9	Replace Fuel Injector(s)	\$468.86	2.72%	New to List
No.10	Replace Thermostat	\$225.83	2.56%	9 – 

(Top 10 most common vehicle repairs in the Western U.S. are based on 2,541,701 repairs in 2017 in AK, AZ, CA, CO, HI, ID, MT, NM, NV, OR, UT, WA and WY. This data applies to roughly 85% of cars, light trucks, minivans and SUVs on the road in the U.S. – foreign and domestic. Source: CarMD.com Corp.)

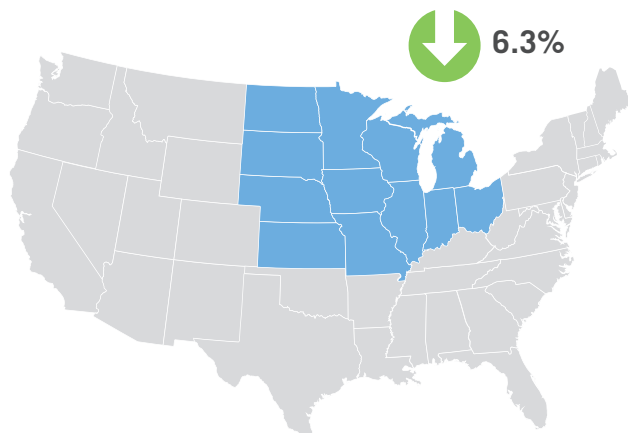


Midwestern Repair Costs & Data

The 10 Most Common Check Engine Vehicle Repairs in the Midwestern U.S. – 2017


RANK	VEHICLE REPAIR	TOTAL AVERAGE REPAIR COST (Parts & Labor)	% 2017 MIDWESTERN U.S. REPAIRS	CHANGE IN MID-WEST RANK SINCE 2016
No.1	Replace Oxygen Sensor(s) (O2S)	\$243.97	5.88%	No Change
No.2	Replace Ignition Coil(s) and Spark Plug(s)	\$368.92	5.36%	3 – 
No.3	Replace Catalytic Converter(s) with new OE Catalytic Converter(s)	\$1,259.81	5.30%	2 – 
No.4	Inspect for Loose Fuel Cap and Tighten or Replace as Necessary	\$25.40	4.57%	No Change
No.5	Replace Mass Air Flow (MAF) Sensor	\$341.81	3.97%	6 – 
No.6	Replace Ignition Coil(s)	\$218.66	3.71%	9 – 
No.7	Replace Evaporative Emissions (EVAP) Purge Control Valve	\$146.70	3.47%	No Change
No.8	Replace Evaporative Emissions (EVAP) Purge Solenoid	\$150.88	2.79%	10 – 
No.9	Replace Fuel Injector(s)	\$475.46	2.72%	New to List
No.10	Replace Thermostat	\$225.33	2.56%	8 – 

(Top 10 most common vehicle repairs in the Midwestern U.S. are based on 1,691,401 repairs in 2017 in IA, IL, IN, KS, MI, MN, MO, ND, NE, OH, SD and WI. This data applies to roughly 85% of cars, light trucks, minivans and SUVs on the road in the U.S. – foreign and domestic. Source: CarMD.com Corp.)






\$361.11

Average cost to repair a vehicle's check engine light problem in the Midwestern U.S. in 2017.

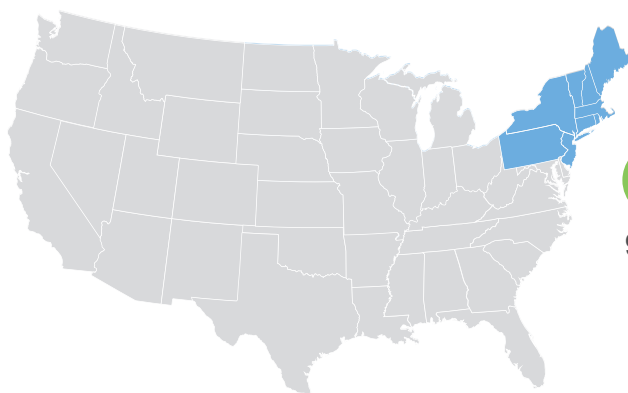


Northeastern Repair Costs & Data

The 10 Most Common Check Engine Vehicle Repairs in the Northeastern U.S. – 2017

RANK	VEHICLE REPAIR	TOTAL AVERAGE REPAIR COST (Parts & Labor)	% 2017 NORTHEASTERN U.S. REPAIRS	CHANGE IN RANK SINCE 2016
No.1	Replace Oxygen Sensor(s) (O2S)	\$241.02	5.96%	No Change
No.2	Replace Catalytic Converter(s) with new OE Catalytic Converter(s)	\$1,259.34	5.41%	No Change
No.3	Replace Ignition Coil(s) and Spark Plug(s)	\$369.32	5.16%	No Change
No.4	Inspect for Loose Fuel Cap and Tighten or Replace as Necessary	\$25.27	4.49%	No Change
No.5	Replace Mass Air Flow (MAF) Sensor	\$340.97	4.00%	No Change
No.6	Replace Ignition Coil(s)	\$217.69	3.69%	No Change
No.7	Replace Evaporative Emissions (EVAP) Purge Control Valve	\$146.80	3.41%	8 – 
No.8	Replace Evaporative Emissions (EVAP) Purge Solenoid	\$151.40	2.83%	10 – 
No.9	Replace Fuel Injector(s)	\$488.13	2.79%	New to List
No.10	Replace Spark Plug Wires and Spark Plugs	\$332.09	2.53%	7 – 

(Top 10 most common vehicle repairs in the Northeastern U.S. are based on 1,006,396 repairs in 2017 in CT, MA, ME, NH, NJ, NY, PA, RI and VT. This data applies to roughly 85% of cars, light trucks, minivans and SUVs on the road in the U.S. – foreign and domestic. Source: CarMD.com Corp.)




9.7%






\$362.17

Average cost to repair a vehicle's check engine light problem in the Northeastern U.S. in 2017.

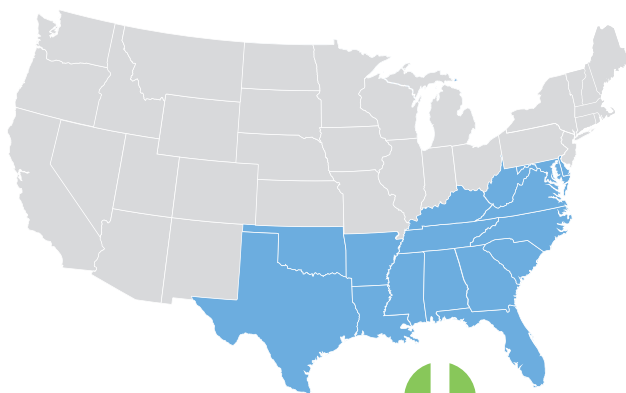


Southern Repair Costs & Data

The 10 Most Common Check Engine Vehicle Repairs in the Southern U.S. – 2017

RANK	VEHICLE REPAIR	TOTAL AVERAGE REPAIR COST (Parts & Labor)	% 2017 SOUTHERN U.S. REPAIRS	CHANGE IN SOUTHERN RANK SINCE 2016
No.1	Replace Oxygen Sensor(s) (O2S)	\$239.36	5.84%	No Change
No.2	Replace Ignition Coil(s) and Spark Plug(s)	\$367.86	5.45%	3 – 
No.3	Replace Catalytic Converter(s) with new OE Catalytic Converter(s)	\$1,265.52	5.14%	2 – 
No.4	Inspect for Loose Fuel Cap and Tighten or Replace as Necessary	\$25.63	4.47%	No Change
No.5	Replace Mass Air Flow (MAF) Sensor	\$340.92	3.85%	No Change
No.6	Replace Ignition Coil(s)	\$217.78	3.65%	No Change
No.7	Replace Evaporative Emissions (EVAP) Purge Control Valve	\$146.09	3.58%	9 – 
No.8	Replace Evaporative Emissions (EVAP) Purge Solenoid	\$150.91	2.86%	10 – 
No.9	Replace Fuel Injector(s)	\$466.13	2.74%	New to List
No.10	Replace Thermostat	\$224.83	2.55%	8 – 

(Top 10 most common vehicle repairs in the Southern U.S. are based on 2,952,616 repairs in 2017 in AL, AR, DC, DE, FL, GA, KY, LA, MD, MS, NC, OK, TN, VA, SC, TX and WV. This data applies to roughly 85% of cars, light trucks, minivans and SUVs on the road in the U.S. – foreign and domestic. Source: CarMD.com Corp.)



10.5%

\$357.71

Average cost to repair a vehicle's check engine light problem in the Southern U.S. in 2017.





\$ Most Expensive Car Repairs

The **most expensive repair** in the CarMD database in 2017 was “replace engine” (\$7,050). This repair is indicative of the fact that cars are being made to outlast parts such as their engine. The good news is that most expensive repairs remain extremely rare in terms of percentage of occurrence. The five **most expensive repairs** combined only **account for less than one half of one percent (0.36%) of all repairs** seen by CarMD’s network of thousands of certified technicians last year. The ten least expensive repairs account for more than 5 percent of all needed repairs.



The 10 Most Expensive Check Engine-Related Vehicle Repairs in the U.S. – 2017

RANK	VEHICLE REPAIR	MOST EXPENSIVE REPAIR COST (Parts & Labor)
No.1	Replace Engine	\$7,050
No.2	Replace Electronic Power Steering (EPS) Control Unit	\$5,201
No.3	Replace Transmission Assembly and Reprogram Electronic Control Module (ECM)	\$5,130
No.4	Replace Transmission and Torque Converter	\$5,051
No.5	Replace Audio and Visual (AV) Control Unit	\$4,293
No.6	Replace Transmission Case and Torque Converter	\$4,245
No.7	 Replace Hybrid Battery and Reprogram Engine Control Module (ECM)	\$4,149
No.8	Replace Compuvalve Module	\$4,105
No.9	Replace Transmission Assembly	\$3,905
No.10	 Replace Hybrid Battery	\$3,798

(Ten most/least expensive repairs are based on 7,167,314 repairs recommended and input into the CarMD database by the company’s team of factory trained repair professionals in 2017. This data is for model year 1997 to 2017 OBD2 cars, light trucks, minivans and SUVs in the U.S. – foreign and domestic. Source: CarMD.com Corp.)

\$ Least Expensive Car Repairs

The **least expensive repair** is “Inspect for loose fuel cap and tighten or replace as necessary” at an average cost of \$26 to replace/purchase a new one.



The 10 Least Expensive Check Engine-Related Vehicle Repairs under \$60 In the U.S. – 2017

RANK	VEHICLE REPAIR	MOST EXPENSIVE REPAIR COST (Parts & Labor)
No.1	Inspect for Loose Fuel Cap and Tighten or Replace as Necessary	\$26
No.2	Replace Air Conditioning (A/C) Compressor Clutch Relay	\$38
No.3	Replace Electronic Engine Control (EEC) Fuse	\$46
No.4	Perform DTC Confirmation Procedure	\$47
No.5	Repair Ground Wire From The Front of The Engine To The Body	\$48
No.6	Clean Ground Wire	\$49
No.7	Replace Exhaust Gas Recirculation (EGR) Boost Sensor Vacuum Hose	\$52
No.8	Inspect for correct air filter and air box is securely latch properly	\$53
No.9	Replace Electronic Throttle Control System (ETCS) Fuse	\$53
No.10	Replace Secondary Air Injection Control Solenoid Valve Vacuum Hose	\$55

(Ten most/least expensive repairs are based on 7,167,314 repairs recommended and input into the CarMD database by the company's team of factory trained repair professionals in 2017. This data is for model year 1997 to 2017 OBD2 cars, light trucks, minivans and SUVs in the U.S. – foreign and domestic. Source: CarMD.com Corp.)

Index Methodology

CarMD has compiled the industry's most comprehensive database of OBD2-related problems and associated fixes uploaded by automotive technicians and vehicle owners since 1996.

The data for the 2018 CarMD® Vehicle Health Index™ was procured from repairs uploaded to the CarMD diagnostic database from Jan. 1, 2017 to Dec. 31, 2017. The entire vehicle problems uploaded is from the vehicle ECO to the CarMD database directly without any human interface. This database is also used to support the fleet, consumer automotive tools, Software as a Service (SaaS) and CarMD Garage products offered by CarMD.

The data was collected and analyzed was from between March 13, 2018 and Apr. 3, 2018.

Virtually all makes and models of cars, light trucks, minivans, SUVs and hybrids made since 1996 – foreign and domestic – with on board diagnostic second generation (OBD2) technology are included in the Index. Those makes and models with more registered vehicles on the road may have a larger statistical weighting in the Index findings, as will vehicles that experience more failures or whose owners seek guidance from sources that report to the CarMD database.

The 2017 Index statistically analyzes 7,167,314 repairs. Each recommended repair has also been reviewed and validated by CarMD's team of ASE-certified Master Technicians and then output based on a probability algorithm that takes into account the vehicle's year, make, model, mileage, postal code, DTCs and similar vehicle problems to produce a most likely repair. Because the data stems from those U.S. vehicle owners and

automotive technicians who elected to use the diagnostic devices and/or upload data into the CarMD database; no estimates of theoretical sampling error can be calculated.

All 50 U.S. states, plus the District of Columbia, are represented in this Index. The states with larger registered vehicle populations and participating ASE-certified technicians may have a larger quantity of logged repairs; however, all have been averaged into the overall Index findings. For regional data, CarMD used the U.S. Census Bureau Regions and Division Map to define regions.

Repair costs are based on parts and dealer list plus 10% markup. Labor rates are procured from several sources, including the *Undercar Digest* National and Regional Hourly Shop Labor Rate reports, as well as the average amount of time required for each repair. Both are updated annually.

CarMD has contracted with an independent consulting company to create and maintain the database for compiling and generating this Index.

On a daily basis, CarMD's nationwide network of thousands of automotive service excellence (ASE)-certified technicians recommend, confirm and upload repairs and costs by region to the CarMD database. As a result, subsequent CarMD Vehicle Health Index reports will draw from an updated sampling of diagnostic trouble codes, expert fixes and repair costs.



Additional, customized reports are available upon request.

Please visit www.carmd.com/wp/vehicle-data-services for more information.

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