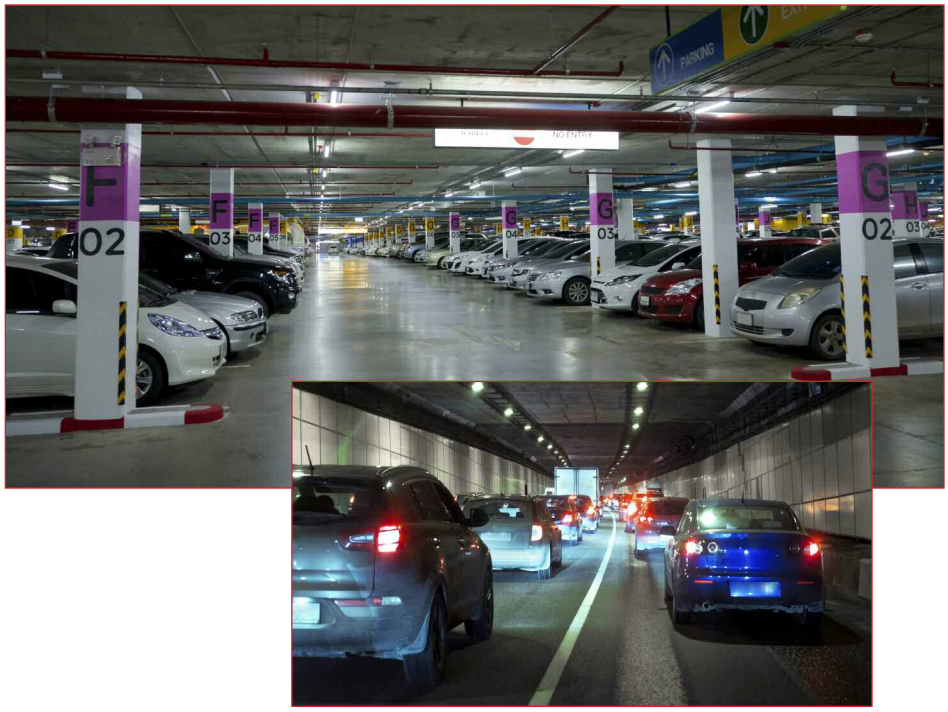
Carbon Dioxide in Garages & Tunnels

Garages & Tunnels in general

Modern vehicle engines emit many harmful substances including carbon monoxide (CO), carbon dioxide (CO_2), nitrogen oxides (NOx), hydrocarbons and some 20 other gases. Internal combustion engines produce CO during a cold start. To protect people from this toxic gas, a catalytic converter is usually installed as part oft he exhaust system. A warm running modern engine with a catalytic converter installed generates 140 times more CO_2 than CO.



Facts & Figures

The longest transportation tunnels in the world:

1. Guangzhou Metro Line, Guangzhou, China – 37.5 miles
2. Beijing Subway, Beijing, China – 35.5 miles
3. Gotthard Base Tunnel, Lepontine Alps, Switzerland – 35.4 miles
4. Seiken Tunnel, Tsugaru Strait, Japan – 33.5 miles
5. Channel Tunnel, English Channel, UK – France – 31.3 miles

The longest water supply tunnels in the world:

1. Delaware Aqueduct, New York, NY USA – 85.1 miles
2. Paijanne Water Tunnel, Finland – 74.6 miles
3. Dahuofang Water Tunnel, Liaoning Province, China – 53.0 miles
4. Orange-Fish River Tunnel, South Africa – 51.4 miles
5. Bolmen Water Tunnel, Kronoberg, Sweden – 51.0 miles

Why the need to measure CO_2?

Older vehicles (pre-catalytic converter) generate most of the carbon monoxide pollution. To reduce CO emissions, catalytic converters were introduced in 1975. Catalytic converters are not very efficient during cold start up but once warm they convert CO to CO_2 very effectively. This means modern engines emit much higher quantities of CO_2 than CO. It is well-known that CO is extremely toxic but CO_2 in high levels is also hazardous to health. To ensure healthy air quality in closed spaces where there are many vehicles such as garages and tunnels, it is important to provide adequate ventilation. However, running a ventilation system constantly is inefficient especially when only a few cars are running at any given time.

In garages and tunnels, vehicles are operating in both warm and cold conditions. Therefore, it is important to measure both gases to ensure a safe breathing environment. There are laws in most countries governing the level of CO. The maximum allowed value is 35 ppm. There are currently no rules or regulations on measuring CO_2 but it is equally important.

continued

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Measurement and Control

Measurement instruments usually allow for control and alarm as part of a larger air management system. This application operates on the same principal as used in a school classroom where fresh air is brought in based on the measurement of carbon dioxide.

The required level of air ventilation depends on the number of cars running in a garage or tunnel in the same way classroom ventilation depends on the number of students in a classroom. The instruments and sensors typically used to measure CO_2 and CO in public garages and tunnels are capable of covering an area of around 2700 square feet.

Reduced cost of ventilation

A case study, based on a garage containing 77 parking places and covering an area of 15,550 square feet, was conducted to determine how much more efficient the ventilation system could become when the ventilation was controlled by gas measurement instead of running constantly. The study showed that using sensors to control the ventilation reduced the fan operating time by 90%. The demand-control solution produced an energy savings of 970 kW/h per month. If all residential garages were equipped with a demand control solution, the sum of energy saved would make for a considerable benefit to society and the environment. A larger garage would have saved even more money thanks to the controlled ventilation system.

Another benefit of a demand control solution is that fewer people will suffer from CO or CO_2 poisoning.

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