

WHAT GOES AROUND...

HOW BRAZIL HAS REDISCOVERED THE MERITS OF THE ROUNDABOUT

Roundabouts have proved to be a highly cost-effective presence on the roads of Brazil. Inexpensive to construct, their benefits in the reduction of road deaths and vehicle collisions are incalculable, as traffic consultant Philip Gold explains



After a hiatus of several years, Brazil came to a fresh understanding regarding the many virtues of the classic roundabout. They were previously unpopular in the South American country due to the way they were initially implemented in North America, where they were often constructed as large circles, which led to a shift in priority (from vehicles on the roundabout, to those entering), and a consequent loss of the advantages normally associated with their application.

Midi-roundabouts however, were introduced to the roads of São Paulo in 1979 with considerable success – approximately three fewer fatalities a year per midi-roundabout. “These roundabouts cost just US\$2,500-5,000 each,” explains Philip Gold, CEO of Gold Projects, “and pay for themselves through damage reduction with the first crash they prevent from occurring.”

Examples of the full-sized variety have been spreading throughout the country and have led to a measurable drop in serious traffic accidents at intersections, and a corresponding reduction in associated costs.

MIDI-ROUNDABOUT, MAXI RESULT

“Several Brazilian cities have been installing midi-roundabouts, notably the capital Brasilia, but none as much as in São Paulo,” says Gold. When midi-roundabouts first began to be introduced in São Paulo, the British TRL mini-roundabout design was adapted for Brazilian use.



The busy metropolis of São Paulo has adopted a widespread use of midi-roundabouts

Gold reveals that the aim of the bespoke São Paulo midi-roundabout was to improve the control of street intersections with similar low-to-medium traffic flows. It was not originally designed to reduce death and injury, but to reduce the noise made by vehicles suddenly braking to avoid crashes, especially during the night. This drop in noise levels was an instant success among residents living around the intersections.

Soon the additional benefit of reduced accident statistics became clear. "A study of 88 of the midi-roundabouts installed in São Paulo in 1997 showed that average annual accident frequency per intersection was reduced by 78%, from around four or five to one or two. Personal injury accidents not involving pedestrians were reduced by 80%, and pedestrian accidents were eliminated," declares the British ex-pat, who has observed these developments over the 30 years that he has been based in Brazil.

"The basic idea," he explains, "is a circle of about 8m diameter, which is big enough to oblige drivers to reduce their speed, if they do not just drive over it. (The circle is composed simply of paint and studs, so large vehicles can drive over it if necessary, as the studs produce little discomfort.)"

Few people expected this to work with such success, least of all the traffic engineers. São Paulo's drivers were thought to be so undisciplined that they would just drive over the circle, but this was not the case. Even without the midi-roundabout being explained to the public, correct use was almost universal from the start. There are now some streets that have midi-roundabouts in two and even three successive intersections with no complaints from drivers, as the benefits are obvious."



Paint and studs define the midi-roundabout

Not only did the new roundabouts prove to have distinct advantages over other forms of intersection control in terms of accident and noise reduction, they were also shown to be a very cost-effective solution. When the newer designs were first implemented, in 1979, the midi-roundabouts cost approximately US\$5,000 per intersection, including paint, studs and signs.

However, after they became generally accepted, a cheaper version was tested that was half the price. "As the effects were identical," says Gold, "this cheaper version was adopted as the standard design." As they were typically installed in intersections with several accidents per year, the cost was recuperated within a few weeks. "These midi-roundabouts, of which there are now about 370 in São Paulo, were designed for intersections with traffic flows below the minimum necessary to require traffic lights.



Roundabouts help cut accidents at junctions

Before the installation of midi-roundabouts, most of the intersections were being controlled, not very successfully, by stop signs, but with little or no enforcement."

Although some of the intersections where midi-roundabouts are installed have now experienced an increase in traffic flow to well above the level that would have required traffic lights to be installed,

BACKGROUND STORY



Roundabouts are an essential solution for traffic managers across the world

Brazil has a dire road-safety record. Many of its (often unpaved) roads are in poor condition, heavily congested, and also badly maintained. They are very well used, probably because the country's rail network comprises just 29,295km of track, compared to the road network's almost two million kilometers of highway. Ground passenger transport is therefore almost exclusively by bus or taxi.



Furthermore, the vast majority of freight is carried across country by truck and driven by (often aggressive) drivers, who are not legally obliged to take rest breaks on long journeys.

About one-third of automobile drivers do not have

Although roundabouts make a positive difference to safety, far more needs to be done to reduce Brazil's number of KSIs

valid licenses, and many treat red lights and other stop signs as advisory rather than obligatory. Excessive speeding is often ignored by the authorities, and

most continue to work well with minimal congestion and very few accidents. This showcases exactly the inherent value of these midi-roundabouts: they are more effective than stop signs and their deployment can save agencies from having to buy and maintain traffic lights.

Despite their success, midi-roundabouts are not being used as much as they could be. Traffic planners in other parts of the country are resistant to them, possibly due to politicians' loss of confidence in the measure that they (wrongly) expected to eradicate accidents completely. Gold is puzzled by this reaction: "The São Paulo experience shows that it's a really fantastic, simple device, which can solve problems in lots of intersections, and can mean that you don't have to introduce traffic lights."

LARGE ROUNDABOUTS IN BRAZIL

A number of large roundabouts were installed in the south of Brazil at inter-urban intersections where flyovers or 'fly-unders' were needed, but insufficient funds were available to build them. "Most were circles, a few were ellipses," reveals the 60-year-old. "Diameters varied between 30m and 40m, with an average cost of US\$50,000 each."

The engineer behind the construction of these roundabouts was Avani Aguiar de Sá, who was responsible for a federal highway in the state of Rio Grande do Sul, which had 14 intersections along 100 miles of highway.

Gold says: "Aguiar de Sá felt there had been too many people killed or injured – totally avoidably, in his opinion – at these intersections. In 1996, out of desperation, he got the support of a few other believers and managed to get a very simple roundabout built."



Traffic levels are on the rise in São Paulo

The roundabout practically eliminated accidents, and the associated deaths and injuries. Then, over a period of three or four years, he extended this idea to the remaining 13 intersections. He slightly improved the design each time and therefore also improved the accident problem.

These roundabouts controlled the intersections for well over 10 years, before

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drink-driving remains a problem despite recent efforts to curb it. As a result, Brazilian roads are dangerous places, upon which more than 36,000 people die each year and approximately 350,000 are injured. This is more road casualties than in the USA (approximately 41,000 traffic fatalities), even though the USA has 10 times as many vehicles on its roads than Brazil.

However, the situation is improving. Among projects aimed at reducing casualties on Brazilian roads, the introduction of roundabouts has been seen to substantially increase road safety and demonstrably



alter accident statistics for the better. These improvements reflect similar cases in the USA, where the installation of new roundabout systems has been seen to dramatically reduce incidents involving vehicles and pedestrians, and has led to their extensive proliferation. This has been entirely due to their positive effect on accident statistics. The USA now has about 1,000 modern roundabouts and the boom in building them means that approximately 150-250 new ones are being added each year.

Cost is an important spur for this popularity. The Washington DOT points out that a two-lane roundabout costs an



estimated US\$330,000 to build, whereas a typical intersection with traffic signals and a U-turn costs roughly US\$450,000. Roundabouts have a service life of around 25 years, whereas signaling equipment has a lifetime of around 10 years. Other savings include an average US\$5,000 a year in electricity and

Midi-roundabouts are simple to deploy and can delay or even prevent the need to invest in more costly solutions

maintenance costs, and the obvious savings relating to the aftermath of traffic accidents.

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Philip Gold has worked in Brazil for 30 years

increasing congestion prompted the construction of fly-unders (currently being built), which cost 10 times as much – an average of US\$500,000 per intersection.

“Although Aguiar de Sá doesn’t have precise statistics, he knows that very many deaths and injuries were avoided because all of these 14 intersections previously had high death and injury accident rates,” continues Gold. “The first one had about 20 deaths per year. If they were eliminated when the roundabout was built 10 years ago, that’s 200 lives saved in just one intersection.”

Many politicians and city mayors saw the success of the project and demanded the same be implemented in other intersections in the state. “Neighboring states showed some resistance because many Brazilian engineers have a resistance to things unless they’ve actually seen them working for themselves, and there wasn’t much communication between engineers across the states,” observes Gold philosophically.

“But then, my efforts, principally working as a consultant for the inter-American development bank, which finances highway investment in Brazil, helped to get these roundabouts used in other states as well. I teach traffic engineers all over Brazil, and we have a lot of discussion about the subject. In the end, we are able to convince them that roundabouts are a good idea, so they’re being used much more on very large intersections and also very small ones, depending on traffic flow conditions.

“The roundabout can’t be a permanent substitute for the flyover – eventually you get traffic flows that a roundabout can’t cope with – but it can certainly postpone construction of a flyover until the money comes in. The only problem if you wait too long is that you get traffic congestion, but the accident problem is practically solved.”

Gold reflects that, in the past, traffic planners in the USA wrongly concluded that roundabouts didn’t work very well. Perhaps theirs did not, because of a flaw in their design: “They were giving preference

The benefits of midi-roundabouts in São Paulo 1996-1998:

Accident type	1996	1998	Change
Non-pedestrian personal injury	44	9	-35 (-80%)
Pedestrian injury	5	0	-5 (-100%)
Damage only	312	71	-241 (-77%)
TOTAL	361	80	-281 (-78%)

“Many Brazilian engineers have a resistance to things unless they’ve actually seen them working for themselves”

to people who were joining the roundabout, rather than people already on it, and they started making them bigger and bigger, trying to get more capacity out of them, and that just doesn’t work. Then a couple of decades ago, the US traffic authority recommended that they shouldn’t be used any more. Fairly recently, the USA woke up to the fact that it was one of the few countries not truly reaping the rewards of roundabouts and started to use them again.”

THE PRESENT AND FUTURE

“The main benefit of roundabouts compared with intersections controlled by signals,” observes the traffic consultant, “is that you don’t stop the traffic flow, and you have a much higher capacity. These larger roundabouts can deal with traffic flows that go right up to the point where you really need a flyover.” Gold also notes that in some locations in Brazil there have been muggings

and armed robberies of drivers stopped at red traffic lights: “It is much more difficult for this to happen at a roundabout.”

Gold is optimistic that roundabouts will be used increasingly in the future, because there are still places in Brazil that have yet to realize their benefits, or have only limited resources to invest in traffic engineering.

Other nations could also learn a great deal from this Brazilian story. Adopting a targeted, widespread deployment of roundabouts is a particularly effective strategy for use in developing countries: especially in areas not yet suffering from the horrific traffic congestion that plagues much of the developed world.

Even if roundabouts are eventually replaced by traffic lights or other more costly alternatives, they are an invaluable tool in any traffic manager’s armory.

The growing popularity of Intelligent Transportation Systems (ITS) and other high-tech approaches often overshadows those ideas perceived as less sophisticated, or old-fashioned. But there is much to be said for taking a ‘back-to-basics’ approach to traffic management.

Roundabouts may not be high-tech, but they are one of the most longstanding, proven and cost-effective solutions out there. Many decision-makers would do well to bear in mind their remarkable properties if they find themselves going round in circles attempting to solve a problem. ■



“Around a quarter of global road deaths occur at junctions – 10 million people killed or seriously injured annually. This tale about roundabouts in Brazil illustrates the opportunity and barriers to their widescale introduction.

In economic terms, roundabouts are surefire winners. Well-designed roundabouts in the right place cost a few thousand dollars. Once in place, they go on and on saving lives, with little maintenance. As in Brazil, there are sites where they totally eliminate carnage.

In most countries there are thousands of potential sites for roundabouts whether small, midi or large. But they must be modern, well-designed roundabouts. Even in advanced developed countries, many roundabouts are not well designed, nor do they work well at every site with every mix of road user. At heavy volumes, roundabouts may need to be signalized – and traffic demand may mean eventually split-level junctions are needed.

Local politicians, the public – and even many engineers – will judge what they think from local experience which may be limited. Introducing a roundabout program is often about more than design: it can require real communication skills.”

John Dawson, chairman, iRAP

