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### DAVE BROOKS



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Wednesday, November 26, 2003

## Three sides to city's manhole story

By **DAVID BROOKS**  
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**Staff photo by Don himsel**  
Manhole covers in Nashua are unique for their triangular shape. The shape never caught on in other cities. Most covers are circles, because they can't possibly fall through their own hole onto a worker.

Truth is a complicated thing, and never more so than when it involves a complex web of topics – such as manhole covers, constant-diameter polygons and the unique nature of New Hampshire's second-biggest city.

Nonetheless, let's grasp the nettle and seek the truth to a perennial brainteaser: Why are manhole covers round?

First of all, in Nashua they aren't.

Large portions of the street-level entrances to city sewers are, in fact, equilateral triangles. This, folks, is one of the things that makes Nashua stand out, because so far as I can tell, nowhere else in the world can say this.

"There was a suburb of Pittsburgh, and from things I have heard, they had triangular manholes at one point," said Peter Lyon, president of Nashua Foundries. "But that's all."

Nashua Foundries first made triangular manholes for the city in 1919.



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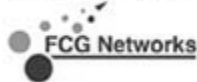
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They have one main advantages over circles, says Scott Pollock, deputy director of the city's Department of Public Works: "They don't rattle. You know how stable a tripod is; this is the same idea."

As an added bonus, the triangles point in the direction that the sewage or drainage should be flowing. If the flow is going the other way, it's a quick sign to workers that something is amiss.

Despite this, triangles never caught on outside Nashua.

Certainly, my Internet search couldn't find any others. From Tokyo to Paris to Buenos Aires, manhole covers are round. (There are, oddly, a scadillion collections of manhole-cover pictures on the Web, including the charmingly named "DrainSpotting.")

Now back to our question: Nashua excepted, why the circular bias?

Because a circular cover can't fall into the manhole, and any polygon could.

This is the answer expected on brainteasers, where the "Why are manholes round?" question is popular – and the answer expected by Shahzeb Syed, a geometry teacher at the south campus of Nashua High School, who likes to spring it on students.

"When I was working in (the computer) industry, I would usually ask this question of any person I interviewed. I would just throw it in, to see what they said," he recalled. "Most people are thrown off by it."

A square manhole cover could fall through its own hole because the diagonal of a square is 40 percent longer than the side. Ditto with rectangles, pentagons, equilateral triangles – all of them have diagonals that are longer than at least one side, which means the lid can be maneuvered down through the hole, and fall.

This would not be good. A cast-iron cover can weigh up to 200 pounds, and Nashua's main sewers can be 20 feet deep, making for a deadly combination if a cover landed on a DPW worker.

In reality, says Pollock of the DPW, Nashua's triangular lids can't fall down into the sewers despite what geometry says, because Nashua Foundries built them slightly tapered so the hole is just a little too small to fit the lid.

And now things get complicated.

Those brainteasers often say that a circle is the only shape that can't fall through its own hole, but that's not true.

## David Brooks



Previous columns by  
[David Brooks](#)

David Brooks has spent a quarter century as a reporter, editor and columnist for daily newspapers in four states, including the past 16 years with the Telegraph. Holder of a bachelor's degree in mathematics, he has written Science from the Sidelines since 1991. He lives in Mont Vernon with his wife and two children. He can be reached at 594-5831 or [brooksd@telegraph-nh.com](mailto:brooksd@telegraph-nh.com)

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In fact, any polygon with an odd number of sides would work – well, sort of.

The key is that they can't have straight sides (which means they're not really polygons, but we'll skip the nomenclature debate). Instead, each side has to be a slight bulge – an arc centered on the opposite vertex. Doing this with an equilateral triangle creates what is called a Rouleaux triangle, which you may know as the shape of the rotor of the Wankel rotary engine.

Such shapes don't fall into their own holes because the diameters are always the same length – a property I thought was unique to circles. Draw lines from one side to the other of a Rouleaux triangle, through the center, and their length will never vary; so it has no dimension shorter than any other that could be used to squeeze the lid through the hole.

So if the circle isn't really the only shape that won't fall through its own hole, and Nashua already has hundreds of historic triangular manhole covers in the ground, why is the city phasing them out?

Alas, our pointy little street dwellers have fallen victim to one of modernity's dreaded diseases: Standards.

State safety standards say manhole covers should be at least 30 inches across, whereas Nashua's triangles are only 17 inches wide at the narrowest diameter.

It's not that DPW workers have gotten fatter in the past century (although they probably have, if they're like the rest of us). The problem is that officials now want enough room for workers wearing air tanks, in case methane or other dangerous gases build up. Further, says Pollock, the triangles have a small drawback, which might be called the flip side of their non-rattle-ness: They sometimes get stuck in the hole.

For both those reasons, when covers have broken or streets have been torn up for other reasons over the past year or so, Nashua has been replacing the triangular covers with newfangled circular ones. It's a slow process and triangular covers will remain around for years to come, but like VCRs and afternoon newspapers, they're on the downward slope to extinction.

"They haven't bought one in almost two years, I think," said Lyon at Nashua Foundries. "My only request is, please take all the inventory that I have. Don't leave us with any of them."

Lyon, who remembers watching the big triangles get made as a child, admits he'll be sorry when the last one is gone.

"It definitely is the end of an era," he said.

*Science From the Sidelines* appears Wednesdays in *The Telegraph*. David Brooks can be reached at 594-5831



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