

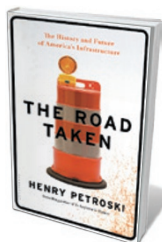
infrastructure below ground. In an opening vignette about his Brooklyn childhood, he highlights the contradictory nature of all that cabling and piping — simultaneously invisible and utterly necessary, the ever-present context of our daily lives, carrying electricity, waste, water and gas to and from our homes. But his focus is the structures and elements of the ever-evolving road.

He delves into the progression of road surfaces from carefully stacked stone to tarmac, concrete and asphalt, in the unending quest to make smooth, durable surfaces. He shares the history of modal conflict — between horse-powered vehicles, pedestrians and automobiles — by looking at how safety features and traffic signals developed. Finally, he discusses materials failure not only through how steel and concrete deteriorate, but by connecting that decay to financial and political choices that undervalued risk. There are more than 6 million kilometres of public roads in the United States, and its citizens travel nearly 5 trillion kilometres a year on them. But as the American Society of Civil Engineers reported in its 2013 'report card' on US infrastructure, 66,749 US bridges (1 in 9) are structurally deficient, and 32% of US roads are in "poor or mediocre condition".

Petroski shows how past practices ripple forwards. Details paint a rich, sometimes pungent, history: for example, woodblock roads (first used widely in the mid-nineteenth century) fell out of favour because they absorbed horse urine. On the country's notorious scourge of potholes, Petroski describes how the combined forces of heavy traffic, water and freezing temperatures conspire to create spreading cracks and distortions in asphalt. He concludes by casting forwards to future roads. Here, he opines, self-driving cars will create safer roads by calculating hazards faster than human drivers can. Asphalt could be revolutionized by mixing in fibres of steel wool; when these are heated by induction coils on a special vehicle, the asphalt will melt and reform, becoming self-mending.

Petroski's goal is to ask how, given the importance of the car to the US economy and mobility, federal and state governments have allowed the country's infrastructure to reach crisis point. But he goes beyond hand wringing. With an engineer's technical knowledge and a historian's eye, he offers a nuanced argument about the political, financial and engineering calculus that contributes to failures.

Acknowledging that infrastructure is part of the political domain,



The Road Taken: The History and Future of America's Infrastructure
HENRY PETROSKI
Bloomsbury: 2016.



The heavily used I-35W bridge in Minneapolis, Minnesota, collapsed in 2007.

Petroski urges political engagement. He cites the controversial rebuilding of the eastern span of the Bay Bridge in Oakland, California, which opened in 2013. This cost a whopping US\$6.4 billion, took 12 years to build, was beset by construction problems and was arguably over-designed. He also discusses the disputes over the Department of Transportation's Highway Trust Fund, intended as the primary support for federal investment in US road systems, but due to run out of money this June. Politicians, he shows, too often choose expedience over sound solutions.

Despite that focus, Petroski does leave out many of today's crucial political debates. There is almost no discussion of the local decisions that shape US roads, such as where or how state and city officials decide to apply federal and state funds, or how municipalities shore up their road funds through different financing mechanisms. Nor does Petroski delve into the vexed issue of the displacements caused by interstate construction since the 1950s, which at its peak forced between 60,000 and 100,000 people to leave their homes every year. Finally, despite framing the book as a look at choices made

and not made, he does not comment on the possibility that roads and their continued construction are creating further problems.

As politicians and citizens consider how to fix existing highways, byways and bridges, they must also consider whether remaining so tethered to the system is a necessity. Might it not be time to ask how major investments in mass transit could complement, if not start to replace, the US reliance on cars? Reflective decision-making is, after all, at the core of what this informative book recommends. ■

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CLARIFICATION

Surfaces, the exhibition reviewed in 'Medical modernist' (*Nature* **530**, 30–31; 2016), was originally a joint production of the Museum of Concrete Art and the German Museum of Medical History, both in Ingolstadt.