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"You can't build your way out of congestion." – Or can you?

A Century of Highway Plans and Induced Traffic

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Abstract: The phenomenon of induced traffic was recognized (if rarely measured) even before the automotive age. Its existence calls into question the effectiveness of road construction as a solution to traffic congestion. Why, then, has it rarely been factored into highway investment decisions? An examination of references to induced traffic suggests that it posed an inconvenient complication to a consensus that had emerged by the 1920s. That consensus endorsed automotive mobility along with a commitment to keep building road space as long as traffic grew to fill it. Recent research challenges the factual assumptions underlying that consensus, but has not yet overturned the deeper beliefs upon which it rests.

Understanding Congestion

Transportation scholars often agree with anti-highway activists that the long-standing failure to take account of induced traffic has sometimes discredited transportation policies (e.g., Metz 2008b: 31–35; Gorham 2009; Litman 2011). However, little been done to incorporate the phenomenon into decisions about transportation investment. Indeed, its very existence has often been denied. To understand why, we must turn our attention to the history of urban street congestion. Disputes about the existence and extent of induced traffic are a consequence of efforts to reduce congestion, in particular, the long-standing belief that the solution to congestion is the construction of more road space.

Congestion has always been mainly an urban issue. Street congestion is an old problem in major cities, one that was much lamented, but little analyzed. In other words, those who decried congested streets rarely explained why they saw congestion as a problem, as Asha Weinstein's study of Boston in the 1890s and 1920s has shown (Weinstein 2002; Weinstein 2006). Furthermore, congestion was typically not defined with any precision. The American traffic expert Miller McClintock admitted as much in 1925: "The term congestion as generally applied to street traffic is used to designate almost every type of undesirable condition." His attempt at a useful definition was only a little more specific: "a condition resulting from a retardation of movement below that normally necessary for contemporary street users."[1] A plausible if unprovable inference is that the perception of congestion was, at bottom, simply a frustrated reaction to busy streets (Why can't I go faster?) so it is hardly surprising that the problem was not analyzed with any precision. Congestion is, in fact, most easily measured if one assumes that what is "normally necessary" is uninterrupted high-speed movement. In cities, however, free flows at high speeds have been the exception rather than the rule. Yet transportation planners since the 1920s have striven to make speed normal, with the automobile as their model of rapid urban transportation.[2] The gap between urban reality and the automobile's mechanical potential has framed a century of discontent.

Congestion was also measured as a cost – if crudely. Since it was essentially identified as an evil, cost measurements may have been mainly attempts to justify this established understanding. Weinstein (2006: 109–111) locates the origins of the cost accounting of congestion in the 1920s and argues that the need to quantify cost arose from the fact that those directly affected, motorists, were relatively few in number at the time. Certainly it is true that by the 1920s, congestion in US cities was equated with slow automobiles, and its causes were identified as a shortage of street space as well as the obstruction caused by pedestrians and other vehicles (Brown 2006: 13). The assumption that additional road space will increase speed, and thus create a measurable benefit in travel time-savings, has continued to justify road projects in many countries, despite mounting criticism.[3] Recent arguments in defense of congestion, as inevitable or even as a sign of urban prosperity (notably by the president of the Congress for New Urbanism, former Milwaukee Mayor John Norquist), have largely failed to influence policy because the established system of measurement promises statistical clarity and the hope of a solution, even if both are illusory.

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Induced Traffic and Road Construction

Induced traffic is a problem because its existence (real or imagined) calls into question the efficacy of road expansion as the obvious solution to congestion. Early references to the phenomenon of induced traffic seem to have been casual observations, perhaps made in the aftermath of major construction projects, but not as part of any decision-making procedures. The recognition that transportation projects can induce traffic is, fundamentally, an awareness of the dynamic interrelationships between moving vehicles or people and fixed spaces or structures. The historian James Winter observed a dawning recognition in 1830s London that: "unplugging traffic stoppages by reconstructing Cannon St aggravated the congestion at St Paul's Churchyard" (Winter 1993: 5). At the end of the nineteenth century, just before the automobile age, clogged traffic in the centers of the largest cities was a major complaint, with underground or elevated railways the favored remedy. When new rail lines in London, New York, Boston, and Chicago failed to banish congestion, some observers concluded that (in the words of the engineer E. P. Goodrich in 1916) "rapid transit has increased congestion … More people come to the center when we get rapid transit than they did before."[4] Contrary to the hopes of their proponents, the new rail lines had only increased the concentration of commerce and people in the city centers.

Goodrich believed that automobiles, too, would merely increase congestion. Others, more optimistic, were convinced that the nimble new vehicles would be different. During the 1920s and 1930s, the enormous influx of automobiles into American city centers (far more than in all other lands, where auto ownership grew much more slowly) gave urban congestion a new visibility. Municipal governments devoted a great deal of effort to reducing automotive congestion and their methods were widely debated. Street widening and road construction were, of course, routinely proposed.

However, planners and traffic engineers observed again and again that added road capacity seemed to attract new traffic and that new roads never solved the congestion problem. Many of them cited induced traffic (although not using that word) as the phenomenon that prevented road construction from solving congestion. In 1902, H.G. Wells (1902: 25) had already ridiculed "the remedy of the architect and builder," since "every new artery means a series of new whirlpools of traffic." As one Los Angeles official observed in 1928, "a newly opened ...or widened street immediately becomes glutted by the access of cars that hitherto have reposed more in their garages than they have utilized the streets."[5] New road space inevitably attracted new traffic, according to the eminent planner Harland Bartholomew in 1925: "it would just be a question of time" before the new space was filled.[6]

These observations, however, were rarely used to cast any doubt on the desirability of road construction. Even observers who acknowledged the problem of induced traffic insisted that new roads were needed, and that they would, somehow, makes things better, at least by keeping ahead of the growing congestion. Miller McClintock (1925: 4), for example, observed in a 1925 book that "any reasonable increase in street capacity, either through a more rapid movement of traffic, or through a widening of the thoroughfare, will not reduce the density of traffic, for the places made available, will be taken by those drivers who may be said to be on the margin of convenience." However, this observation does not seem to have deterred him from recommending such street improvements. Similarly, an official study of London's roads in 1937 concluded both that "new roads create new traffic" and that the new roads had surely prevented congestion from becoming much worse (Plowden 1980: 50).

The rapid growth in car ownership strengthened the case for more road space. Hypothetical scenarios bore no weight against visible needs – and at any given moment, it seemed obvious that additional road space would relieve congestion. Powerful interests, professional, political, and economic, tugged nearly everyone in the same direction. As McClintock continued his work in a think tank funded by the auto industry, the topic of induced traffic simply vanished from his reports recommending road construction (Norton 2008: 167–168). In 1927 *Automotive Industries* magazine did take note of an engineer's warning about the futility of adding street capacity, but merely to observe that it was "an interesting thought from a sales perspective" (Norton 2008: 157).

By the 1930s, the model of the new limited-access highway (the newly named freeway) promised to increase road capacity by an almost unimaginable extent. Surely, thought some observers, this new design would free us from having to worry about induced traffic. A consultant assured Boston officials in 1930 that fears of induced traffic negating increased capacity had "no validity whatever as applied to any major traffic artery" (Brown 2006: 27). In

1937 McClintock described freeways as "a permanent cure" for congestion (Brown 2006: 27). In 1935, the prolific English transport historian Vernon Sommerfield (1935: 111–113, 279) lamented the futility of road building as a solution to congestion, but soon afterward the new American expressways and German autobahns seem to have convinced him that more highways were both necessary and desirable (Sommerfield 1938: 202, 206). This new-found optimism overwhelmed the sort of skepticism expressed in 1925 by a Los Angeles planner who had resigned himself to a futile cycle of road construction and congestion: "Every possible solution which involves a physical improvement results in greater congestion, or, in other words, 'the cure is worse than the disease.' However, engineers will continue to effect these 'cures' as fast as economic pressures produce the urge and the where-with-all, but they cannot hope ever to do away with congestion at city centers by any known means of actual physical betterment" (Damon 1925: 1132).

There was a more specific context to the choice to ignore induced traffic in the 1920s. Possible solutions to the perceived crisis of urban congestion took two forms: regulation and construction (Norton 2008: 149–175; Fogelson 2001: 255–259). Because stricter regulation entailed limiting traffic (and cars in particular), the alternative, construction, could assume the mantle (and mantra) of freedom, growth, and progress – an aura that struck a deep chord in the UK as well as in the US. Freedom of movement was widely assumed to be a basic right of the modern age. Already in 1913, the English Fabian socialists Sidney and Beatrice Webb (1913: 242, 254; also quoted by Goodwin 2011) celebrated the defeat of "repressive legislation" that limited automotive movement and argued that "the roads have once more got to be made to accommodate the traffic, … not the traffic constrained to suit the roads." Vernon Sommerfield (1938: 206–207) agreed that the choice was between progress and retreat: "We have the alternative of making the roads fit the traffic, or adopting the retrograde policy of cramping the traffic to fit the roads …. It is time that the eighteenth-century mind should retire from the regulation and planning of twentieth-century transport." It was the specter of restrictions on urban car use that outraged Lord Montagu in 1927: "But shall we ever stand such a denial of individual liberty? If I am right in my opinion that the right to use the road, that wonderful emblem of liberty, is deeply engrained in our history and character, such action will meet with the most stubborn opposition. More street space and more road space will have to be provided whatever be the plan for it or the cost of it" (Plowden 1971: 401).

A solid consensus in favor of road construction emerged as the solution to congestion, and with it, an implied decision to treat traffic as a physical rather than a behavioral phenomenon. This engineering mentality would become known as "predict and provide." It presumed that the growth in car use was both inevitable and desirable, and that the need could be met. New roads filled up, of course, since car use was growing; at that point more and wider roads were called for. For the emerging coalition of economic, professional, and ideological interests committed to highway construction, this spatial logic became reflexive. In 1955, leading highway engineers testifying in favor of the proposed US Interstate highway system lamented that congestion had held down annual increases in urban traffic, and concluded that a benefit of the new system would be that it "will induce traffic" (Leavitt 1970: 39).

Induced traffic was no secret, in other words, but neither was it a vicious circle. Instead, as the official publication of the American asphalt industry proclaimed in the mid-1960s, the fact that "safe, attractive roads generate travel" was the key to the "magic circle" and a "cyclic and beneficial process" in which new roads "ease traffic congestion and develop even more travel", creating a demand for yet more roads.[7] In later years, when such claims might have attracted more controversy, they re-emerged as references to "latent" or "repressed" traffic: "Travel that is 'induced' by added capacity is actually travel that had been repressed or shifted by capacity shortages" (O'Toole 2001: 398).[8] Here, the implication that induced travel is undesirable was being turned on its head: to invoke "repressed" travel implied that someone had been deprived of a fundamental right to mobility. Meanwhile, broader public discourse remained dominated by the often unquestioned belief of local government and business officials that new roads were a fundamental tool of economic development because they generated traffic that accompanied commercial and residential growth in newly accessible areas. According to the spatial logic of "predict and provide," increasing car ownership and growing mobility were simply assumed, and new roads merely met the given need. The logic was all the more unassailable because automotive mobility was treated as something close to a fundamental right.

Freeway Revolts and the End of a Consensus

The freeway era, however, also saw the gradual revival of claims that induced traffic might call into question the value of new roads. During the 1950s, the prominent American urban critic Lewis Mumford (1958: 182)[9] pounded home the argument that the construction of expressways in crowded cities—which was beginning on a large scale in the US—would tempt transit users to drive, creating a "cycle of congestion" and destructive road construction that would ultimately kill cities. Mumford had no need to draw on any esoteric knowledge. By the late 1950s, drivers were lamenting the traffic jams on new US suburban freeways. One of the most notorious was New York's monumental Long Island Expressway, which had hardly opened in 1958 before frustrated motorists dubbed it the "world's longest parking lot."

Around this time, observers in other countries began to fret that induced traffic might negate the promised gains of their own road construction plans. Clear evidence of the problem rarely seems to have been at hand; in many cases, they alluded to the US experience. In 1958, for example, the Mayor of Hamburg cited Mumford's prophecies about induced traffic to bolster his opposition to urban freeways. Adelaide's planner returned to Australia from a US trip in 1964 with similar warnings. The UK government's Buchanan Report observed that US experience showed that each new motorway "seems to call into existence new traffic sufficient to create a new congestion" (Südbeck 1994; Sandercock 1975; UK Ministry of Transport 1963).[10]

In 1962, the American economist Anthony Downs (1962) formulated an influential theory of induced traffic, describing how new or expanded roads attracted a "triple convergence" of travelers changing their route, departure time, or transport mode. His extensive discussion of shifts among transit modes came at a time when privately owned commuter rail and bus services in many US cities were on the verge of collapse. He argued that balance was needed in transport investment: if money were spent on freeways, as it was, in vast quantities, at the time, then a corresponding increase in mass transit investment was needed. Otherwise, the new highways would simply entice transit users to drive, with no lessening of congestion. His advice went largely unheeded: massive freeway investments in the US continued for another decade, and (to a lesser extent) much longer; transit investments have seldom kept pace.

Mumford and Downs were writing at the dawn of the freeway revolt era. Urban freeway opponents drew on their ideas to challenge the established consensus about transportation planning. A new slogan that emerged from their ranks, "You can't build your way out of congestion," was actually a restatement of the view often expressed during the 1920s. In both eras, this belief arose from groups critical of car use, and for much of the 20th century's second half it appeared that their efforts would again be futile. The difference was a dawning recognition in North America and Europe that car use could not grow endlessly. Thus, it became difficult to defend induced traffic as a desirable or at least acceptable phenomenon. But its existence could still be ignored or denied, in part because it was not being measured, and also because criticism of highway plans came from activist citizens. Both reasons stiffened the resistance of highway engineers, who saw themselves as non-political professionals committed to the necessary task of road construction.[11]

New Thinking, Old Policies

The influence of the freeway revolts have to be traced along two different paths: research and policy. Statistically minded scholars were slow to enter the fray, so the disputes over induced traffic remained long unmoored by numbers. Harry S. Cohen found a single study of induced traffic per decade from the 1940s through 1960s, and a few more from the 1970s (all of them American) (Cohen 1995; Cervero 2002 adds a study from the 1950s). Serious attention began only in the 1980s, notably in the UK (Pells 1989; Goodwin 1996a).[12] At first, the studies produced something less than a solid consensus. For all the considerable evidence of induced traffic effects, they are difficult to measure precisely since highway investments typically occur where demand is growing anyway. However, a mounting number of studies as well as continuing refinement of measuring techniques have, in recent years, produced more solid evidence of the fact of induced traffic, although measured elasticities of travel demand vary widely.[13]

Researchers were presumably prompted to investigate induced traffic in part by growing doubts about the wisdom of road construction, although the conventions of social-science research mean that publications leave little trace of their authors' motives. For policymakers as well, changed views depended not only on a recognition that induced traffic existed, but also

that increased driving was not a good thing because of its external costs, such as energy use, pollution, death and injury, and urban sprawl. The combined influence of scholars and road opponents ensured that an awareness of induced traffic would affect decisions about road construction. Yet changes in policy have remained quite limited. As in the 1920s, cognitive dissonance, bureaucratic inertia, and powerful interests all resisted the experts' consensus. Politics and scholarship have often been at odds, as in the case of the Greater London Council in the 1960s, when planning experts advised the need to take account of induced traffic, while politicians, promoting new motorways, denied its existence (Jenkins 1973: 261). Standard traffic models remained in use, to the satisfaction of engineers, bureaucrats, politicians, and road builders.

There has been an understandable reluctance to abandon a simple formula in favor of a more complicated one. Those who are committed to road construction, intellectually, politically, or economically, have found it easy defend the old system (probably with genuine conviction) by raising legitimate doubts about the clarity or efficacy of any alternatives. The clearest case of a reversal of policy was in the UK during the 1990s, when the government officially surrendered the goal of keeping up with congestion by building new roads (Goodwin 1996b). But the change in policy turned out to be less decisive than it seemed (Goodwin 2006; Noland 2007). Politicians and bureaucrats remain reluctant to renounce road construction amid obvious congestion, and the complexity of any substitute for "predict and provide" gives them great flexibility in interpreting expert advice. For motorists stuck in traffic, and therefore their representatives, the obvious solution continued to be more pavement.

Fundamental beliefs were at stake. Looking at a recent Danish case, Petter Næss (2011) concluded that decision-makers assumed that traffic growth was inevitable and that it would therefore be irresponsible *not* to build a new road. Assumptions of continued growth are part of the wider belief in progress that has guided road construction for a century. It followed that new roads were undoubtedly necessary and beneficial, even if reductions in congestion were less than projected. Where the necessity of new roads seemed obvious, it was easy to accept "win-win" analyses of road projects that promised reductions in congestion, fuel consumption, and air pollution, despite solid evidence that induced traffic negates those benefits wholly or in part.[14]

If growth in motor traffic is not merely assumed, but rather understood to be partly the result of road construction, then the traditional logic of congestion relief is turned on its head. The existence of induced traffic reveals the fact that not only traffic, but mobility in general is a dependent variable. Pavement does not merely make movement more efficient; it changes behavior and it changes spatial patterns, for example, by shifting real-estate development and therefore traffic from one place to another. Since traffic is behavior, it cannot be measured or predicted in merely mechanical terms; so transportation policies need to assess and influence behavior and not just pavement. This realization makes it much more difficult to assess the costs and benefits of transportation projects.

Alternative Models

The need to balance costs and benefits more honestly has prompted economists to recommend road pricing as a more efficient solution to congestion. The idea goes back to A.C. Pigou in 1920 and was revived, notably by William Vickrey, in the 1950s, leading to a vigorous discussion mainly in the UK during the 1960s (For an overview, see Lindsay 2006; for UK, see Starkie 1982: 42–48). Short of the full privatization of transport infrastructure, however, it is difficult to calibrate price signals in existing transportation networks. In addition, the inevitable opposition to any proposed pricing scheme draws in part on deep-seated beliefs that mobility is a right rather than a good to be purchased and that any increase in the price of anyone's mobility is a step backward.

Even more radical than putting a price on mobility has been the position of those freeway opponents who rejected mobility as an ideal (Ladd 2008: 127–129). They argued that the promotion of mobility has encouraged long commutes and new real-estate development at the expense of established neighborhoods. Induced traffic, therefore, made road construction not only pointless but also harmful. Their new way of thinking about cities valued proximity more than mobility, while asserting that speed on city streets was not in fact a desirable goal. In recent years, scholars have followed the activists' lead as they shifted their attention from mobility to accessibility as the goal of transportation: that is, to reach destinations rather than to move quickly on the way there. The crucial difference from the older model is that accessibility combines mobility with proximity, and

therefore demands that transportation planning be meshed with land-use planning. A goal of maximum accessibility does not reward projects that increase mobility (measured by travel time-savings) while decreasing proximity, as critics have long charged that sprawl-inducing freeways do. A wider focus on proximity and land use, rather than on narrow channels of motorized traffic flow, also permits comparison of the efficacy of promoting other (usually slower) modes of transportation: mass transit, bicycling, and walking. However, accessibility is less visible and more difficult to measure than mobility.[15]

Hence the dilemma of contemporary transportation policy: an acknowledgement of induced traffic, added to a recognition that every mile of driving carries harm as well as benefits, makes it impossible to proclaim cost-free solutions to traffic congestion. The benefits of roads have to be recalculated (with much more complex formulas), and they have to be measured against previously unacknowledged costs that accompany increases in motor vehicle use – costs long noted (if rarely measured) by freeway opponents, environmentalists, and critics of urban sprawl.

The older model retains the advantage of simplicity, both statistically and politically. Where political support for road pricing is lacking, and where it remains possible to evade measurement of induced traffic, the bureaucratic logic of "predict and provide" trumps the arguments of economists and transportation scholars – especially since that bureaucratic logic suits powerful, entrenched interests. The bureaucratic logic is also visible and spatial: moving more vehicles at greater speed requires more space, a conclusion that seems obvious, although it isn't necessarily true, and isn't necessarily desirable. There are, in fact, numerous reasons, politically or economically defensible to varying degrees, to build or expand roads. Yet it is congestion that creates a popular demand to do so, and the estimated costs of congestion have typically served as the formal justification for new roads. Induced traffic fouls the equation, by calling into question the basic calculations of economic benefit. It also drives a wedge between the two goals of decreasing congestion and increasing the mobility of people and goods. These two goals have often been conflated. Whereas reduced congestion has been a generally lauded goal (and has been routinely quantified in economic terms), increased mobility is not such an unalloyed good, nor has there been much measurement of the benefits of longer, faster commutes or to the effective expansion of urban areas – that is, to what is often labeled as urban sprawl.

An acknowledgement of induced traffic, therefore, poses a fundamental threat to established methods of transportation planning: if induced traffic is real and significant, then new roads might do more harm than good. Thus, induced traffic forces policymakers to face the question of whether mobility is a good thing in itself. Do roads create economic growth, or merely redistribute it? (See Ewing's 2009 literature review, which argues for the latter position). When do the social and environmental costs of automotive mobility exceed its benefits? Scholars have begun to address these questions (Metz 2008b: 31; Litman 2011: 17–21; Zöllig, Axhausen 2011), but the answers are likely to be neither obvious nor conducive to clear endorsements of construction projects. These difficult questions are more easily evaded when the focus remains on congestion alone. Thus, the measurement of induced traffic is not merely a statistical exercise; and it is far more than a new variable to consider in cost-benefit analyses: It challenges the logic that has driven transportation planning in the automotive age.

Notes

1 McClintock (1925): 25 (both quotations). In more recent definitions, it is a reduction in speed caused by the presence of other vehicles, see Dargay and Goodwin (1998): "…the impedance vehicles impose on each other, due to the speed-flow relationship, in conditions where the use of a transport system approaches its capacity."

2 Brown (2006): 13. On recent use of similar calculations: see Dargay and Goodwin (1998): 163–166.

3 See Metz (2008a) and Cortwright's (2010) criticism that the widely cited Texas Transportation Institute statistics on US urban congestion assume that the ideal is highway speed rather than accessibility.

4 Proceedings of the Eighth National Conference on City Planning (1916): 75. Other early examples are cited by Vanderbilt (2008): 155 (from 1900) and Barrett (1983): 46 (from 1907).

5 George Baker Anderson, quoted in A. Brilliant (1989): 144.

6 Bartholomew in American Society of Civil Engineers, Transactions 88 (1925): 238–239. For other examples, see Fogelson (2001): 259–260, 267–268, 274; Norton (2008): 336, note 49. What Bartholomew describes is induced traffic as I am using the term, including travel diverted in time and route as well as new travel generated by a transportation improvement.

7 *Asphalt 17* (1) (Jan. 1965): 2, *17* (4) (Oct. 1965): 2, and *18* (2) (Apr. 1966): 1.

8 See the argument against using the term "latent demand" in Gorham 2009: 4–5.

9 For further examples, see Ladd (2008): 121.

10 For other British references to US induced traffic, see Foster (1963): 18.

11 On engineers' dominance of transportation planning, see Rose (2003): 217, and Seely (1987). On the freeway revolts, see Ladd (2008): 103–129.

12 Meier (1989) is an early German-language example.

13 Recent studies (the first two include literature reviews) include Noland (2007), Weis and Axhausen (2009), and Duranton and Turner (2011).

14 Handy (2008) concludes that congestion relief measures still drive the planning process in the US. Næss et al. (2012): 294–295 points to several European states' policies that ignore induced traffic. Bayliss (2008): 13–16 accepts its existence, even while pushing for new road construction.

15 Recent scholarship on measuring accessibility: Axhausen (2008); Grengs et al. (2010). On integrating land-use and transportation planning: Straatemeier and Bertolini (2008); Zöllig and Axhausen (2011).

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