

Level of Service: Design Standards, Imposed Car Dependence, and Urbanization in the Capitalist State

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ABSTRACT

Transportation scholarship has become increasingly critical of design standards and engineering methods that promote car-dependent development patterns in American cities. Level of Service (LOS) is a design standard that has received scrutiny for its misapplication to urban streets, accommodating highway-like traffic flow where local service and accessibility should be a priority. Combining the work of contemporary planning and engineering researchers, Marxist urban theorists, and critical theorists Henri Lefebvre and Michel Foucault, this paper understands such design standards as forms of knowledge that reproduce power structures of capitalism. The paper focuses on an in-depth historical analysis of three watershed moments of federal decision making that helped establish and reproduce a car-centric discourse of urban transportation in the United States. Using this analysis, the paper describes how the widely accepted use of LOS as a quality measure for urban streets acts as mechanism of the capitalist state's spatial logic of managing urbanization around production and consumption to reproduce its own dominance.

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GENERAL AUDIENCE ABSTRACT

Level of Service (LOS) is a design standard that is used in the design and maintenance of roads and streets across the United States. Expressed as an A through F letter grade, a roadway with an LOS closer to A is one where cars can move quickly and freely without interruption. Seeking higher levels of service in densely developed areas has contributed to the American phenomenon wherein wide, high-speed, unwelcoming and dangerous roads dominate the built landscape of urban and suburban communities. This paper looks at federal policy of the mid-20th century to understand how this logic of designing cities came into being. Drawing on multiple transportation researchers and theorists of urban planning and sociology, this paper argues that the use of LOS in urban areas fits within the capitalist logic of designing cities wherein constant growth is valued above all else, including the safety, convenience, and beauty of a city designed for more than just car owners.

Dedication

Dedicated to my parents who encouraged me to follow my heart to happiness.

And to Franklin S. Zhang, a first-year Virginia Tech student who passed away following a collision on Prices Fork Road where he was standing on the sidewalk. May he rest in peace.

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Chapter 1

Introduction and Background

1.1 What is Level of Service (LOS)?

In 1965, the Transportation Research Board's (TRB) Highway Capacity and Quality of Service Committee (HCQSC) released the second edition of its *Highway Capacity Manual* (HCM).

Since 1950, the Committee has written and maintained this manual, which has become a national and international standard for guiding the analysis of highway capacity and quality of service. In the United States, it is used on all federally aided highway projects (Roess and Prassas, 2014). In the second edition, the Committee introduced the concept of Level of Service (LOS). The manual defines LOS as follows:

“...a term which, broadly interpreted, denotes any one of an infinite number of different combinations of operating conditions that may occur on a given lane or roadway when it is accommodating various traffic volumes. Level of service is a qualitative measure of the effect of a number of factors, which include speed and travel time, traffic interruptions, freedom to maneuver, safety, driving comfort and convenience, and operating cost.”

(Transportation Research Board, 1965, p. 7)

Levels of service are represented as letter grades on a scale of A through F, where A represents “free-flow operation”, where a driver’s speed is not affected by other drivers in the traffic stream. In other words, there is minimal traffic density. Level of service F, on the other hand, describes “forced flow” conditions with “substantially” reduced speeds and stoppages occurring for short or long periods (TRB, 1965, p. 81). Based on the description given above, we can understand LOS as a standard that measures the convenience and comfort that a driver

experiences on a roadway. **Figure 1** provides visual depictions of LOS A through F from the 1965 HCM.

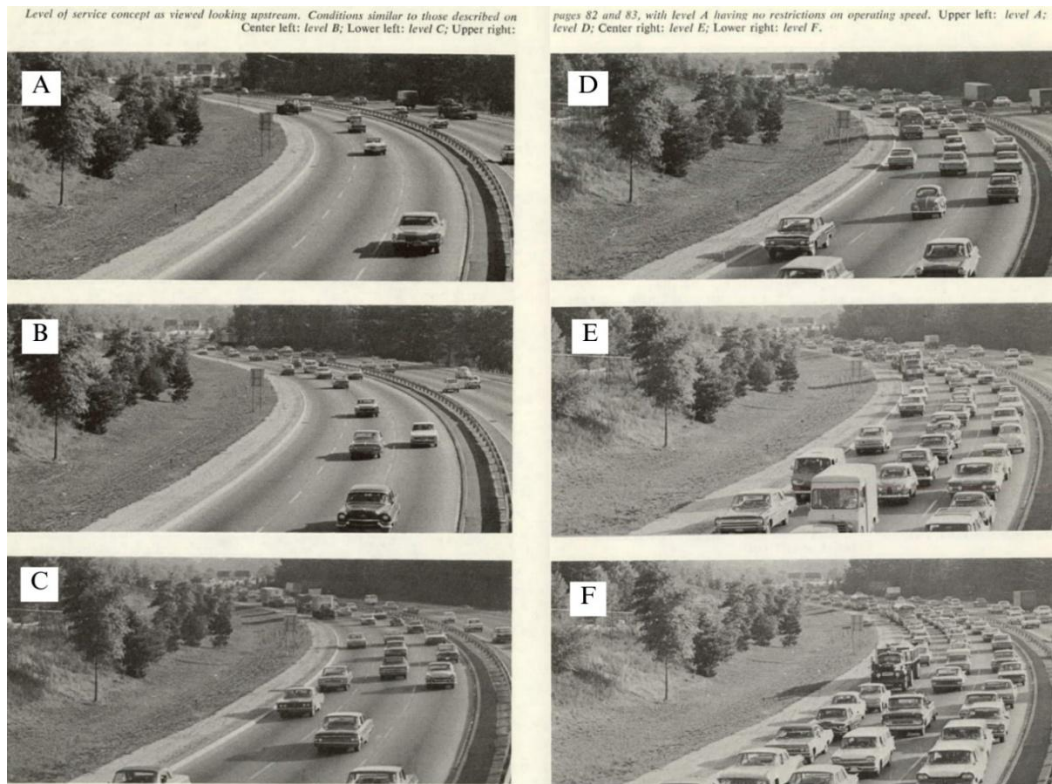


Figure 1: Level of service concept as viewed looking upstream

Since the 1965 edition, the HCQSC has provided details on how Level of Service can be applied to various types of roadways including freeways and expressways, rural highways, two- and three-lane highways, urban and suburban arterials, and downtown streets (TRB, 1965).

1.2 The Problem with LOS

While the *Highway Capacity Manual* itself is not a piece of legislation that has legal bearing over the design of our streets, it is a well-written, continuously updated design manual published by a credible research organization (the National Academies of Sciences, Engineering, and Medicine). Furthermore, parts of the HCM, and LOS, specifically, have been codified into

federal, state, and local policies. In most of these cases, a desired LOS grade must be maintained a) to receive federal or state funding for roadway construction and maintenance, or b) for new land developments to be approved, as part of local and state Traffic Impact Analysis (TIA)/Traffic Impact Study (TIS) requirements (Marshall, 2024). Further, the American Association of State Highway and Transportation Officials (AASHTO)'s *A Policy on Geometric Design of Highways and Streets* (commonly known as the *Green Book*) uses LOS as a primary design criterion for arterials, collectors, and local streets in urban areas. Specifically, it recommends LOS C for arterials, LOS D for collectors, and “the highest level of service practical and consistent with the project context” for local streets (AASHTO, 2018, p. 7-4). Much like with the HCM, these LOS standards from the Green Book have been legally codified at the federal, state, and local levels. The Federal Highway Administration adopted the Green Book's standards in 1985 (FHWA, 1985). The Virginia Department of Transportation (VDOT) demands that “all design criteria” must meet minimum Green Book standards (VDOT, 2025, p. A1-1). The town of Blacksburg, Virginia, to give just one local example, requires that local arterials meet the LOS standards of the Green Book (Town of Blacksburg, 2025)

This is where LOS becomes its most problematic, once it is applied as a legal design standard to streets within urban or more intensely developed areas where people live and work. This design criteria may work well for controlled-access roadways like freeways and multi-lane highways. However, it is dangerous to apply these same rules to suburban and urban arterials and downtown streets which feature far more pedestrian activity, public transit service, adjacent commercial and residential uses, and general urban social life, which naturally act as barriers to high volume car traffic.

Chapter 2

Review of Literature

2.1 Three Groupings of Literature

This section provides an overview of the intellectual foundations for this paper's argument. The literature that informs this foundation comes from three main camps of scholarship.

The first section of literature includes selected works of Marxist urban theorists Henri Lefebvre, David Harvey, and Edward Soja. Building off ideas of Marx, Hegel, Von Thünen (and each other), these three writers introduced critical interpretations of capitalism's influence on the social production of space. This paper uses these theories to establish a theoretical framework on the *spatial logic of capitalism*, within which this paper analyzes the following two groups.

The second comes from a selection of modern-day researchers and professionals in the fields of transportation planning and engineering. These writers provide criticisms and alternatives to many of the prevailing methods of transportation planning, including the use of LOS as a qualitative metric of urban streets. Their writing is focused on the technical aspects of processes and standards in planning roadways and the poor logic that often supports them. While their expertise is primarily geared towards the design and operations of transport systems, their work features discussions on the justification and desired outcomes associated with the methods in question, which they argue can often be economic in nature. The work of these experts comes almost exclusively from the 21st century, much later than the theoretical literature that will be analyzed after.

The third portion of literature is focused specifically on the work of critical theorists Henri Lefebvre and Michel Foucault. These theorists offer unique insights into concepts of knowledge,

power, social control, scientism, and technology. The included works from Lefebvre and Foucault were written and published in the mid-20th century, primarily the 1960s and 70s. It may appear an intellectual leap to apply this relatively old, theoretical work in an effort to understand the modern-day use of Level of Service on city streets. However, their writing is not only thematically relevant, but temporally appropriate, considering how this paper applies those theories to federal decision making of the mid-20th century, which helped establish the discourse, power relations, and logic of urban development and regulation centered on the automobile and its role as a tool in economic growth under capitalism. Further, the work from the first group of literature (while it does include Lefebvre), helps bridge this temporal gap with much of their work being published in the 1980s.

2.2 The Spatial Logic of Capitalism

This section aims to set the stage for the following sections of the literature review (and the paper at large) by establishing a foundational understanding of the *spatial logic of capitalism*, informed by the work of Henri Lefebvre. This section also considers the responses and arguments of two other Marxist theorists, David Harvey and Edward Soja, as they provide insightful interpretations of Lefebvre's ideas.

A theoretical starting point of this paper is the idea that space is not neutral, that the creation of space is a process that is not free from ideology. Rather, space (particularly, the type of urban space that has come to dominate the modern American landscape) represents an embodiment of capitalist ideology. But how did this come to be? How can it be argued that our spatial existence, our physical built environment of housing developments, commercial centers, and networks of roadways, is imbued with the preferences of a capitalist class? These theorists contend that the management of space is a process of social production and is central to dynamics of capitalism.

While they disagree on some aspects of this process, they all identify, at the very least, that this process is used as a method for capitalism to reproduce its structure of dominance in the face of crises brought about by its internal contradictions.

2.2.1 Space is not Neutral

To begin, one should recognize the most foundational belief shared by these three theorists, that the spaces in which humans live are not neutral in the sense that they are free from ideology, physical environments separate from the social relations that otherwise rule everyday life.

Outside the primordial, physical space of Earth and the universe, this space is produced by humans and reflects a hidden ideology. In his influential work, *The Production of Space*, Lefebvre recognizes how we often “fall into the trap of treating space as space ‘in itself’”, as a “passive receptacle” (Lefebvre, 1991, p. 90). Soja evokes similar imagery, describing the created space we live in as not a mere container that society occupies, but rather something produced by that society (Soja, 1980).

This dynamic of space extends back to the emergence of ancient cities. Lefebvre states that “From the growing surplus product of agriculture to the detriment of feudal lords, cities accumulate riches” (Lefebvre, 1996, p. 4). While this, to be sure, is not the spatial logic analyzed in this paper, it is important to recognize that capital accumulation has intrinsic spatial implications, historically influencing human cohabitation. Harvey echoes this interpretation, stating further that urbanization itself has always been a “class phenomenon of some sort” since these enabling surpluses must be extracted from an exploited labor force somewhere but are then controlled “in the hands of a few” (Harvey, 2012, p. 5). These writers, of course, will go much further in exploring capitalism (in particular, advanced, industrialized capitalism)’s effects on

cities and the geographic expansion that comes with urbanization. They will argue that urbanization, like the kind analyzed in this paper that shot up in the mid-20th century United States, is a process used to absorb surplus and thereby perpetuate the existence of capitalist social relationships. These three theorists assert that this ideologically infused creation of space is, at its core, an attempt to mediate the crises of capitalism that threaten its own existence, rising out of the contradictions that are built into the very nature of capitalism.

2.2.2 Urbanization: The Survival and Spatial Logical of Capitalism

Lefebvre and the Production of Space

Starting with Henri Lefebvre, some of whose work predates the theories of Harvey and Soja by about a decade, we see him identify capitalism's desire to resolve its internal contradictions through space throughout his work, even dedicating a book to the subject in *The Survival of Capitalism*. Early in this work, he presents this dynamic of capitalism. He refers back to Marx, who thought "the productive forces constantly flung themselves against the restrictive limits of the existing relations of production (and of the capitalist mode of production)" (Lefebvre, 1976, p. 20). This is to say that social relations under capitalism will inevitably degrade as the ruling class hordes masses of wealth from exploited labor and that the displeased working class would usher in a transition from capitalism to communism through revolution. What had actually happened since the time of Marx, Lefebvre argues, is a new tactic of capitalism reproducing itself "by occupying space, by producing a space," allowing capitalism to at least attenuate its contradictions and continue to achieve growth (Lefebvre, 1976, p. 21). But how exactly is space used to ensure this reproduction?

Throughout his works, Lefebvre offers multiple methods through which capitalism achieves this reproduction through space. These methods relate directly to the capitalist mode of production by

providing new avenues for reinvesting surplus and indirectly through the maintenance of social relations that uphold this mode of production. To better understand the physical effects of these processes on the lived-in, urban space of humans, it will first be helpful to discuss Lefebvre's ideas of spatial practice, representations of space, and representational space (which he calls the perceived-conceived-lived triad). *Spatial practice* (perceived space) refers to the space with which humans interact and operate on a daily basis. *Representations of space* (conceived space) refer to conceptualizations of space commonly expressed through plans, maps, signs, and codes. This is the space of planners, engineers, and architects, and Lefebvre argues this type of space is used to promote the capitalist mode of production. This space will be the most relevant in our analysis of capitalist spatial logic, as these conceived spaces come to dominate the urban landscape, subordinating the perceived and lived qualities of space, leaving only what Lefebvre calls *abstract space*. Finally, *representational spaces* (lived spaces) are the spaces tied to human emotion, history, and experience, in other words the "passively experienced space - which the imagination seeks to change and appropriate," (Lefebvre, 1991, p. 39).

Between his works *The Production of Space*, *The Survival of Capitalism*, *The Right to the City*, and *The Urban Revolution*, we can identify the aforementioned methods through which capitalism reproduces its mode of production, simultaneously noting the necessary dominance of abstract space over lived and perceived space in facilitating this process.

1. **Commodification and the absorption of surplus capital:** This method plays the most direct role in the capitalist mode of production, a process to which he refers as the *consumption of space* (Lefebvre, 1991). This includes all components of the built environment: privately developed and owned housing tracts, commercial centers, and networks of transportation designed to unlock new areas of investment. Space itself

becomes a commodity, a new product that can be bought, sold, and speculated upon, a way to reproduce the capitalist mode of production through geographic expansion, managed by the urban planning of the capitalist state.

2. **The regulation of everyday life:** Space is produced in a way to discipline and organize society to meet the needs of capitalist production. For Lefebvre, the city becomes “the material device apt to organize production, control the daily life of the producers and the consumption of products.” Through the codes and plans that regulate land use, transportation, housing, and leisure, capitalist urbanization achieves a “socialization of society” around the “devouring activity, ‘consumption’” (Lefebvre, 1996, p. 117). Urban planning, he maintains, is “capitalism's and the state's strategic instrument for the manipulation of fragmented urban reality and the production of controlled space” (Lefebvre, 1976, p. 15).
3. **The naturalization of abstract space:** Lefebvre explains how socially produced space is presented as neutral and natural. He believes that the acceptance of space as such is due to a deliberate “complex of illusions” helping to maintain this abstract space that is otherwise *unnatural* and repressive. This illusion, which he describes as *second nature*, is designed into those spaces and our everyday life, keeping citizens from “uncovering the social relationships (including class relationships) that are latent in spaces” (Lefebvre, 1991, p. 90).
4. **Space as *global, fragmented, hierarchical*:** The urban planning of the capitalist state seeks to globalize space into one comprehensive system of production, consumption, and interchangeability that is “reductive of differences”. Space is segregated into spaces of residence, commerce, industry, and leisure. This process separates spaces “both in order

to control them and in order to make them negotiable” (Lefebvre, 1991, p. 282). Space, he argues, is hierarchized, with the classic example being the center-periphery contradiction. This separation from the commodities, information, and capital that constitute the center serves to “[exclude] those elements which it dominates (the “governed”, “subjects”, and “objects”) but which threaten it,” (Lefebvre, 1976, p. 18). This ‘trinity’ of social space serves to systematize all of geography into the urban-industrial fabric while masking the contradictions that would compromise its dominance and separating space according to capitalism’s social division of labor.

Finally, it is important to note the degree of autonomy with which Lefebvre views the social production of space. At one point in *The Production of Space* Lefebvre asserts that “The ‘commodity world’ and its characteristics ... now govern space as a whole, which thus attains the autonomous (or seemingly autonomous) reality of things, of money” (1991, p. 337). He goes as far as to say that the “products” that are commodified spaces “become more real ... than productive activity itself, which they thus take over” (Lefebvre, 1991, p. 81). Invoking Marx’s concept of commodity fetishism and applying it to urbanization as its own process independent of industrialized capitalism is no small claim. Lefebvre was aware of the boldness of his assertion, sometimes softening it saying this fetishization *may* take place under “specific sets of circumstances” and acknowledging a “number of objections may also be reasonably raised” in response (Lefebvre, 1991, p. 102). David Harvey would raise such objections.

Harvey and ‘The Spatial Fix’

David Harvey, like Lefebvre in *The Survival of Capitalism*, makes explicit reference to those long-theorized contradictions, frequently citing Karl Marx, himself, in *Capital* and *The Grundrisse*. Harvey, however, rejects some of the conclusions upon which other theorists arrive,

most notably Lefebvre, regarding the social production of space under capitalism. In his article *The Spatial Fix*, Harvey connects certain writings of Hegel, Marx, and Von Thünen as they relate to this topic. He comments on Hegel's idea of civil society and how it seeks an *outertransformation* to address the threats posed by its inner dialectic. Then he turns to Von Thünen's concept of the *frontier wage*, wherein laborers, faced with the minimal wages of industrialized capitalism, are able to migrate to available abundant land and subsist off their own property, forcing capitalists to raise wages to at least what one could earn on the frontier. This an idea towards which Harvey and Marx are critical, for its idealism and "childish" acceptance of "that 'patriarchal bond' whereby capitalists can fulfill their obligation to the laborer" (Harvey, 1981, p. 6). Finally, Harvey considers Marx's final chapter of *Capital* on colonization and his response to Von Thünen's frontier wage. Marx argues that the frontier wage, as a threat to capitalist ownership of the means of production, would be met with force and state intervention to ensure control over extractable surplus from the frontier (Harvey, 1971). Harvey found that these theorists were all asking the right question regarding how the tensions of capitalism's inner dialectic (namely, the contradiction of overaccumulation) might be resolved through some geographic expansion. This discussion sets up Harvey to introduce his own interpretation, the *spatial fix*. Ultimately, capitalists will turn to geographic expansion, investing in space, and capturing the frontier laborers as wage laborers. This, he believes, is what Marx meant to point towards in *Capital*. Ultimately, Harvey argues, the spatial fix does not provide a long-term solution to capitalism's contradictions, and "the social relations which propel capitalism's inner dialectic are merely re-created on a wider geographical scale" (Harvey, 1971, p. 9).

While the idea of the spatial fix shares many similarities to Lefebvre's assertions mentioned earlier, there lies key disagreements, however, between Lefebvre and Harvey's theories on the

social production of space, which Harvey makes clear. In *Social Justice and the City*, Harvey plainly rejects the degree of autonomy to which Lefebvre ascribes urbanism and the production of space. Harvey insists that the process of producing space should not be conceptualized in this way, affirming the primacy that industry holds over the process of urbanization. His counterargument to Lefebvre is threefold.

1. Fixed capital investments are needed to create the space these theorists are discussing here (Harvey, 1973).
2. Urbanization, to Harvey, creates demand for the products of industrialized capitalism. The response to that demand, however, is controlled and can be constricted “by conditions relating to industrial capitalism rather than to urbanism” (Harvey, 1973, p. 312).
3. The growth and decline of the secondary circuit of capital (that is, speculation on property) still operates as a function of the primary circuit in Harvey’s view and has not (at least yet) come to supplant it and achieve independence from the availability of capital (Harvey, 1973).

This disagreement can be tied back to the temporary nature of the *spatial fix* in relieving the internal contradictions of capitalism. Since the process of urbanization to Harvey is inseparable from the strategies of capitalism that work to reproduce its dominance in society, urbanization itself could never become an autonomous process. Rather, the social production of space only occurs because of constant inputs of *fixed capital investments*. “The processes governing industrial capitalism” are what guide urbanization and the production of space, not “those governing the evolution of urbanism as a separate structure” (Harvey, 1973, p. 311).

Soja and the Socio-Spatial Dialectic

In his 1980 article *The Socio-Spatial Dialectic*, Edward Soja takes into consideration previous theorizations of Lefebvre and Harvey (as well as Manuel Castells, Ernest Mandel and others) to provide his own distinct interpretation of urbanism under capitalism. He describes three camps of Marxist theorists who approach the spatial problematic of capitalism. These include a) those who refer to Marxist orthodoxy and completely reject any fetishization of space; b) those like Harvey who make considerable contributions to spatial analysis but “sidestep the spatial problematic” and lean closer to orthodoxy, as he does in addressing Lefebvre; and c) those like Lefebvre who make bold new takes on Marxist spatial analysis, going as far as pose the social production of space as autonomous (Soja, 1980, p. 214). His theoretical mapping of Lefebvre and Harvey is important here, since he offers an idea that draws from both theorists. Refusing to draw the same line in the sand that Harvey used to separate his theorization from Lefebvre’s autonomous, fetishized one, Soja, rather, states that this debate over cause and effect between social and spatial practices is an “empty question” (Soja, 1980, p. 208).

Soja’s conceptualization of spatial production emphasizes the dialectical nature of production and consumption under capitalism, applying this same character to relationship between the space production and industrial capitalism. These dialectics, he adds, are what these Marxist theorists fail to consider in their analyses. Soja introduces his own concept, the *socio-spatial dialectic*. There are a few novel contributions that his theory provides, distinguishing his conceptualization from those of Harvey and Lefebvre.

1. The spatial and social relations of production are homologous, emerging from the same condition: the capitalist mode of production (Soja, 1980).

2. Neither spatial nor social relations of production are autonomous, and neither one holds preeminence over the other in some sort of cause vs effect relationship. Rather, he puts forth the notion that these sets of relations are “dialectically inter-reactive, interdependent; that social relations of production are both space-forming and space-contingent” (Soja, 1980, p. 209).

In many ways, Soja agrees with and defends the concepts put forth by Lefebvre. A key example of this is how he discusses the roles of different fractions of capital in shaping space. In the context of the modern, monopoly capitalist city, finance capital (rather than productive capital or private property capital) plays an increasingly important role in shaping urban space (Soja, 1980). Further, he echoes Lefebvre’s ideas of nature vs second nature, with his own dichotomy. Soja asserts that there is *contextual space* (neutral, geometric, and primordial space in itself) and *created space* (a product of human action). Similarly to Lefebvre, he argues that the ideological dominance of a contextual view of space leads to a misguided understanding of created space where we view it as “a part of the "environment," a context for society-its container-rather than a structure created by society” (Soja, 1980, p. 210).

2.2.3 Spatial Justice

A final consideration when conceptualizing the spatial logic of capitalism is how it adversely affects the lives of those who inhabit urban space. All three of these theorists land on this conclusion in some form or another, although Harvey and Soja are more explicit about these connections, dedicating works to the topics of social justice and inequality as they relate to space.

Harvey and Soja both focus on who receives access to the benefits of urban growth. This analysis typically considers *distribution* between groups according to wealth, class, and racial-ethnic differences. As Soja describes spatial justice, it is about the “distribution in space of socially valued resources and the opportunities to use them” (Soja, 2019, p. 237). For Harvey, injustice is inherent to the spatial fix, a process which requires inequality to function. A central dynamic to the expansion of a city, he believes, is the unequal distribution of wealth among its inhabitants. A reflection of the social relations that constitute a capitalist structure of dominance, “an attempt to organize the distribution of externality effects to gain income advantages” and *income inequality* are the methods and results, respectively, of capitalist management of urban growth (Harvey, 1973, p. 58).

Lefebvre does not directly expound on the justice implications of capitalism’s spatial management like Harvey and Lefebvre. However, his work does point at social injustices caused inherent to the social production of space, particularly as it affects everyday life through the dominance of abstract space and repression of the lived and perceived experiences of humans. Often exhibiting a romanticism for the antique city and its *oeuvres* that are erased in the homogenized abstract space produced under capitalism, he states “There is a poverty of daily life as soon as nothing has replaced the symbols, the appropriations, the styles, the monuments, the times and rhythms, the different and qualified spaces of the traditional city” (Lefebvre, 1996, 44). In *The Production of Space*, Lefebvre makes frequent reference to how the very ideas of leisure and pleasure are manipulated under capitalism’s management of the built environment. A leisure that could exist in everyday life is programmed into an occasional event (holidays, vacations) and sequestered to its own spaces (tourist destinations), nothing but another space for another form of consumption. Our pleasurable experience in these “spaces set aside for leisure,”

he contends, “does not go beyond an illusory 'culture of the body', an imitation of natural life,” (Lefebvre, 1991). Finally, Lefebvre’s very idea of *the right to the city*, as described in his book of the same name, calls for a democratization of urban space and the city, highlighting the exploitation of citizens subjected to the *immutable structure* of urban society that had destroyed the benefits of the traditional city (Lefebvre, 1996).

2.2.3 Settling on a Spatial Logic of Capitalism

From the insights provided by Henri Lefebvre (as well as the later contributions of David Harvey and Edward Soja) we can identify a commonly theorized *spatial logic of capitalism*, wherein the city serves as a device for production and consumption, reproducing the contradictions necessary for capitalism’s survival. The spatial logic of capitalism is upheld by four primary strategies:

1. The commodification of space,
2. The naturalization of space,
3. The regulation of everyday life, and
4. Uneven spatial development

Figure 2 displays this paper’s conceptualization of the spatial logic of capitalism through a graphic representation. The four strategies identified are used to temporarily mitigate the internal contradictions of capitalism through a process of spatial expansion. This process reproduces capitalism’s dominance in society, while simultaneously exporting these contradictions over a wider geographic scale.

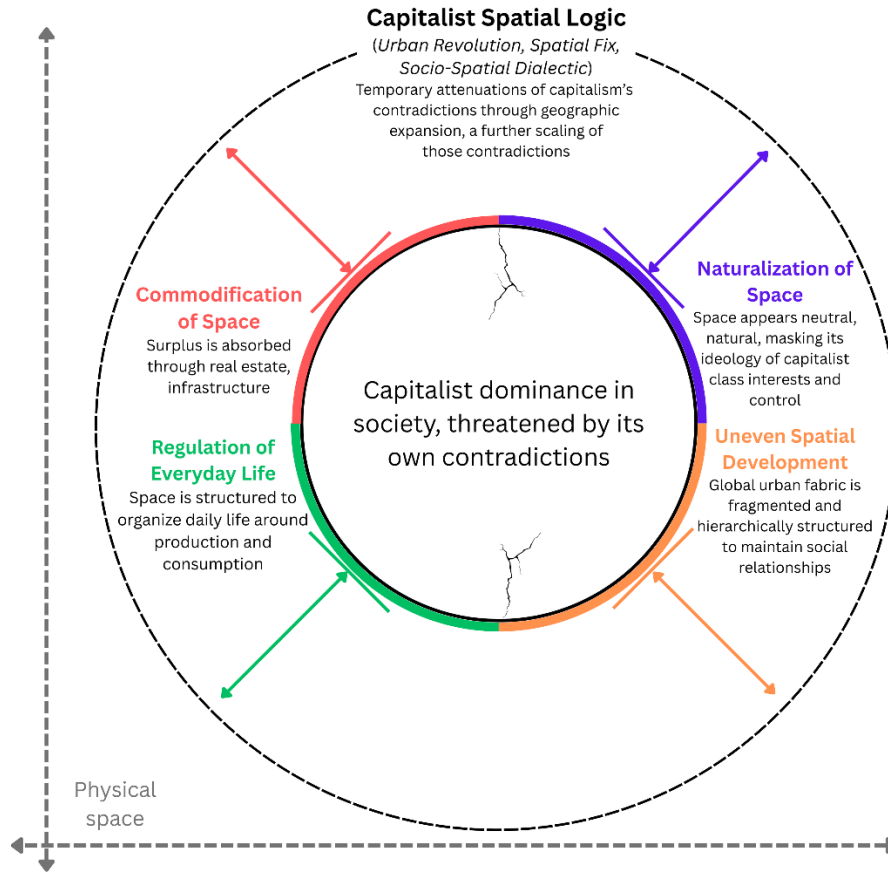


Figure 2: Capitalist Spatial Logic

2.2 Knowledge

One of the fundamental intellectual inquiries shared by these two schools of work, which helps lay the bedrock of this paper's argument, is their investigations into knowledge. These writers question how and why certain forms of knowledge are formed and employed.

2.2.1 Contemporary Researchers

The works of these modern researchers ask similar fundamental questions about why certain forms of knowledge are used over others, only they relate these questions directly to matters of street and road engineering.

It will first be helpful to approach this question of knowledge creation through the works of those modern-day planning and engineering researchers. These researchers look more specifically at the forms of knowledge used in the *practical* setting of designing urban streets, where Level of Service comes up as a prime example. This (mis)use of knowledge, after all, is the current problematic of transportation planning that this paper aims to address and understand.

A common stance shared by many of these critical transportation researchers is that the standards, methods, and “science” which dictate design decisions are not necessarily founded in good science, current or relevant data, or logical thinking. A common way that *many* of these researchers describe the work of transportation planners and engineers is with the word *pseudoscience* (Marohn, Jr., 2021; Marshall, 2024; Shoup, 2017). This understanding of the profession serves as a basic point of departure in this paper. These researchers highlight not just general misuse of science and reasoning, but specific biases, preferences, and values that are baked into engineering convention, and by extension, the design of our cities. The most glaring bias is a consistent preference for the private automobile.

The primary mode in which knowledge is centralized and circulated in the spheres of transportation planning and engineering is in the form of technical guidebooks and manuals. This fact represents a key problem with the work of planners and engineers. These texts, the most common of which are published by professional organizations like the Institute of Traffic Engineers (ITE), the Transportation Research Board (TRB), and the American Association of State Highway and Transportation Officials (AASHTO) are often treated like “bibles” by engineers and planners (Marohn, Jr, 2021; Marshall, 2024; Shoup; 2017). These books, which typically run from hundreds to over a thousand pages, with countless charts and tables for different roadway typologies, are treated like the Bible for this exact reason. It is the convenient compilation of so much knowledge under one cover, rather than some irreproachable wisdom they contain that give them their “centrality to the practice” (Marshall, 2024; Marohn, Jr., 2021).

As experienced firsthand by former New York City Transportation Commissioner, Janette Sadik-Khan, these “decades-old standards” that originated in the auto-obsessed era of the mid-20th century, are “part of the reason why our streets have been frozen in time ever since,” (Sadik-Khan, 2016). Researchers note that these standards and guidelines receive very little questioning by practitioners, thanks in part to the fact of their longstanding use in the field. So, despite the age of this handed-down knowledge, engineers and planners tend to not question, but rather “assume that the people who came before us did enough research to know what’s best,” (Marshall, 2024,). The knowledge is thought of as a *recipe* that has been proven by widespread use over many years (Marohn, Jr., 2021). The best practices we see in these books, as well presented as they are, are not inherently sound or practical when applied. Furthermore, writers find that these standards and methods are often based on notions from the mid-20th century,

when the newly necessary professions of street and highway design were in their infancy (Sadik-Khan, 2016; Marshall, 2024).

It is not just the age of the information in these manuals that is of dubious applicability, but also the methods used in acquiring this information. A survey of the ITE's 1987 *Parking Generation* manual, which planners rely on for determining how much parking certain land uses need, found that half of their 101 rates were based on 4 studies or less, and 22% were based on only one study (Shoup, 2017). ITE's *Trip Generation Handbook* has also received criticism for its methodologies. The projected number of trips generated by a new development is central to determining LOS impacts during traffic impact analyses. The overly simplistic nature of ITE's methodologies have been shown to overestimate resultant traffic congestion and help cause the "incremental overdevelopment of automobile facilities" (Currans, 2017, p. 343; Millard-Ball, 2015).

The TRB's Highway Capacity Manual, the source material for Level of Service and much of the field's understanding of roadway capacity, is another such text that has received criticism from researchers in recent years, but very little second thought from practitioners (Ewing, 1997; Litman, 2024; Marshall, 2024). First circulated in 1965, the performance metric of LOS has gone primarily unchanged, even into the 21st century editions of the HCM (Roess, et al., 2010). The methods behind determining LOS are noted to be "hazy" and contradictory. Further, while LOS is defined as a "qualitative" measure, it is consistently represented through quantitative means, which themselves are not sound in the way they produce results. Marshall also points out that the concept's stepwise function of the delay times makes for arbitrary LOS designations (Marshall, 2024). LOS projections, in addition, are measured at *peak* times of travel. This often consists of considering the congestion at an intersection or along a roadway segment during only the busiest

15 minutes of rush hour traffic. Outside of those brief moments of congestion, a roadway “may actually have an acceptable LOS range for the remaining 23 h and 45 min of that day” (Henderson, 2011, p. 1140). The poorly designed and misapplied nature of these methods, however, do not exist in themselves as neutral, poorly formed forms of knowledge.

These customary practices are said to incorporate certain “embedded values” as elaborated by Charles Marohn, Jr in his book *Confessions of a Recovering Engineer*. When it comes to designing streets and roads, there is a hierarchical order of what engineers implicitly deem the most important considerations. He asserts, from most to least important, these values are design speed, traffic volume, safety, and, finally, cost (Marohn, Jr, 2021). This idea is echoed by Reid Ewing, who in an early critique of LOS states that it places a greater import on “how fast vehicles move” rather than focusing on how well people’s travel needs are met,” (Ewing, 1997, p. 71).

These implicit values of engineers represent a large problem that many of the standards and guidebooks possess. It is a tendency to prioritize the car, in general, over other modes of transportation that permeates the conventional wisdom of engineers and planners. This tendency has not only important implications for the convenience of modes, but also the use of space in the city, which affects the development patterns, aesthetics, and productivity of a city, not to mention the convenience of living there. Looking specifically at LOS, Todd Litman concludes that this kind of thinking “favors automobile travel to the detriment of slower but more affordable, inclusive, and resource-efficient modes,” (2016, p. 32). As will be explored in the following sections, the knowledge we employ is not only worth investigating because of the methods and sources backing that knowledge, but also because of how it shapes urban space. In

thinking about from this angle, we see that much of our planning knowledge contains “a deep confusion over what it means to build a place,” (Marohn, Jr., 2021, p. 51).

2.2.2 Foucault and Lefebvre

Foucault provides us with an understanding of how the state often has a major influence over the knowledge that informs societal structure and the power relationships that exist in that structure. Foucault describes how the state will “intervene” in a process of “selection, normalization, hierarchicalization, and centralization” of knowledge, which constitutes the system of disciplinary power (Foucault, 2003, p. 181). The state’s ability to promote and legitimate certain disciplines does not represent a *complete* concentration of power in society. In fact, he describes it as something that circulates between all actors in society, rather than strictly being enforced in a top-down direction. However, despite power’s relational structure, these “delicate mechanisms of power cannot function unless knowledge, or rather knowledge apparatuses, are formed, organized and put into circulation,” which is a function typically performed by the state (Foucault, 2003, p. 33).

The state’s role in organizing knowledge into *disciplines* establishes a “normalizing society” where individuals are trained to act in accordance with certain norms, to accept certain power dynamics or ways of being as natural (Foucault, 2003, p. 38). Individuals are unknowingly made “subjected” or “docile bodies” and obey the conventions of a given discourse. This docility is a primary goal of the state’s efforts in organizing and circulating knowledge (Foucault 2003, p. 179). This normalization through knowledge, or the body “subjected to training” represents a concept a Foucault’s critical to this paper, a *technology of power*. He elaborates that these mechanisms of power cannot be reduced to laws, institutions, or moral choices. Rather, they are more subtle ways of controlling the behavior of individuals (Foucault, 1979). In the capitalist

state, this compliance with disciplinary power “increases the forces of the body (in economic terms of utility) and diminishes these same forces (in political terms of obedience),” (Foucault, 2003, p. 179).

Lefebvre, in his book *The Production of Space*, attempts to describe the process of knowledge creation, being most interested in those forms of knowledge that regulate the formation and subsequent use of urban space. The control over bodies is echoed by Lefebvre, who relates the concept more directly to the production of urban space in a capitalist society. He puts forth a similar idea of a *normalizing* relationship of knowledge and power that persists through a capitalist discourse of space, wherein “the supposed solutions of the planners thus impose the constraints of exchangeability on everyday life, while presenting them as both natural (or *normal*) and technical requirements - and often also as moral necessities,” (Lefebvre, 1991, p. 338). The reference to the “solutions of planners” and their ostensibly “technical” nature reflects that selective organization of knowledge into what we refer to as a science.

Lefebvre argues that urban space, while it may appear to be “‘neutral’, ‘objective’, fixed, transparent, innocent or indifferent implies more than the convenient establishment of an inoperative system of knowledge.” Rather, this knowledge represents “a complex of illusions, which can even cause us to forget completely that there is a total subject which acts continually to maintain and reproduce its own conditions of existence, namely the state,” (Lefebvre 1991, p. 94). Here we see, that, like Foucault, Lefebvre finds that power is not explicitly or visibly enforced down on bodies by the state, but that society is normalized into accepting the power relations which we can glean from our lived experience in a space. These power relations are established on the foundation of knowledge, a knowledge that is largely informed by the power of the state, and its own economic self-interest.

2.3 Spatial Logic of Capitalism

The second similarity that exists between our modern planning and engineering researchers and the theoretical work of Lefebvre and Foucault is an understanding that the creation and intended use of urban space (or *planning*) is not a purely objective process. Writing by both groups suggests that the way space is designed and ultimately used favors certain interests or at least perpetuates certain ways of being.

2.3.1 Contemporary Researchers

While these contemporary writers may not intend to make the same unified point as our two critical theorists, they nonetheless add to this paper's understanding of how urban space can be devised for effective, ineffective, or even exploitative uses. Further, much of this writing provides examples that focus on centering urban design around the automobile and the effects that that model of design has. The emphasis on production and its influence in planning urban space, while not the primary concern for those transportation planning and engineering researchers, is something that they acknowledge. When looking at the effects of street design on safety, Marshall finds that "early decision makers were more concerned with selling cars than assessing safety," when they came up with the standards we still adhere to today (2024, p. 13). Jason Henderson notes, referencing the work of Lefebvre and Harvey, how the preference of car travel through investments in automobile facilities over more sustainable and space-efficient infrastructure reflects social relations. Specifically looking at Atlanta, Georgia's mobility efforts, he remarks how investments were influenced by and built to benefit business interests, rather than people of lower socio-economic status who would benefit from public transit access (Henderson, 2004).

Specifically looking at the design of different types of infrastructure, Charles Marohn offers a helpful interpretation of the differences between streets and roads. The defining physical aspects of streets are low speeds, high levels of access to adjacent development, and higher levels of complexity due to the intensity of development and number of people outside vehicles. His simplest definition, however, is based on another form of analysis. He states, “While roads connect productive places, streets are the platform for building wealth within a community.” He emphasizes this point in saying that “The greatest value is provided where speeds are very low (street) and where they are very high (road),” (Marohn, Jr, 2021, p. 42). Here we already see how space serves a certain purpose greater than the physical. What he is pointing to, one can argue, is the concept of *use value* that a traditional, human-centered form of urban development provides. He elaborates further, saying that our preference for designing with LOS “describes an anti-place — the opposite of the platform for wealth that a city is trying to build with its streets,” (Marohn, 2021, p. 73). Susan Handy’s research on the link between transportation and land use points to the same patterns. American transportation policies that invest in highways, freeways, and large interchanges guide the sprawling development pattern that dominates the American built environment, such as large subdivisions, shopping malls, and gas stations (Handy, 2005)

This effect of LOS on urban form is echoed by other researchers, especially as part of the land development review process in urban areas. It is argued that since urban areas have more intense land use and greater baseline congestion, LOS impacts from development in these areas are far more common than in suburban or rural areas. This leads developers to avoid urban centers in preference of fringe areas to avoid fees and the costs of paying for congestion mitigation measures (Volker, et al., 2021).

But moving away from this practice and designing a city that is convenient for more than just driving has proven to be politically challenging as it challenges prevailing ideology. One study looked at the use of LOS in San Francisco and how it limits the accommodation of other modes and the ability to build dense urban developments, particularly housing. Studying planning documents and government initiatives as well as conducting interviews, Jason Henderson found that the cemented legacy of LOS has a “chilling effect on thinking about possibilities of how urban streets can be used, and it dampens enthusiasm among decision-makers” (2011, p. 1139).

This, essentially, is the *rejection* of use value and the traditional city. But to what ends does this type of planning serve? Marohn offers an example of urban renewal policies and the building of urban interstates in the 1950s and 1960s (both of which will be discussed in later sections). He describes this period of urban and suburban development as “a multi-decade economic mania” where the federal government directed the country’s industrial power toward a “continent-wide new living arrangement” where the urban land of minority-owned housing was devalued, and federal-backed mortgages were made available for the purchase of large suburban housing (Marohn, 2019, p. 86). At the same time, “the transformation of local communities around the automobile” and the top-down transportation investment of interstates were designed to free up land for development (Marohn, 2021, p. 165). Further, the traditional, pre-automobile form of urban development, to Marohn, actually provides “*higher* levels of financial productivity [emphasis added],” in terms of *community* wealth. Focusing on Gross Domestic Product, or a high “volume of transactions” (consumption), which is often a qualifying measurement when assessing new transportation infrastructure, only results in “the *community* ... merely growing poorer,” (Marohn, 2021, p. 87).

2.3.2 Foucault and Lefebvre

In *The Production of Space*, Lefebvre's overarching assertion is that "space serves ... in the establishment, on the basis of an underlying logic and with the help of knowledge and technical expertise, of a 'system'" (Lefebvre, 1991, p. 11). This conception of space, as something that serves a greater signification than just that of a physical setting, particularly in terms of an urban built environment, will be a starting point in the remaining review of the literature and the later historical analysis of watershed moments. Specifically, we analyze those moments and the Level of Service design standard through what this paper considers the *spatial logic of capitalism*.

In his work, Lefebvre describes *abstract space*, the dominant form of space produced under capitalism which "includes the 'world of commodities', its 'logic' and its worldwide strategies, as well as the power of money and that of the political state" (Lefebvre, 1991, p. 105). These abstract spaces are reliant on *representations of space*, that is, the conceptualized space of planners and engineers consisting of signs, codes, and geometry; a political use of knowledge that is tied to the relations of production and which carries an ideology (Lefebvre, 1991). Urban reality, he explains, loses its historic features of "organic totality, belonging, an uplifting image, a sense of space that was measured and dominated by monumental splendor", replaced by "signals, summary codes for circulation (routes), and signage," (Lefebvre, 2014, p. 14). This is the same type of space that Charles Marohn describes as an "anti-place", mentioned earlier. He describes planners and engineers who, if they were intellectually consistent, could be expected to live in "a home built almost exclusively of hallways," (Marohn, 2021, p. 74).

In specific moments, Lefebvre contends that the traffic congestion-focused knowledge of planners leads to an abandonment of the useful urban space found in the traditional city. He says,

“this technocratic and systematized planning, with its myths and its ideology (namely, the primacy of technique), would not hesitate to raze to the ground what is left of the city to leave way for cars,” (Lefebvre, 1996, pp. 15-6). In later sections of this paper on slum clearance and urban interstate construction of the 1950s and 1960s, we see specific examples of how ideology-infused technique is operationalized.

Lefebvre’s main assertion with planning knowledge, however, is not that it is rooted in a preference for automobile travel. This is only a manifestation of a deeper ideological infection. Rather, the planning of urban space in the period of *neocapitalism* is informed by a need to reproduce the capitalist mode of production, regulating the lives of individuals to do so. He states that the “science of space” is “a knowledge which is at once integrated into, and integrative with respect to, the mode of production,” (Lefebvre, 1991, p. 9). Under the “name of planning,” the city “becomes the material device apt to organize production, control the daily life of the producers and the consumption of products” (Lefebvre, 1996, p. 44).

This idea of government planning as a tool to organize production, consumption, and lives is reflected in the work of Foucault as well, particularly as it relates to his concepts of disciplinary power (already mentioned) and a later idea of governmentality.¹ While his writing was not primarily focused on issues of space or the urban, it does often discuss the norms and forms of power that permeate designed space. In his book *Discipline and Punish*, he writes extensively

¹ It is important to note the progression over time of how Foucault describes the ways that power operates in society. From *Discipline and Punish*, specifically, to his work in later years, Foucault shifts from an idea primarily concerned with *disciplinary power* to an idea of *governmentality*. While disciplinary power is concerned with power exercised over bodies and governmentality focuses more on the organization of populations, society, and its structures, there still exist key throughlines between these ideas that remain relevant to this paper’s analysis. These include the dominant role that the state (the US federal government, in our case) plays in influencing power relations and the operationalization of knowledge into disciplines or technologies of power. In short, it is not the ideas of disciplinary power and governmentality *themselves* with which this paper is most concerned, but rather those theoretical throughlines central to both ideas.

about how urban space was used in the 17th and 18th centuries as a stage for the “spectacle” of punishment and the normalizing role of knowledge over individuals, which can dictate how we use urban space (Foucault, 1977). Foucault’s writings, especially concerning his idea of *heterotopia*, also suggest agreement with Lefebvre’s core assertion that space is not a neutral container in which we live. Specifically, he states, “we do not live in a kind of void, inside of which we could place individuals and things ... We live inside a set of relations that delineates sites which are irreducible to one another and absolutely not superimposable on one another” (Foucault, 1986, p. 23).

Foucault’s writing in the years following, *Discipline and Punish*, however, further incorporates a helpful concept to this paper’s discussion on the creation of urban space, the idea of *technologies of power*. In a particular interview titled *Truth and Power*, Foucault describes technologies of power as methods and techniques of a “concrete and precise character” with an objective of “obtaining productive service from individuals in their concrete lives” (Foucault, 1980, p. 124). In this context, technologies of power are exercised over populations, in other words “the control and direction of the accumulation of men” which is used to promote “the economic system that promotes the accumulation of capital,” (Foucault, 1980, p. 124). He identifies that from the end of the 18th century onward that “becomes a question of using the disposition of space for economic-political ends.” He goes on to state that the regulation of space “has to do with the preservation, upkeep and conservation of the ‘labour force’,” (Foucault, 1980, p. 148). This idea of the regulation of populations is central and closely related to his concept of *governmentality*, which can be related to matters of urban planning. In his lectures on *Security, Territory, and Population*, he concludes that the ultimate objective of governmentality “ensuring the security of the natural phenomena of economic processes or processes intrinsic to population,” (Foucault,

2007, p. 451). This idea is relevant to this paper's discussions on highway infrastructure in the mid-20th century, where the federal government imposed decentralization and the related housing development and car-dependent life on urban areas. By partaking (or, existing) in this physical restructuring of society, citizens 'naturally' play a role in the process of production and accumulation laid out by the state. In this process, design standards like Level of Service function as a technology of power, a method employed to ensure 'natural' economic processes.

This "double process of industrialization-urbanization" means an "explosion" of the traditional city, with modern urban society paving over its ruins. Urban reality, for many, is voided of the *oeuvres* or urban beauty found in the "streets, squares, edifices and monuments" (Lefebvre, 1996, pp. 4-5) of the antique city (a city that is still related to commerce, to be sure) and is replaced with urban spaces which are products, cultivating greater exchange value. Such spaces in an urban environment feature a distortion of what Lefebvre calls *spatial practice* or the perceived aspect of space, where now our daily routines become closely associated with the "urban reality" of "the routes and networks that link up the places set aside for work, 'private' life, and leisure." *Representational space*, he describes, are symbols and aesthetics within space that humans attach emotional significance to. The idea of the traditional city and historic town loses its force through this industrialization-based method of urbanization (Lefebvre, 1991).

Spatial practice, representational space, and representations of space (mentioned earlier) make up Lefebvre's perceived-lived-conceived process of space, a process manipulated into complete abstraction by capitalist forces for the purposes of production and accumulation.

This, again, is the true capitalist spatial logic: exchange value over use value; an abandonment of the old ways of urban life, complete with the possibility of social interaction, beauty, and a

richness of lived experience, replaced by an abstract landscape of interchangeability,
commodification.

Chapter 3

Methodology

3.1 Selection of Watershed Moments and Analytical Criteria

This study employs a historical-interpretive methodology to examine how federal policy interventions have influenced the production of urban space in the United States in accordance with the spatial logic of capitalism. To do so, the analysis focuses on three federal policy episodes, or *Watershed Moments*, which, due to their discursive and institutional power, significantly shaped state and municipal planning practices during the 20th century.

The selection of these moments was guided by two primary criteria:

1. **Knowledge Production and Institutional Authority:** Each moment represents a federal-level intervention that actively produced and disseminated planning knowledge to subordinate jurisdictions. These moments served as vectors through which technical and ideological frameworks, especially those governing urban spatial organization, were communicated to local governments.
2. **Alignment with the Spatial Logic of Capitalism:** The selected events articulate state-sanctioned goals, rationalities, and techniques that conform to what this paper (drawing on the theorizations of Lefebvre, Harvey, and Soja) terms the *spatial logic of capitalism*. This logic involves the commodification, segmentation, regulation, and functionalization of space in ways that sustain production, consumption, and, by extension, the capitalist state's authority.

The three selected Watershed Moments are:

- The **First National Conference on Street and Highway Safety** (1924)
- The **Housing Act of 1949**
- The **Federal-Aid Highway Act of 1956**

These moments are examined in chronological order, highlighting the temporal and discursive continuity through which a capitalist spatial logic became increasingly institutionalized within urban transportation policy. The analysis focuses on how each event manifests the above characteristics in both its textual content and practical consequences.

3.2 Justification for Source Selection and Exclusions

These three federal interventions were selected due to their national reach, their legislative or bureaucratic authority, and their explicit connection to the restructuring of urban space on a national scale. Each significantly contributed to the intellectual and regulatory environment that culminated in the 1965 edition of the *Highway Capacity Manual (HCM)*, particularly in the emergence of the *Level of Service* metric as a “technology of power.”

Other moments were considered but ultimately excluded for methodological reasons. For instance, while the **1950 edition of the Highway Capacity Manual** is a foundational text in transportation planning, it functions more as a **technical effect** of earlier federal guidance rather than an originating cause. Therefore, the HCM (1965) is treated not as a standalone Watershed Moment but as a culmination of prior ideological and regulatory developments.

Likewise, the **1958 Sagamore Conference on Highways and Urban Development**, though significant in coordinating state and municipal highway efforts, lacked the authoritative legal force of federal legislation (Reft, et al., 2023). Additionally, the influence of private actors, such as the role of National City Lines (a holding company organized by General Motors, Firestone

Tires, and Standard Oil of California) in dismantling public transit systems, are noteworthy but were excluded from the central analysis due to the study's focus on state power and regulatory **frameworks**, rather than market-based or corporate interventions alone (United States v. National City Lines, 1948).

3.3 Analytical Framework

Figure 3 reintroduces the capitalist spatial logic established earlier, through a synthesization of the works of Lefebvre, Harvey, and Soja. The diagram of this logic shows how the four strategies identified earlier are used to assuage the contradictions internal to capitalism that threaten to destroy it, while spreading these contradictions spatial expansion, managing and controlling that space to reproduce the social conditions of capitalist growth. It is essential to establish this spatial logic of capitalism, as it will provide the foundation for the analytical framework (**Figure 4**) which will be used to perform the coming content analysis of watershed moments.

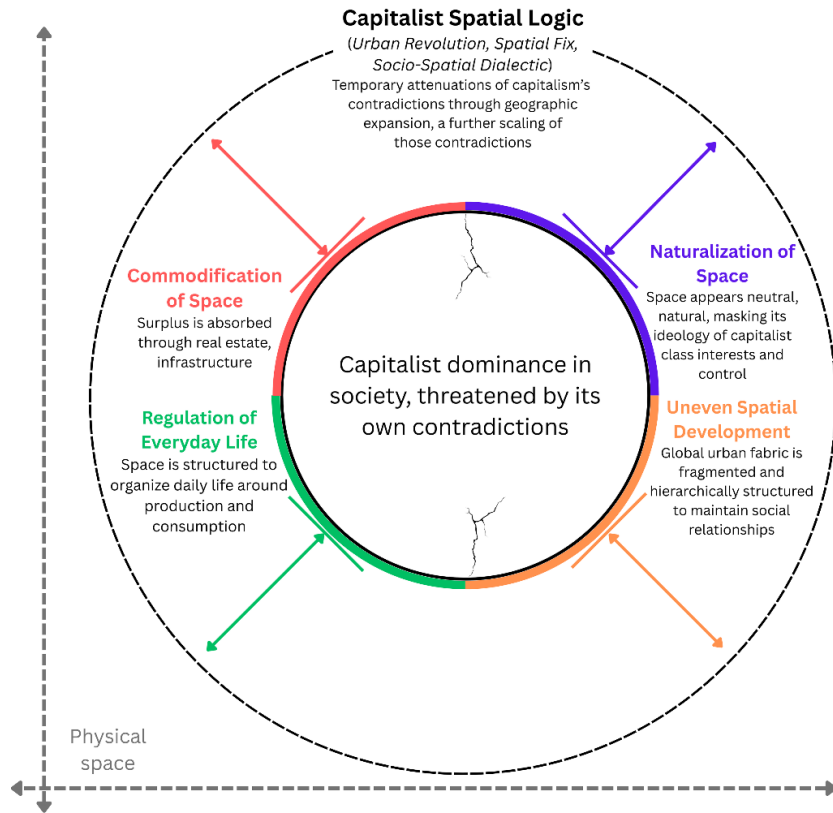


Figure 3: Capitalist Spatial Logic

Figure 4 offers a visual representation of this paper's analytical framework, which will be applied to the following analysis of three Watershed Moments.

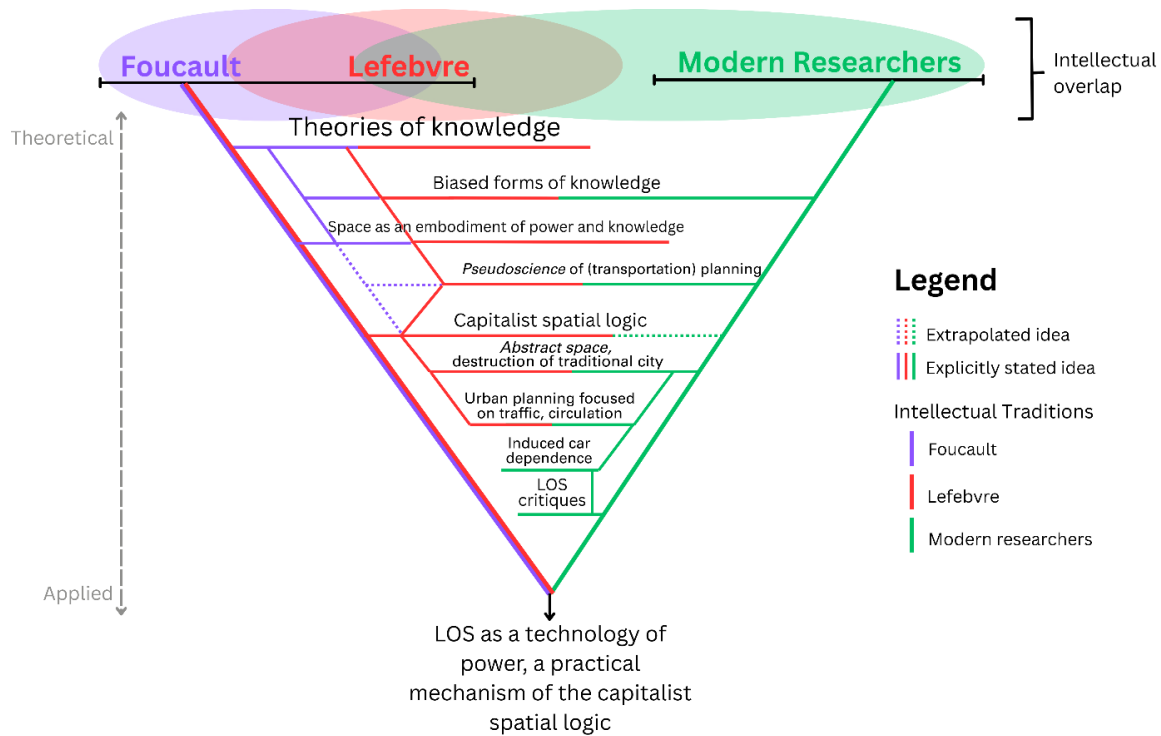


Figure 4: Analytical framework, as applied to the historical analysis of Watershed Moments

This diagram maps the theoretical lineage connecting Foucault's and Lefebvre's theories on knowledge, power, and space with modern research in critical transportation planning scholarship. The diagram illustrates how these three distinct traditions, despite starting from different intellectual positions, converge on similar critiques which can be applied to transportation design metrics like Level of Service. This framework will help answer the main question of this thesis: *How does the use of LOS as a measure of urban transportation system quality represent a knowledge mechanism (or technology of power) which imposes upon cities the capitalist spatial logic of urbanization, as established by federal policy setting in the mid-20th century?*

Chapter 4

Content Analysis: Watershed Moments

This section analyzes three Watershed Moments that helped establish and reproduce ideas of what city streets should be used for and how the city should be designed to accommodate those preferred uses. These three watershed moments are actions taken by the United States federal government during the early- to mid-twentieth century whose purposes were to guide or directly regulate urban development and transportation. The point is not that these policies are directly responsible for our modern use of Level of Service, but rather that they helped create an understanding of the growing city and of how transportation should function on its streets. This understanding views the city as a device for organizing production and consumption, with the built environment being treated as a commodity.

LOS as a way to measure transportation system “quality” on urban streets fits into this understanding of urbanization. As a codified form of knowledge, LOS is employed as a tool that contributes to the city’s role as a capitalist device. As will be shown through the following analysis, the federal government had already been organizing the knowledge and disciplines of transportation and urban planning to serve this function of the city in the age of the motor vehicle. This represents a neoliberal method of urban planning; wherein state power is used to promote the free market as a solution to society’s needs.

This federal-level intervention is analyzed in the following three moments of policy setting: 1) The First National Conference on Street and Highway Safety; 2) The Housing Act of 1949; and 3) The Federal-Aid Highway Act of 1956. Accompanying the official texts associated with these watershed moments, this section will reference a selection of sources (not included in the

literature review) that provide historical context to the events surrounding these federal actions and evidence of their impacts.

4.1 The First National Conference on Street and Highway Safety, 1924

4.1.1 Transportation Means Business

A major early action that helped establish our national understanding of what urban transportation would look like in the age of the car was the First National Conference on Street and Highway Safety, organized in 1924 by the Department of Commerce under then Secretary Herbert Hoover. This was the first national gathering to discuss the dangers associated with automobile traffic, with the goal of “the attainment of a common standard of perfection,” to be adopted by states and localities so that “rules may be wise and uniform” across the country (First National Conference on Street and Highway Safety, 1924, p. 5).

This conference was made up of various committees, constituted by leaders of national transportation-related associations, officials from federal agencies, state highway officials, university researchers, and industry leaders. While their role was not to write some federal legislation regulating traffic, President Calvin Coolidge emphasized their influence in his conference address, stating, “further course of action and regulation will largely depend on your recommendations,” (First National Conference on Street and Highway Safety, 1924, p. 6). This statement from the nation’s chief executive represents a desire to form, organize, and circulate new apparatuses of knowledge, which would help to establish a discourse on the way the city functions and the way street space is used.

The opening address by Conference Chairman and Commerce Secretary Hoover provides further insight into the logical foundation that these knowledge apparatuses would be built upon and subsequently help to reproduce. Hoover goes into deeper detail in describing the costs related to

traffic accidents, citing the 22,600 deaths and 678,000 serious injuries in 1923, an 80 percent increase over the preceding 7 years. He also notes that 65 percent of street and road users in that time were pedestrians, a group that suffered “a very large portion” of those deaths and injuries. He is sure to mention, as well, the “millions of property damage” and an estimated \$600,000,000 in yearly economic loss associated with these collisions (First National Conference on Street and Highway Safety, 1924, p. 7). Despite these injuries to human life, personal property, and productivity, Hoover moves onto focus on the virtues of the personal automobile. Hoover states that this new technology is “the greatest development of twenty years, both economically and socially” and further, that owning a car is “no longer a luxury—it is a complete necessity.” He even compares the “almost incredible” growth of the auto industry in the early 20th century to works of science fiction (First National Conference on Street and Highway Safety, 1924, p. 8).

This infatuation with the automobile, not only as a technology, but as a driver of economic growth, should not be overlooked. It is worth remembering that, after all, this conference concerning “safety” and the future of the automobile, was put under the authority of the Department of *Commerce*, rather than the Bureau of Public Roads, for example. Peter Norton, in his extensive research on the Conference, found that at most 7 percent of the 607 Conference participants were engineers, of which only one was a city traffic engineer (Norton, 2008). Of the eight Conference committees, four of them were led by secretaries who served on the Chamber of Commerce of the United States (First National Conference on Street and Highway Safety, 1924).

In these early days of the car, the federal government clearly recognized the economic potential of a domestic auto industry. And so, as we see in the following sections of the report, matters of

traffic regulation, city planning, and “street and highway *safety*” had become synonymous with matters of *commerce* and the accumulation of capital.

4.1.2 Planning for Traffic

The conference report provides sections on legislative principles, administrative and regulatory principles, and suggestions for cooperative work between public and private entities. While the two other sections are worth analysis, it is the administrative and regulatory principles that are most relevant and clearly align with greater ideas associated with car-centered design. Many of the recommendations in this section foreshadow what would become widely accepted ideas of city planning and design moving forward.

The principles in this section are largely principles related to traffic flow, and how planning and policy can be designed to prevent traffic congestion. They recommend several street design elements that should be optimized to ensure the smooth operation of vehicles on our cities’ streets. These considerations include width, corner radius, and sight clearance, all of which are measures cited in the *Highway Capacity Manual* as ways to improve capacity and enhance the level of service (TRB, 1965). They go as far to say that, within *cities*, roadways should be “wide enough for at least three lanes of traffic without streetcars and four lanes with streetcars,” First National Conference on Street and Highway Safety, 1924, p. 23). At the same time, they recommend that pedestrians be “instructed, urged, and required to keep within the boundaries of designated safety zones and crossing places,” (First National Conference on Street and Highway Safety, 1924, p. 28).

The Conference provides many recommendations on the “zoning regulation of private property”, which take this car-centric approach a step further. Beyond the design of the street, the entire city should be laid out to enhance the experience of those driving cars. In fact, the report calls for a

general change towards less dense development and the control of land uses to best accommodate traffic. Specifically, we see a call for cities to “determine, through use and zoning, the use and bulk of abutting buildings” and the “control of subdivisions” to avoid “the types of streets which tend to congest traffic,” (First National Conference on Street and Highway Safety, 1924, p. 22). Further, the Conference hopes for a wider decentralization of cities into far flung metro areas, whose peripheral communities should, themselves, be designed for traffic.

It is necessary for each legion or group of communities to plan more carefully the development of industrial and business sub-centers and satellite communities with a view both to encouraging appropriate *decentralization* and to preventing these new centers from in turn becoming areas of traffic congestion and danger. (First National Conference on Street and Highway Safety, 1924, p. 22)

These recommendations represent more than planning for the emerging needs of an evolving transportation network. Rather, it places a priority on the needs of drivers over those of other modes of transportation. To decentralize urban areas while dispersing and segregating development with respect to land use is to guarantee that future developments, and those who want to access those developments, will depend on the use of automobiles. This represents a “dissolution of the city”, as Lefebvre describes, once the city becomes “associated to industrial enterprise and the “planned land use of the territory into the ‘urban fabric’ determined by the constraints of traffic,” (Lefebvre, 1996, pp. 44-5).

4.1.3 Model Municipal Traffic Ordinance

The ideas of the Conference did not end, however, with the conference report. The knowledge that was organized by the conference was further circulated and promoted with the resulting *Model Municipal Traffic Ordinance*, published in 1928. The Model Ordinance takes the

recommendations of the Conference and presents them as legislation, available to be deployed by any willing municipality. As the name suggests, the document is written out like a template local traffic code, even providing blank spaces where the adopter can simply insert the name of their municipality or add a reference to an existing local policy. By the end of that year, more than 100 American cities had adopted it as their own ordinances. By 1930, Wisconsin and New Jersey had adopted most of it for use in their cities, state-wide (Norton, 2008).

As the Conference had recommended, the Model Ordinance sought to simplify and streamline the regulation of vehicular traffic on city streets and rural highways, establishing *standards* that could be respected across the nation's independent jurisdictions. What this also required, however, was a complete reimagining of what the city street, in particular, could be used for. It is important to note that before this time, the street was not a space dedicated to the movement of motor vehicles. In fact, cars were first perceived by many as intruders in a public space. Engineering historian Peter Norton reminds us that at the beginning of the 20th century, the city street was a space shared in a "delicate and sometimes unstable balance" between pedestrians, playing children, commercial vendors, streetcars, horsedrawn carriages, and, for a brief time, private automobiles. During a period marked by high rates of traffic related death and injury, as noted by Secretary Hoover, there were cries from pedestrians and motorists for the street privileges to be officially given to one user over the other (Norton, 2007). With state-sponsored thrusts like the First National Conference on Street and Highway Safety, it was the private car who would win the fight for the street. New ideas had been formed, centralized, and circulated that would affect an ideological paradigm shift in urban transportation. This shift could happen most easily through the recommendation and adoption of new laws.

Among the regulations in the ordinance were multiple sections normalizing a new behavior for pedestrians. Unlike before, the new standard for those on foot was to yield right of way to vehicular traffic. Under the ordinance, pedestrian right of way would now be officially restricted to crosswalks, and only with the proper signal when it comes to controlled intersections (National Conference on Street and Highway Safety, 1930).

4.2 Housing Act of 1949

With the Housing Act of 1949 came a further reimagining of what the city was meant to be. Passed by the 81st Congress under presidency of Harry S. Truman, this piece of federal legislation has been the subject of scrutiny and academic research, largely due to its destructive consequences for poor, minority neighborhoods in the downtowns of hundreds of cities across the United States (Fullilove, 2016; Tucker-Abramson, 2018). Particularly when considered together with the Federal-Aid Highway Act of 1956, the Housing Act was instrumental in the “explosion” of the traditional city, as Lefebvre might call it, and the prioritization of the car driver in urban transportation.

But even without the sweeping interstate highways that came to dominate the urban landscapes of those cities, the Housing Act of 1949 itself still had a major impact on ideas of urban transportation, the city’s built form, and the general process of urbanization.

Title I is perhaps the section for which the Housing Act is most infamous. Here, the bill authorized one billion dollars in loans for cities to use to acquire and “eliminat[e] their slums and blighted areas” and to provide “maximum opportunity for the redevelopment of project areas by private enterprise,” (Housing Act of 1949, 1949, p. 414). With these funds, the United States government, with its municipality grantees, “bulldozed 2,500 neighborhoods in 993 American cities” during the period between 1949 and 1973 (Fullilove, 2016, p. 23).

In her seminal book on the impacts of Urban Renewal, *Root Shock*, Dr. Mindy Thompson Fullilove describes the built forms of those neighborhoods before their destruction, informed by resident interviews and historic city maps. From this information, Fullilove describes the typical changes that occurred in most of these cities. In almost every case, denser neighborhoods featuring narrow streets and a mix of practical uses were replaced with infrastructure more fit for the private car (Fullilove, 2016).

It was not just the federally funded removal of walkable downtown neighborhoods that would cement the Housing Act's impact on patterns of urban development and transportation in American cities. Equally important to what kinds of (re)developments would occur under the Act was *who* would carry out development. This law places an extra emphasis on the role of private developers in reshaping American cities in the image of the suburb. In fact, the very first paragraph of the 1949 Act declares that mass housing production is not only necessary to meet the needs of American citizens, but also "to enable the housing industry to make its full contribution toward an economy of maximum employment, production, and purchasing power" which would positively contribute to the "advancement of the growth, wealth, and security of the Nation" (1949, p. 413). Specifically, the policy prescribes that "private enterprise shall be encouraged to serve as large a part of the total need as it can" and that "governmental assistance shall be utilized where feasible to enable private enterprise to serve more of the total need," (Housing Act of 1949, 1949, p. 413).

Here, we see the national strategy for developing housing (and thus to a large extent, cities themselves), as laid out and approved by Congress. By entrusting private industry with so much of the country's urban development, the federal government was ensuring that market forces would have as large of an influence as possible in shaping urban space. This method represents a

neoliberal logic of urbanization, where we see the state prioritizing and promoting the market as a solution to society's problems, in this case a housing shortage and a perceived "blight" that was low-income urban centers.

Fullilove's description of urban renewal's effect on the built environment is that "it stripped the downtown of residences and replaced people-friendly blocks and structures with megablocks and megabuildings surrounded by parking lots," (Fullilove, 2016, p. 95). This method of urban development reflects what Henri Lefebvre described as the "first period" of the destruction of the city in the era of "neocapitalism":

Industry and the process of industrialization assault and ravage pre-existing urban reality, destroying it through practice and ideology, to the point of extirpating it from reality and consciousness. Led by a class strategy, industrialization acts as a negative force over urban reality: the urban social is denied by the industrial economic. (Lefebvre, 1996, p. 14)

4.3 Federal-Aid Highway Act of 1956

The final federal action that this paper presents as an ideological precursor to the 1965 *Highway Capacity Manual* and the subsequent adoption of Level of Service as a measure of urban transportation system quality is the Federal-Aid Highway Act of 1956. This piece of federal legislation provides, for the first time, both the authorization and the allocation of funds to construct the national highway system that we know today. As with the other watershed moments, this federal action informed our ideas of how urban space should ideally be used and what modes of transportation should be prioritized in these spaces.

Before analyzing the 1956 Act, itself, it will also be important to look at the 1955 *General Location of National System of Interstate Highways Including All Additional Routes at Urban Areas* (also known as “The Yellow Book”). This book served a dual role as both an early phase planning document and marketing material for the proposed interstate system. Approved by the Bureau of Public Roads in 1955, the *Yellow Book* opens with a map of the continental United States, overlaid by a spiderweb-like system of curving lines, with a high density along focused on the east coast that inevitably stretches across the Midwest, ending with a single line running parallel to the Pacific coast. The next one hundred pages, on the other hand, display the proposed “additional routes into, through, and around urban areas,” where this system would connect to the nation’s largest population centers (Bureau of Public Roads, 1955). Each page shows a map of a different city (representing 44 states and Washington, D.C.) with a proposed interstate piercing the city limits. In many cases there are multiple branches, with their routes going directly through urban centers.

The first way in which this policy influenced the national discourse on transportation is through the funding that the bill authorized. The legislation officially allocated existing funds, from the 1944 Federal-Aid Highway Act, in billions of dollars every fiscal year through 1969 until the national system was brought to completion. Furthermore, the Act ensures that the federal government will pay for ninety percent of the total cost of “any project on the Interstate System,” plus a further portion of the remaining ten percent in any “State containing unappropriated and unreserved public lands and nontaxable Indian lands,” (Federal-Aid Highway Act of 1956, 1956, p. 376). This section on federal cost share, while not explicitly written about the design of roadways or city streets, has some

of the greatest implications for the design of urban space, and urban streets especially, in the mid-20th century and onward. While it may seem natural for the federal government to provide a majority of funds for a national system of highways, it is once again the use of these funds for projects in the *urban* setting that becomes especially problematic.

Offering ninety percent of up-front capital investments provides localities a way to save money on their locally serving transportation infrastructure. This means, however, that these cities took on massive, high-capacity automobile infrastructure that they then must configure the city around. This applies not just to the extensive networks of collectors and arterial streets that feed the main urban freeway, but also in terms of the adjacent private development. After the initial capital investments to construct these roadways, localities often remain dependent on federal and state funds for maintenance, since their decentralized, dispersed private development typically does not provide enough revenue to pay for maintenance locally. To receive funding, these cities must maintain federal and state design standards on these urban roadways, which are taken directly from the Highway Capacity Manual, namely, Level of Service (Marohn, Jr., 2021; Roess, et al., 2010).

In addition to the implications of the individual aspects mentioned above, this federal legislation can be understood, on a greater scale, as an ideological continuation of the two previous watershed moments. Like the Housing Act of 1949, the Highway Act contributes to the same idea of an ideal urban form with the patterns of development it promotes. With the creation of national highways that feed directly into the country's biggest cities (often running straight through them), this transforms the city into a decentralized urban region, wherein everything is accessible by car. With the private

automobile as your ticket into, out of, and around the city, there is no need to live within the city. This proposed ease of individual movement, coupled with federal policies subsidizing suburban housing development, promoted a sprawling urban landscape that destroyed the traditional city where walking, cycling, and public transit are more feasible forms of daily travel.

Chapter 5

Level of Service, Highway Capacity Manual (1965 and on)

Thus far, the three Watershed Moments have been established as promoters of a capitalist spatial logic that would prefer the destruction of the traditional city for a development pattern that necessitates car ownership as an individual's means for travelling in this decentralized urban area. This section aims to fit the *Highway Capacity Manual* and its use of Level of Service (LOS) within the same narrative of ideology-informed urban planning thought through a content analysis of multiple editions of the HCM.

Specifically, we investigate the definitions and methodology behind LOS, and how these factors form the urban built environment into one centered around the car, rather than the human. The section concludes with a case study of a particular urban arterial whose design is beholden to codified LOS standards to show the concrete, detrimental effects of these methods.

The *Highway Capacity Manual* itself functions as a “science” of planning, as Lefebvre might describe it, which, “implies an ideology ... along with the conflicts intrinsic to the highly interested employment of a supposedly disinterested knowledge,” (Lefebvre, 1991, p. 9). It represents a progression of the knowledge organized during those previous moments of federal policy-setting, wherein our understanding of urban transportation and effective city planning was centered on serving the car for its role in national economic growth.

6.1 LOS: Definition and Methodology

The first way in which this automobile-travel-preference reveals itself is in the very definition of Level of Service. In the 1965 manual, the committee explains what considerations are taken into account in determining an LOS letter grade: speed and travel time; traffic interruptions; freedom to maneuver; safety; driving comfort and convenience; and operating cost (or, economy). Of these six concepts, *safety* is the only one that could possibly be used to consider the impacts on other modes, only because of their vague use of the word “hazards”. They define safety to mean “...not only accident rates, but also potential hazards,” (TRB, 1965, p. 78). Theoretically, this could apply to hazards faced by pedestrians, but given the greater car traffic perspective of LOS, it is more likely to mean the hazards of vehicle interactions. Most of these considerations are rendered moot, anyway, since the manual goes on to state that *travel speed* was selected as “the major factor to use in identifying level of service,” with “a second factor” being the ratio of volume to capacity, or *v/c ratio* (TRB, 1965, p. 78).²

In any case, the considerations of operating cost and safety were wholly omitted from the definition of LOS in the third and fourth editions of the HCM, respectively (TRB, 1985; TRB, 2000). In turn, the professional engineers and planners who use LOS as a design standard are valuing the speed of a private vehicle over the safety of and costs incurred by those users, not to mention the safety and costs borne by pedestrians, cyclists, or transit riders. This focus on speed over all other factors that *could* define LOS, is consistent throughout all editions of the HCM.

Figure 5 shows the factors, or *service measures*, used to determine levels of service in urban settings.

² *v/c ratio*, which is used repeatedly in operating speed calculations throughout the manual, is a function comparing roadway demand (vehicle volumes, *v*) with roadway supply (carrying capacity, *c*), where a lower value would typically lead to a higher operating speed and better LOS grade (TRB, 1965).

Exhibit 2-2
 HCM Service Measures by
 System Element and Mode

System Element	HCM Chapter	Service Measure(s)				Systems Analysis Measure
		Automobile	Pedestrian	Bicycle	Transit	
Freeway facility	10	Density	--	--	--	Speed
Basic freeway segment	11	Density	--	--	--	Speed
Freeway weaving segment	12	Density	--	--	--	Speed
Freeway merge and diverge segments	13	Density	--	--	--	Speed
Multilane highway	14	Density	--	LOS score ^a	--	Speed
Two-lane highway	15	Percent time-spent-following, speed	--	LOS score ^a	--	Speed
Urban street facility	16	Speed	LOS score ^a	LOS score ^a	LOS score ^a	Speed
Urban street segment	17	Speed	LOS score ^a	LOS score ^a	LOS score ^a	Speed
Signalized intersection	18	Delay	LOS score ^a	LOS score ^a	--	Delay
Two-way stop	19	Delay	Delay	--	--	Delay
All-way stop	20	Delay	--	--	--	Delay
Roundabout	21	Delay	--	--	--	Delay
Interchange ramp terminal	22	Delay	--	--	--	Delay
Off-street pedestrian-bicycle facility	23	--	Space, events ^b	LOS score ^a	--	Speed

Notes: ^a See Exhibit 2-3 for the LOS score components.
^b Events are situations where pedestrians meet bicyclists.

Figure 5: HCM Service Measures by System Element and Mode (TRB, 2010)

With car travel speed being the primary factor in determining LOS, one can quickly understand how this places high LOS-rated design at odds with other modes. One way in which this is particularly problematic is in how it affects convenience for pedestrians. Wes Marshall, a traffic engineer and professor who takes a highly critical stance on this standard, discusses how an LOS-minded engineer is trained to think of pedestrian crossings as “friction conditions” and “interference” for automobiles (Marshall, 2024, p. 292). Local transit buses, too, are thought of in the same way. The HCM believes that more buses, bus stops, and bus passengers boarding and alighting will have a negative impact on LOS. It goes on to state, “...a route with frequent bus service has a considerably greater adverse effect on capacity than one serviced by only one or two buses per hour,” (TRB, 1965, p. 125). While not receiving any mention until the 2000 edition of the HCM, bicycle traffic also has a negative effect on LOS. Since LOS is largely a function of speed, and since average bicycle speeds (about 25 km/h) are much lower than those

of cars, bicycle activity mixed with or crossing perpendicular to car traffic is known to lower a roadway segment's LOS grade (TRB, 2000).

In his book *Confessions of a Recovering Engineer*, Charles Marohn, Jr., who worked for years as a traffic engineer, echoes this thought when he argues that engineers and planners operate with “embedded values” when they design urban and suburban roadways in this way. He states that these professionals prioritize, from most to least important, design speed, traffic volume, safety, and, finally, cost. He aptly goes on to say, “...minimizing delay for automobile traffic is more important that minimizing delay for people walking or biking,” (Marohn, Jr., 2021, p. 36). It is worth noting, however, that the 2010 edition of the HCM incorporates a concept of Pedestrian Level of Service into their new “multimodal” approach to LOS. However, as shown in **Figure 5** (above), Pedestrian LOS is considered as a service measure of facility's multimodal LOS, but when determining the quality of the system as a whole, car *speed* and car *delay* are the primary analysis measures (TRB, 2010).

6.2 US 19 (SR 55) in Pasco County, Florida: A Case Study

To better understand the design logic and physical impacts related to using Level of Service (LOS) as a measure of effectiveness in an urban context, it will be helpful to consider a case study. US 19 is a route in the United States Numbered Highway System (or US Highways) which is also internally known as State Route 55 within the state of Florida. Pasco County is a largely urbanized county within the Tampa-St. Petersburg-Clearwater Metropolitan Statistical Area with a 2024 estimated population of 659,114 (US Census Bureau, n.d.).

While generally considered a controlled-access highway, US 19 functions as an urban arterial in Pasco County due to the intensity of adjacent development and number of

access points (FDOT, 2008). The ownership and maintenance of the US Highway System, as with Interstate Highways, is divided between the states (Federal Highway Administration, 2023). Per the Florida Department of Transportation (FDOT)'s LOS targets for the State Highway System, LOS D is the minimum grade for this urban arterial during peak hours of travel (FDOT, 2017). In addition, the Pasco County guidelines for Traffic Impact Studies (TIS) demand the same standard when analyzing the transportation impact of new land developments (Pasco County, 2020). **Figure 7** displays the dense commercial and residential land uses surrounding US 19 and Marine Parkway. **Figure 8** shows the lane configuration of US 19 at this intersection, comprised of ten vehicular lanes needed to maintain rush hour LOS D standards.

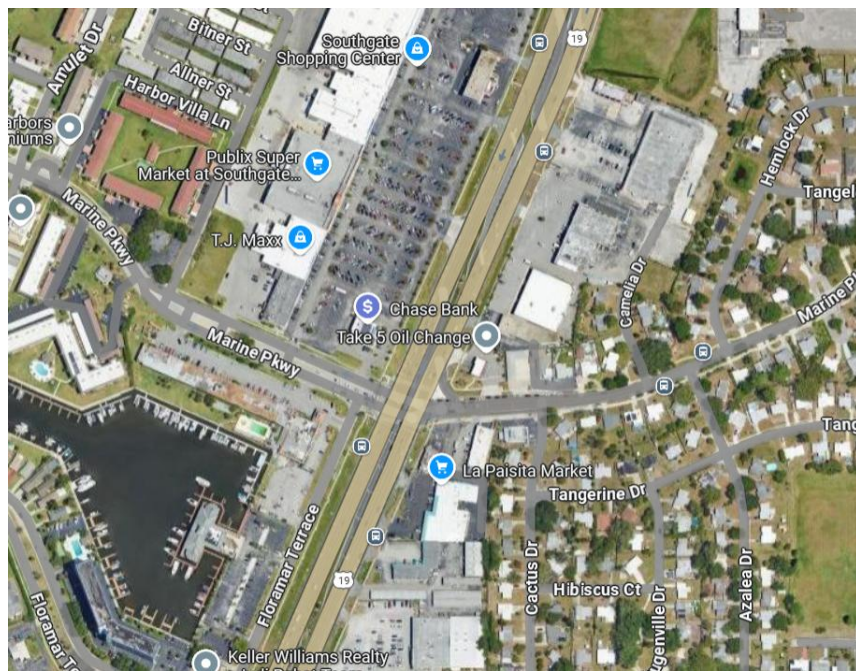


Figure 6: US 19 and Marine Parkway (Adjacent Land Uses)

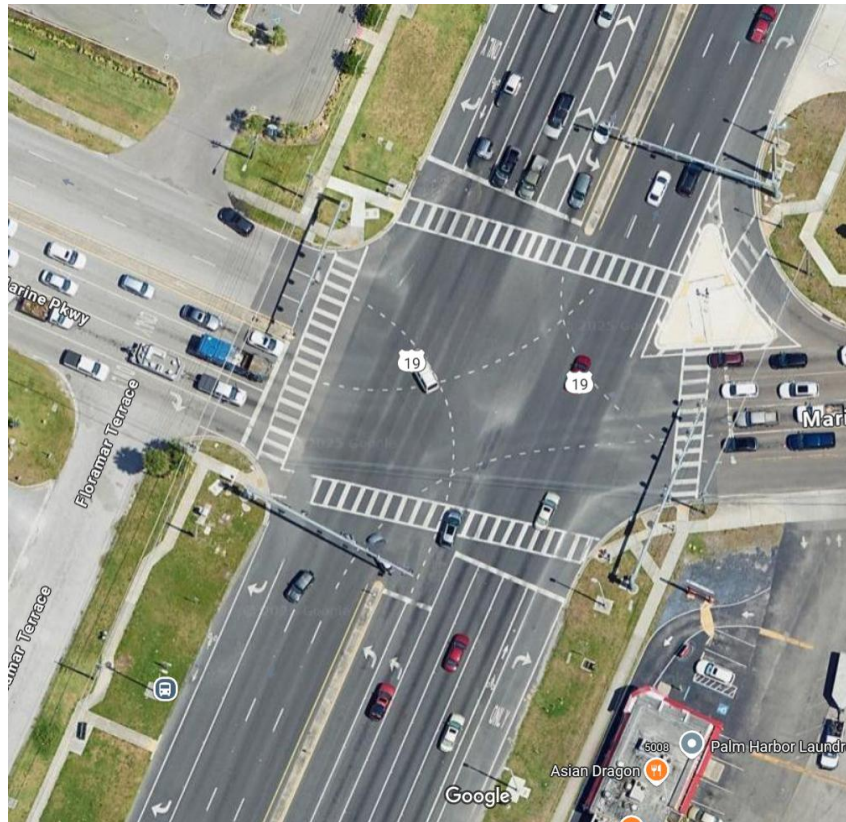


Figure 7: US 19 and Marine Parkway (Lane Configuration)

In 2008, the FDOT carried out a Project Development and Environment (PD&E) Study to evaluate capacity improvement alternatives on US 19 in Pasco County. The study cites LOS deficiencies as the primary reason for needed “improvements”. There was also consideration given to safety along this corridor, but as dictated in the HCM, safety was not a primary service measure in determining final recommendations.

The final recommendations of FDOT’s study highlight some of the major problems and biased thinking associated with using LOS as a measure of effectiveness on urban arterials. First, the study’s Crash Safety Overview found there were 125 crash fatalities and 5,066 injuries within the 19.85-mile study area in just five years (2000-2004).

Despite these alarming numbers, the department proposed more car-focused

infrastructure that would allow higher speeds. The 207 page document concludes with recommendations of providing undesignated bicycle lanes on shoulders, but proposed design speeds of 50 miles per hour (mph), adding vehicle turn lanes and through lanes in both directions, and constructing four grade-separated diamond interchanges at certain intersections all to accommodate LOS D, as per the State of Florida’s LOS targets for peak hour travel on the State Highway System in urbanized areas. The only pedestrian recommendations are to provide adjacent sidewalks and crosswalks at the new interchanges, an Americans with Disabilities Act (ACA) requirement (FDOT, 2008). **Figures 9 and 10** show a cyclist’s point of view travelling northbound on US 19 before and after an intersection with Marine Parkway. After crossing Marine Parkway, the painted bike placed between two lanes on a six-lane segment becomes a completely *undesignated* bike lane.



Figure 8: Northbound US 19 and Marine Parkway (Streetview)



Figure 9: Northbound US 19 past Marine Parkway (Streetview)

Since FDOT’s 2008 capacity study, wider attention has come to US 19 in Pasco County. A study published in 2021 which studied the entire US roadway network identified 65 “hot spots”, 1,000-meter-long sections of roadway where six or more fatal pedestrian crashes occurred during an eight-year period. Seven of these hot spots (over ten percent of all) were sections of US 19 in Pasco County. This included 90 pedestrian fatalities during their 2001-2008 study period and another 47 in the 2009-2016 study period (Schneider, et al., 2021).

While it remains unclear if and when these changes will occur, the Pasco County Metropolitan Planning Organization’s (MPO) FY 2025-2029 Transportation Improvement Program does allocate resources to bridge projects, consistent with the 2008 study’s recommendations. They also list a priority project of constructing a pedestrian overpass at Marine Parkway over US 19. (Pasco County MPO, 2024). These

projects serve to further separate pedestrians from this urban street, prioritizing high speeds and less delay for those driving.

Chapter 6

Discussion

Thus far, this paper has argued that a misguided use LOS as a measure of urban transportation system quality in the United States is linked to the federal government's efforts to guide urbanization according to a capitalist growth model. This growth model sought to deconstruct urban society across the nation and restructure it as a device for production benefitting a burgeoning American auto industry, with little regard for the lived experience of urban residents. The federal government achieves this through a process of establishing and promoting their desired forms of knowledge that would inform the disciplines of transportation planning and engineering whose professionals would then create urban space that complies with the spatial logic of capitalism, reproducing the power structure that concentrates capital in the hands of dominant private industries.

The previous sections elaborated on three Watershed Moments of federal policy setting in the mid-20th century that were most effective in contributing to this process and argued that the *Highway Capacity Manual*'s prescription of LOS to urban facilities fits within this process. This final section reconnects the theories, the three Watershed Moments, and LOS into a single discussion of knowledge and capitalism's spatial logic.

7.1 Knowledge and the Spatial Logic of Capitalism

As a legally codified measure of urban transportation system quality, Level of Service (LOS) is a mechanism of the spatial logic of capitalism, enforcing the organization of urban society into a device for production and consumption.

Federal decision making regarding urban development and transportation during the mid-20th century was focused on restructuring existing cities into decentralized urban areas that would facilitate massive growth in private industries at the expense of the traditional city. The First National Conference on Street and Highway Safety, the Housing Act of 1949, and the Federal-Aid Highway Act of 1956 were three watershed moments that would execute this process. Knowledge production was central to this process. Across these three federal interventions, the federal government undertook a process of “selection, normalization, hierarchicalization, and centralization” (Foucault, 2003, p. 181) of knowledge that would impose norms of how urban space ought to be used. Whether it was new traffic ordinance guidelines allocating street space solely to cars, the forced clearance of “blighted” urban downtowns, or the authorization of urban interstate construction on those lands, the proper use of city space had fallen into a new paradigm. The idea of “people friendly blocks and structures” (Fullilove, 2016, p.) was replaced with an urban environment that would “enable the housing industry to make its full contribution toward an economy of maximum employment, production, and purchasing power” (Housing Act of 1949, 1949, p.). Walkable downtown streets with a balance of pedestrians, streetcars, vendors, and automobiles of the early 20th century city were simply discarded for “the attainment of a common standard of perfection” that would allow the “fullest development” of the American auto industry and make the private car a “complete necessity” (First National Conference on Street and Highway Safety, 1924, pp. 6-8).

They would do this “on the basis of an underlying logic and with the help of knowledge and technical expertise” (Lefebvre, 1991, p. 11). Introduced shortly thereafter in the 1965 edition of the *Highway Capacity Manual*, LOS would emerge as a form of that *knowledge* or *technical expertise* mentioned by Lefebvre. Insofar as this it aids the capitalist spatial logic as a *technology*

of power, LOS “increases the forces of the body (in economic terms of utility) and diminishes these same forces (in political terms of obedience),” (Foucault, 2003, p. 179). This *underlying logic*, established earlier through the work of Lefebvre, Harvey, and Soja, would be the spatial logic of the capitalist state. So how exactly do these watershed moments and LOS fit into this spatial logic of capitalism? To understand this, let us return to the four strategies of the capitalist spatial logic, as derived from the work of those three theorists.

1. **The commodification of space**

Of the three watershed moments, the Housing Act of 1949 opened up urban space for the absorption. As expressed in the statute, “...governmental assistance shall be utilized where feasible to enable private enterprise to serve more of the total need” (1949, p. 413). Similarly, the interstates driven through and around urban areas further unlocked developable land that could serve as areas for capital investment as well as imposing a national transportation system that would incentivize car ownership, with the federal government covering ninety percent of construction costs to ensure these opportunities (Federal-Aid Highway Act of 1956, 1956). LOS complements this system by ensuring car travel is the most convenient form of transportation and its use in traffic impact studies encourages more sprawling development (Henderson, 2011; Litman, 2015).

2. **The naturalization of space**

The infrastructure and form of development mandated by these federal interventions becomes the new urban reality. The legislative authority and the supposed reasoning of safety, quality living conditions, and efficient travel frame the decentralized, car-dependent urban form as natural and logical. Here, LOS serves as a “highly interested

employment of a supposedly disinterested knowledge” (Lefebvre, 1991, p. 9), a rational use of scientific knowledge, hiding its illogical methodologies that ultimately only serve car drivers (Henderson, 2011; Marohn, 2021; Marshall, 2024). Society becomes *socialized* with respect to this existence, with “Signs of the city, of urban life, as the signs of nature and the countryside, as those of joy and happiness, delivered to consumption without an effective social practice enabling the urban to enter daily life,” (Lefebvre, 1996, p. 46)

3. **The regulation of everyday life**

Through enforcement of this new, decentralized spatial existence, humans within this system are encouraged to reproduce the conditions for the capitalist mode of production, simply by living within this system. LOS serves as a component of a representation of space (codes, plans, signs, etc.), the dominant form of space under capitalism. Representations of space “facilitate the manipulation of representational spaces” (Lefebvre, 1991, p. 59). As for spatial practice, the “speculative primacy of the conceived over the lived causes practice to disappear along with life” (Lefebvre, 1991, p. 34), leaving humans to operate within a system that is laid out before them through such codes and standards, ensuring their ability to produce and consume.

4. **Uneven spatial development**

Through the bulldozing of around 2,500 neighborhoods across 993 cities that occurred as a result of the Housing Act of 1949 and the interstates that were subsequently run through those neighborhoods (Fullilove, 2016), the Housing Act of 1949 and the Federal-Aid Highway Act of 1956, the federal government prioritized the development of suburban

housing that would yield greater capital returns for private enterprises. LOS adds to this uneven development by promoting highway-like traffic flow through urban areas.

7.3 Alternatives to Level of Service

It has so far been asserted that transportation planners and engineers are beholden to the wrong model when they are required to use Level of Service as a quality metric of urban transportation system quality. It is therefore necessary to investigate and promote alternative methods of assessment that are compatible with sustainable urban development. Below are just three examples of alternatives that, at the very least, go beyond the status quo of solely accommodating single occupancy vehicles.

Vehicle Miles Traveled (VMT): An innovative metric for assessing urban transportation system quality that is growing in popularity over LOS is Vehicle Miles Travel (VMT). Using this approach considers how *far* people must travel to access a new land development, rather than assessing the impact a development will have on nearby traffic. In doing so, planners can promote denser urban development that is more conducive to short trips safely taken by walking, cycling, and transit. VMT as a performance indicator recenters planning to achieve *accessibility* (i.e., access to destinations like shopping, education, and work) as the primary reason for travel, over *mobility* which primarily serves to increase speeds and reduce wait times for vehicles (Litman, 2024). Policies and goals to reduce VMT have already been adopted at the state level in California and Washington State, as well as in localities such as Portland, Oregon and Minneapolis, Minnesota (Litman, 2025).

Multimodal Level of Service (MMLOS): MMLOS is a method that measures a level of service for automobile, bus, bicycle, and pedestrian modes on an urban street. The strength to this service measure is that, by providing a separate level of service measurement for each mode, it allows planners to analyze the tradeoffs associated with a land development or transportation project (National Academies, 2008). By measuring the cost distribution between modes, decisionmakers can avoid projects that would disproportionately limit the access of more energy efficient and less space-consuming modes of travel. MMLOS was incorporated into the 2010 edition of the *Highway Capacity Manual* (TRB, 2010).

Person Throughput: This performance metric simply looks at the number of *individuals* able to move through a space, such as a single lane of travel at an intersection, irrespective of their mode of travel. This method of analysis highlights the efficiency of different modes moving through urban space and the mode preferences of users in that space (NACTO, 2016). The findings presented by person throughput analysis can inform decisionmakers on how to effectively allocate space in the city in ways that provide access to destinations for the most people.

Chapter 7

Conclusions

The application of Level of Service to measure the quality of urban streets, urban arterials, and suburban arterials misunderstands what makes a city convenient, pleasant, and safe. It has been discussed so far how a car-centered urban transportation system limits the efficiency of other modes of travel, strips the urban environment of character and difference, and endangers the lives of those using in the system. These dynamics are fundamental to the system that LOS helps to reproduce, a system that planners and engineers will continue to reproduce as long as they are beholden to the wrong model. Since this type of knowledge is codified into the ordinances and guidelines that these professionals are required to follow, it will take legal reforms to allow them to create better urban spaces.

7.1 Recommendations

7.1.1 Alternative Service Measure: Vehicle Miles Traveled (VMT)

To refine the methods of creating urban space that goes beyond providing roadway capacity for private vehicles, it is imperative to move away from LOS and offer an alternative measure of transportation system effectiveness. As for an alternative transportation system impact metric of proposed land developments in urban areas, this paper recommends using the service measure of Vehicle Miles Traveled (VMT) and abandoning the traditional use of LOS. While LOS can cause further sprawl as an impact metric (Henderson, 2011; Litman; 2025), VMT offers a way to redress this pattern by incentivizing new developments that can be accessed with shorter trips.

As of 2020, the state of California has adopted a law to abandon LOS in their environmental impact reporting process, replacing it with VMT. This means that they measure the length of new car trips (as additional miles driven) a proposed project would create, with fewer additional miles equating to a lesser impact, streamlining the development review process and encouraging more downtown development (California Environmental Agency, n.d.). This could be an influential change in the future development of the built environment in California. However, this type of policy change would also have to be met with a wider cultural change in the United States. The country has one of the highest rates of car ownership in the world, with about 850 people per 1,000 people owning a car (World Population Review, 2024). To breathe dynamism, social life, and financial prosperity into our cities, we must drive *less*.

7.1.2 Alternative Manuals: NACTO *Urban Street Design Guide* and LEED ND

Currently, design professionals across the country are beholden to the methods laid out in the *Highway Capacity Manual* and the *A Policy on Geometric Design of Highways and Streets*, both of which prescribe LOS as service measures for urban streets. While these guidebooks do propose inappropriate methods for designing urban space, they are useful to these professionals as one-stop-shops that they can easily refer to in their practice. Thus, it is worth offering an alternative source of knowledge that provides appropriate suggestions specific to urban settings. This paper recommends the National Association of City Transportation Officials (NACTO)'s *Urban Street Design Guide* as such an alternative. As the title implies, this text focuses on design solutions for an urban context, ones that by and large diverge from the recommendations in the aforementioned books. In fact, the design guide explicitly discusses the shortcomings of these bibles of transportation system design and the standards they use, including LOS (NACTO, 2013).

As discussed earlier, a primary way in which LOS is employed is through traffic impact studies, where a proposed development's effect on the local transportation system is evaluated based on projected changes to LOS (Henderson, 2011). Sustainable land development standards are another way municipalities can work to counteract the car-dependent, sprawling development pattern of the mid-20th century. Leadership in Energy and Environmental Design (LEED) provides multiple frameworks to guide land development projects around principles of sustainability. Their most common framework is applied to building construction only, with over 100,000 certified buildings as of 2022 (US Green Building Council, 2022). This, however, is not enough to encourage denser, less car-dependent urban development. LEED for Neighborhood Development (LEED ND), on the other hand, takes an all-encompassing approach. Certification requirements that incentivize "locations close to existing town and city centers, sites with good transit access, infill sites, previously developed sites, and sites adjacent to existing development" (US Green Building Council, 2014, p. 59) as well as "compact, walkable, mixed-use neighborhoods with good connections to nearby communities" (US Green Building Council, 2014, p. 169). By requiring a minimum certification level for new developments of a certain scale, municipalities can help ensure their communities do not become fragmented, sprawling abstract spaces devoid of any sense of sustainable development, social cohesion, or beauty.

7.2 Reflections on 2025 Executive Orders and Statements

On January 29th, 2025, newly appointed Secretary of the US Department of Transportation (USDOT), Sean Duffy, issued a memorandum ordering USDOT administrations to:

"... identify and eliminate all orders, directives, rules, regulations, notices, guidance documents, funding agreements, programs, and policy statements, or portions thereof, which were authorized, adopted, or approved between noon on January 20, 2021 and noon on January 20, 2025, and which reference or relate in any way to climate change, "greenhouse gas" emissions, racial equity,

gender identity, "diversity, equity, and inclusion" goals, environmental justice, or the Justice 40 Initiative," (US Department of Transportation, 2025).

Further, in February of 2025, USDOT announced in a letter to New York Governor Kathy Hochul that they would *terminate* New York City's congestion pricing program. Congestion pricing, a plan to toll drivers entering Manhattan's central business district (CBD) \$9 with the goal of providing billions of dollars in funding to the critically underfunded Metropolitan Transit Authority (MTA) (Ley, et al., 2025), is a state law that was passed into the New York state budget in 2019 (Wamsley, 2019). These measures by the United States federal government reflect the same values that were expressed in the three watershed moments this paper analyzed. The initiatives being targeted by ultra-capitalist Donald Trump's administration would, at least in theory, mean less people would have to drive as they would have greater access to higher quality public transportation. Just as in the mid-20th century, the capitalist state means to use its institutional power, even if it has no legal power to do so, to ensure the predominance of exchange value in urban space by "subordinating the city and urban reality which are refuges of use value," (Lefebvre, 1996, p. 5).

7.3 Urban Planning Practice and the Spatial Logic of Capitalism

These alternative metrics, guidebooks, and standards can help institute reform in municipal planning efforts. However, as argued at length in this paper, the common practices of the urban planning profession, including but not limited to the use of LOS in urban settings, are results of a greater ideological infection that has chosen to restructure urban society to serve dominant industries with great concentrations of capital, leaving in its wake the rubble of the traditional city. So long as state interests are concerned only with maintaining the social relations that will reproduce the capitalist mode of production and increase the growing share of humanity's wealth

that is held in the hands of an elite few, the state will continue to use its institutional power to alienate and subordinate its citizens as cogs in a device for production and consumption. Humans must realize the spaces we occupy do not *need* to look the way they do. Everyday life could bring us a greater sense of meaning, a closer connection to nature and each other, a day filled with more leisure and less toilsome work, and a more beautiful built environment. But first we must demand it. As stated by Henri Lefebvre in *The Production of Space*,

“...nostalgia for towns dedicated to leisure, spread out in the sunshine, continues to haunt the urbanite of the super-industrialized regions. Thus, the contradictions become more acute - and the urbanites continue to clamour for a certain 'quality of space'” (1991, p. 353).

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