Ozone Nonattainment and Urban Sprawl in North Texas: Linking Land Use, Transportation, and Air Quality

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I. Introduction

North Central Texas has built one of the nation's most highway-intensive, sprawling, and car-dependent metropolitan regions, and it is paying for that pattern in the air its residents breathe. The Dallas–Fort Worth (DFW) area has failed to meet federal ozone standards for decades and was reclassified by the Environmental Protection Agency (EPA) from moderate to serious nonattainment for the 2015 eight-hour ozone standard in June 2024, with an attainment deadline in 2027 (EPA, 2024). Ten North Texas counties remain designated as nonattainment for ozone, meaning regional pollutant concentrations exceed the National Ambient Air Quality Standards and trigger special planning obligations under the Clean Air Act. In a modeling study of the Dallas–Fort Worth region, ozone reduction was estimated to result in up to $932 million in avoided economic costs due to preventable premature deaths, valued using the Value of a Statistical Life method (Carvour et al., 2018).

This paper examines DFW's ozone nonattainment as an environmental challenge rooted in land-use, transportation, and infrastructure finance systems that have produced a low-density, car-dependent urban layout. Drawing on literature and planning documents from the North Central Texas Council of Governments (NCTCOG), TCEQ, and EPA, it outlines a policy proposal to leverage regional transportation funding to promote compact, transit-supportive development and reduce vehicle miles traveled (VMT).

II. Review of Literature

Sprawled regions feature low densities, segregated land uses, and weak street connectivity (Trowbridge & McDonald, 2008; Ewing et al., 2014; Bereitschaft & Debagge, 2013). These traits lead to longer and more frequent driving, resulting in higher

per-capita VMT and emissions. In contrast, compact regions exhibit shorter travel distances, lower emissions, and better health outcomes.

Highway expansion is not a neutral response but a policy choice that locks in auto dependence (Jacobs, 1961; Shoup, 2005; Speck, 2012). Texas has repeatedly widened corridors, such as I-35 and I-635, despite evidence that adding capacity induces demand and often restores congestion. Freeway siting and urban renewal have historically displaced Black and Hispanic communities, concentrating pollution and safety risks (Fullilove, 2004; Mohl, 2004). Federal highway funding formulas and state subsidies have long favored sprawl, while tools such as brownfield programs, land banks, and split-rate taxation can redirect investment toward established areas (Lee & West, 1997; Kneebone, 2009; Green & Leigh, 2003; Brookings, 2001).

III. Methodology

This qualitative case study synthesizes empirical findings from the literature and public planning documents, primarily NCTCOG's Mobility 2045 plan, TCEQ's ozone status reports, and EPA reclassification notices. It defines the problem, identifies structural causes, and sketches policy responses.

IV. Analysis and Interpretation

TCEQ data show DFW's eight-hour ozone design value declined from 87 ppb in 2012 to 77 ppb in 2022 but remains above the 70 ppb standard. The region's serious nonattainment status carries the risk of federal funding sanctions if the standards are not met by 2027.

Research has linked DFW's persistent mobile-source emissions to entrenched suburbanization and highway-oriented growth (Ewing & Hamidi, 2014; Duranton &

Turner, 2011). Repeated freeway expansion increases trip distances and perpetuates auto dependence. Environmental review practices often underestimate cumulative air-quality impacts (Boarnet & Handy, 1999). Federal funding formulas further reward road building over multimodal investment (Kneebone, 2009; CBO, 2015). Regional programs such as Air North Texas emphasize cleaner technology but lack authority over land use, the key driver of VMT. As a result, while cleaner engines have reduced emissions intensity, sprawl and highway expansion continue to offset those gains (Speck, 2012; Shoup, 2005).

V. Policy Recommendation

In the last ten years, advancements in vehicle technology and stricter fuel standards have significantly reduced emissions intensity, bringing the Dallas–Fort Worth area's eight-hour ozone design value down from 87 to 77 parts per billion (refer to Appendix A). However, this slight improvement has been overshadowed by a more than 15 percent increase in vehicle miles traveled during the same timeframe. While cleaner engines have slowed ozone formation, they haven't reversed it because the region's overall travel demand is still on the rise. To achieve air quality goals, it's not enough to rely on technological progress alone; it also requires reducing total vehicle miles traveled through land-use and transportation policies that shorten trips, encourage different modes of travel, and lessen reliance on private cars. Without these structural changes, further improvements in air quality will remain elusive.

This paper proposes an Ozone-Safe Mobility and Land Use Compact for adoption by NCTCOG's Regional Transportation Council. Flexible funding tied to performance goals can support compact, multimodal development (Lee & West, 1997; Kneebone, 2009).

Redirecting funds to projects that reduce per-capita VMT, including transit corridors, sidewalks, bike networks, and infill infrastructure, would align with evidence linking form and emissions (Cervero & Kockelman, 1997). Highway projects should include induced-demand mitigation (Duranton & Turner, 2011; Hymel, 2019).

Building on research into freeway removal, the compact would also prioritize reconnecting neighborhoods and reducing pollution exposure in communities that have historically been burdened by highway siting (Jacobs, 1961; Mohl, 2004; Fullilove, 2004). Transparent metrics such as per-capita VMT, monitored ozone values, and outcomes by race and income would enable accountability and equity tracking (Forkenbrock & Schweitzer, 1999; Handy et al., 2002).

VI. Conclusions

DFW's ozone problem reflects decades of land-use and transportation choices that have favored automobile-oriented growth. Research consistently shows that compact development lowers emissions and improves public health (Ewing & Cervero, 2010; Frank et al., 2006). Formula-based highway funding reinforces sprawl and limits multimodal investment (Lee & West, 1997; Kneebone, 2009).

North Texas's challenge lies not in identifying causes but in implementing known solutions. An Ozone-Safe Mobility and Land Use Compact would align transportation and land-use decisions with air-quality goals and equity. By embedding performance-based criteria and multimodal priorities, the region can begin translating decades of research into practical governance reform (Cervero & Kockelman, 1997; Ewing & Hamidi, 2014).

Appendix A:

Table A1. Ozone and Vehicle Miles Traveled (VMT) Trends, Dallas–Fort Worth Region

Year	8-Hour Ozone Design Value (ppb)	Annual VMT (billions)	% Change from 2012	EPA Status
2012	87	154	—	Moderate Nonattainment
2016	81	163	+6 %	Moderate Nonattainment
2020	76	158	+3 %	Marginal Nonattainment
2022	77	171	+11 %	Serious Nonattainment
2024	77	175	+14 %	Serious Nonattainment

Source: Texas Commission on Environmental Quality (2024a, 2024b); North Central Texas Council of Governments (2022); U.S. Environmental Protection Agency (2024).

Caption:

Appendix A summarizes trends in regional ozone concentrations and vehicle activity. Despite a roughly 10 ppb decline in design value since 2012, total VMT has risen by more than 14 percent. This divergence shows that improvements from vehicle technology alone cannot offset growth in driving, reinforcing the need for policies that directly reduce travel demand.

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