Improving Sustainable Development: Reducing Exposure to Traffic-Related Air Pollution

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ARUP

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Near-Road Emissions Overview

- Concerns:
  - Health and safety impacts from vehicle emissions
  - How can we promote compact development while protecting human health?

- What mitigation strategies are there?

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Core Concepts

To mitigate traffic-related air pollution exposure near high-volume roadways, planners can target:

Emissions

Image: noaa.gov

Concentrations

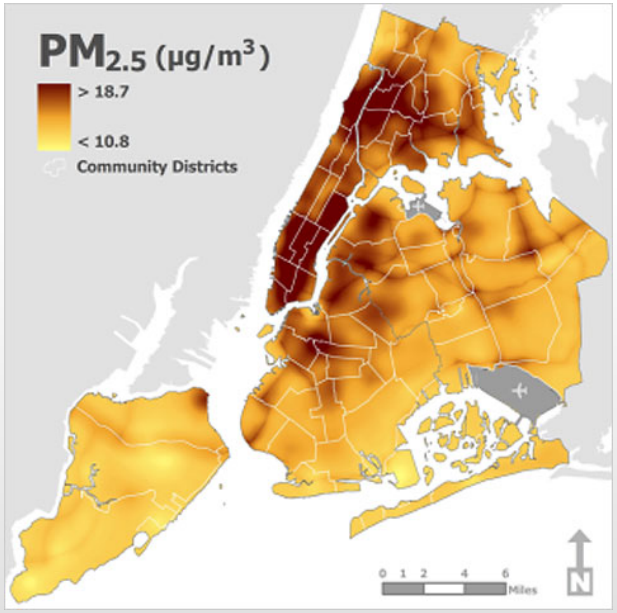


Image: nytimes.com

Exposure

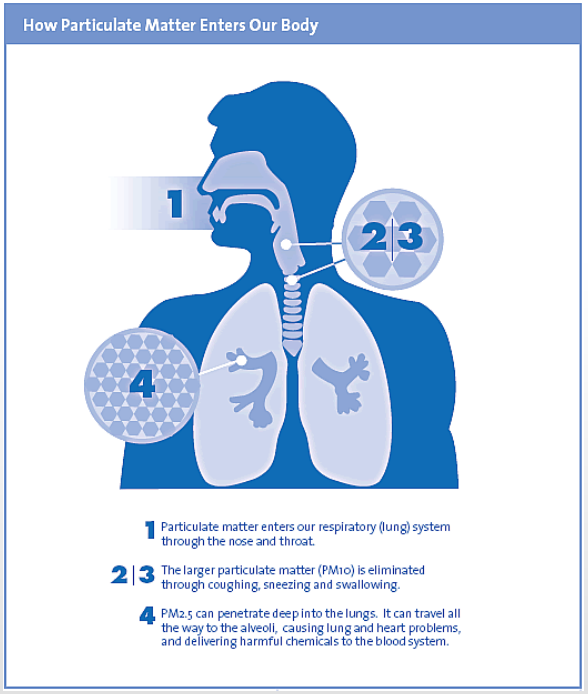


Image: bcairquality.ca

Translating Air Quality Principles to Planning Options

Emissions **Concentrations** **Exposure**

Transportation Infrastructure	Roadside Features	Site Planning	Building Design, Ops.
1. Corridor Mgt. • **Improve traffic flow** • **Reroute trucks** • **Increase trips by foot, bike, or transit** 2. Street Design • **Lower volumes** • **Buffer people from roads**	3. Barrier Use • **Install walls** • **Add vegetation**	4. Design • **Locate sensitive uses farther from roads** • **Phase parcels closest to road later in build out**	5. Design • **Optimize occupant placement** 6. Operations • **Use/improve HVAC filtration**

1. Corridor Management

Truck rerouting reduced diesel PM emissions in San Diego residential area. Image: Karner et al., 2009.

Reduce Emissions

- Improve traffic flow
- Reroute, restrict truck traffic away from sensitive land uses
- Promote land use strategies that encourage the accessibility and use of transit and active transportation

2. Street Design

Reduce Emissions

- Complete streets
- Improve traffic flow

Complete street design supports multi-modal travel (ULI image, 2012).

Wider sidewalks and landscaping create buffers.

Reduce Exposure

- Landscape zones & on-street parking buffer people from roads

3. Barriers: Sound Walls/Vegetation

Sound wall (Missouri DOT)

Image: state.sc.us

Reduce Concentrations

- Walls: 15-50% reduction
- Walls & vegetation together: 60% reduction
- Vegetation can filter
- Gaps can allow pollutants to pass through and accumulate

3a. Sound Walls

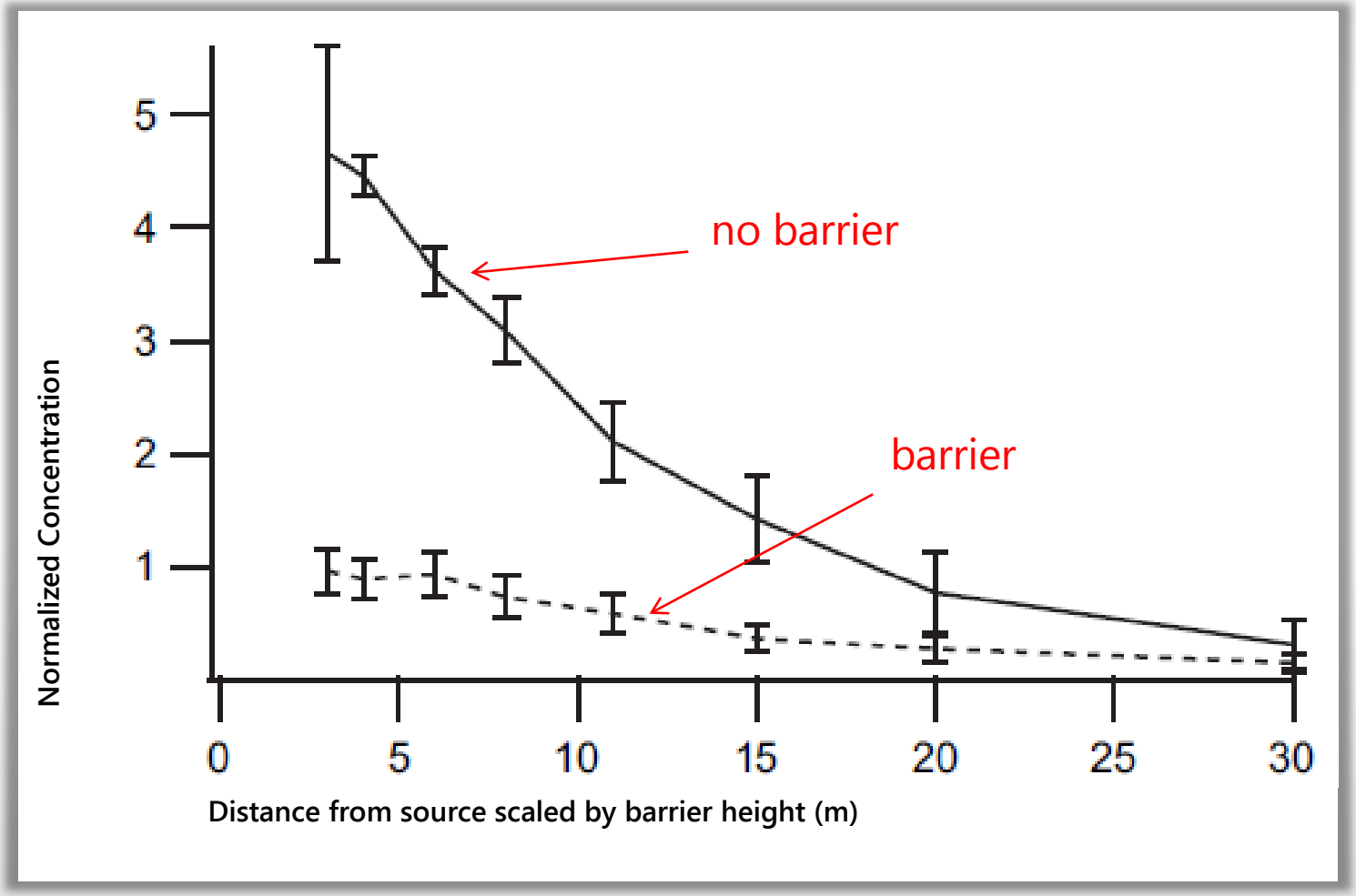


Image: Finn et al., 2010.

3b. Vegetation

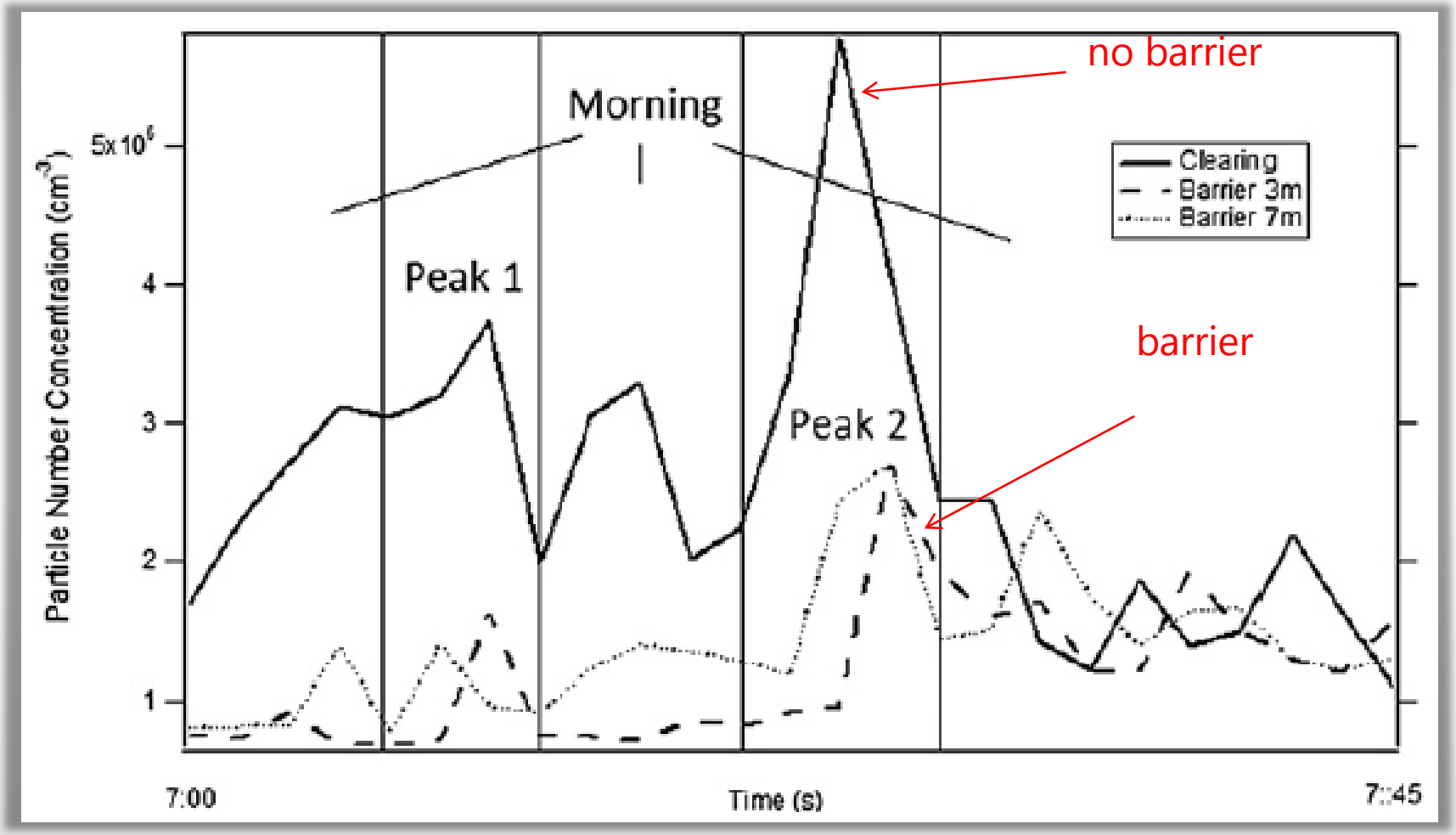
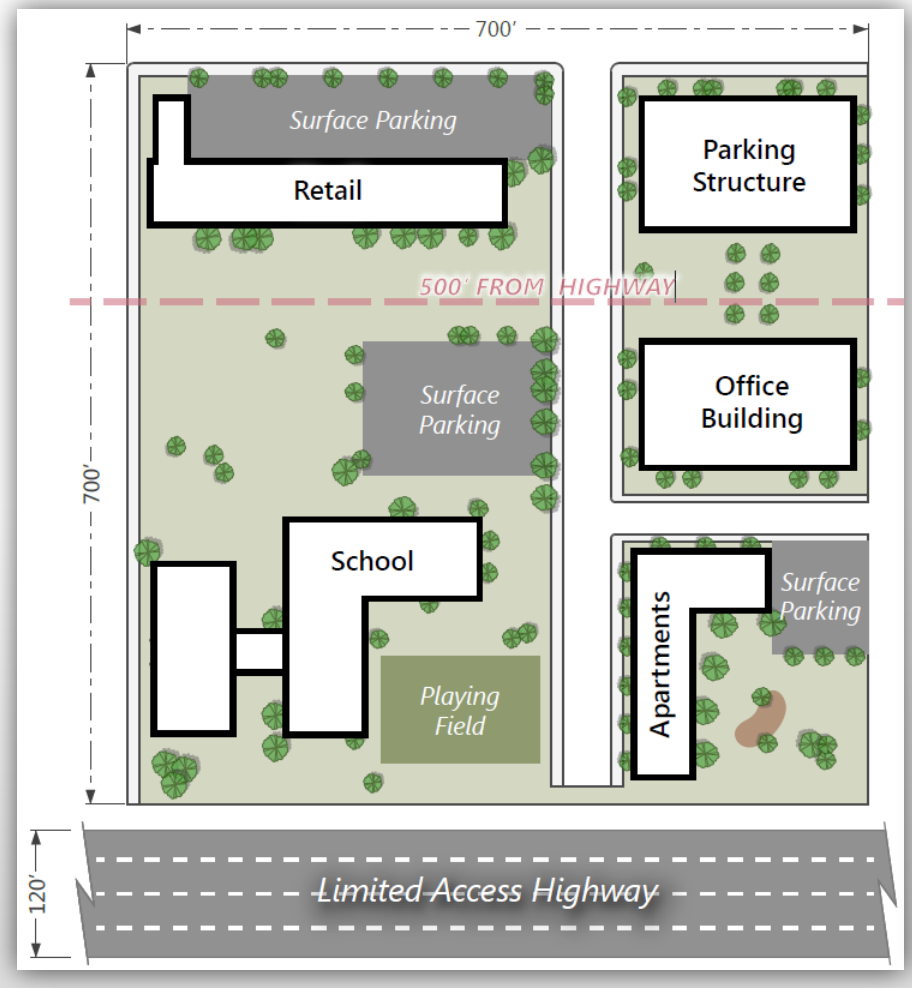


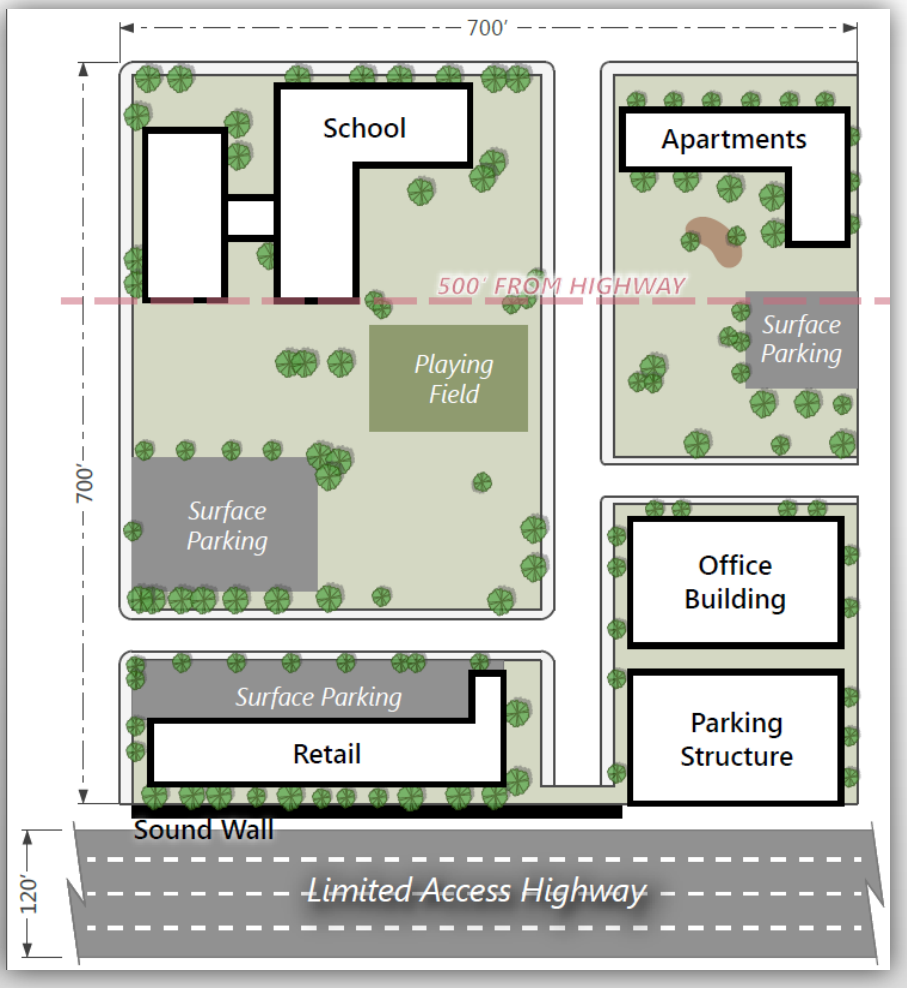
Image: Steffens et al., 2012.

4. Site Design

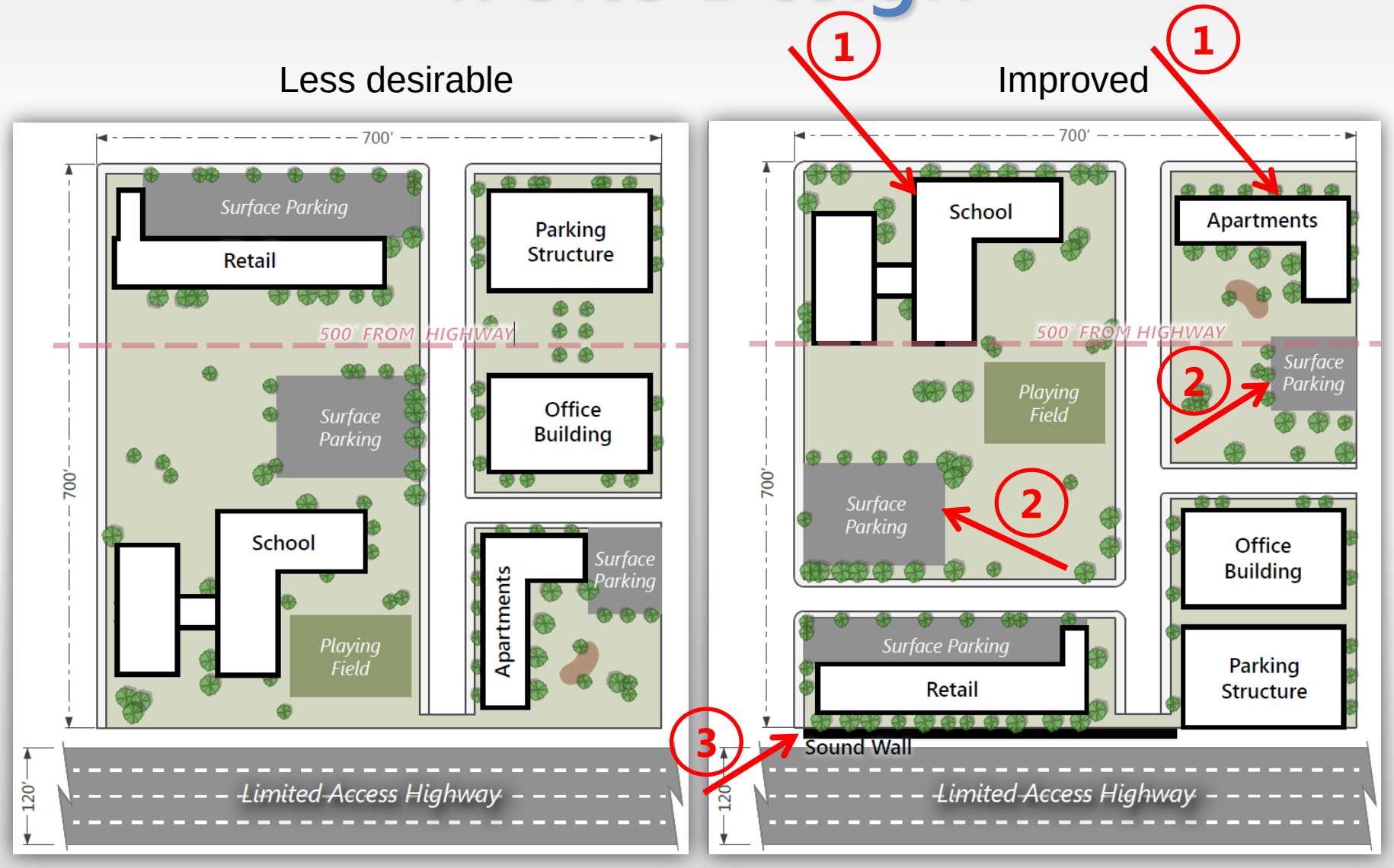
Less desirable



Improved



4. Site Design



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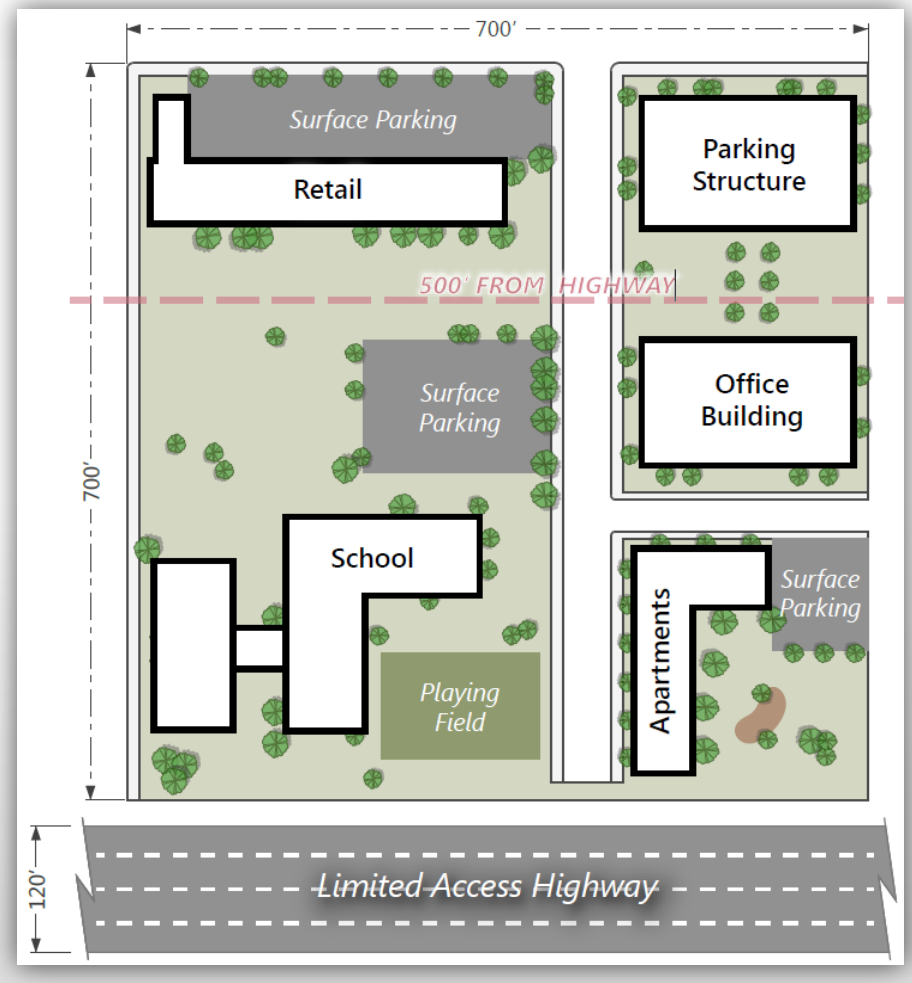
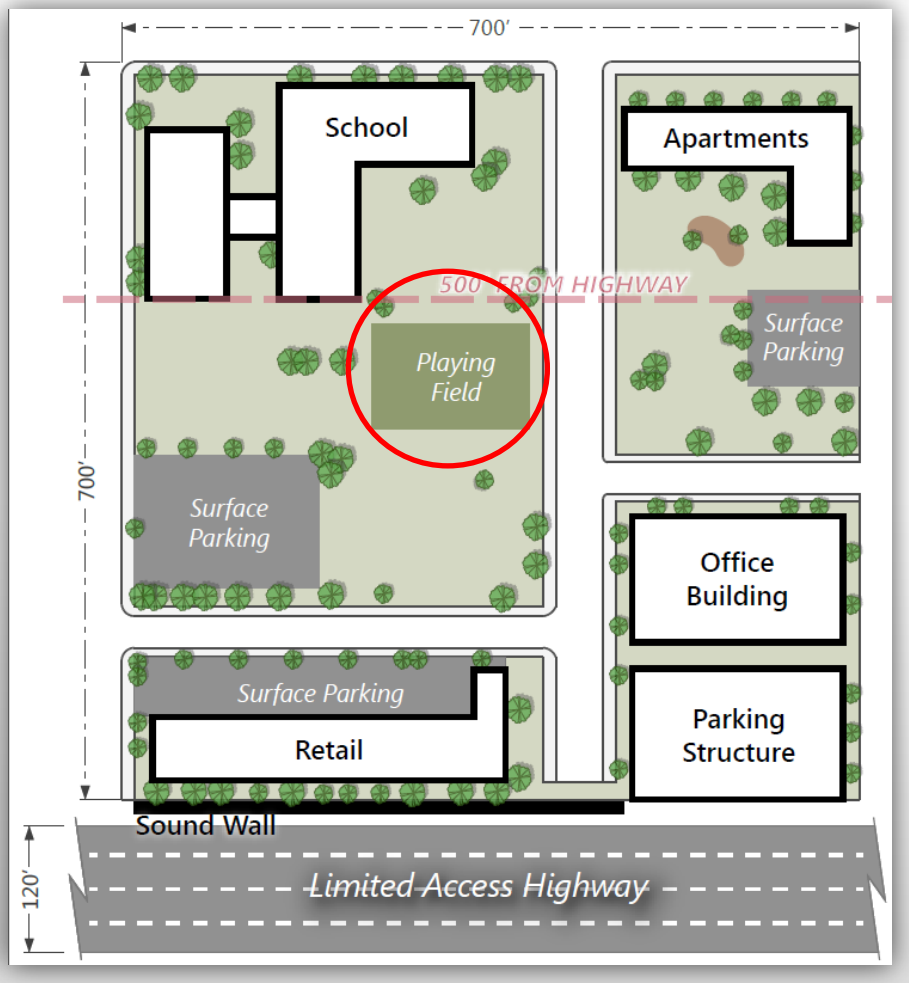


Improved



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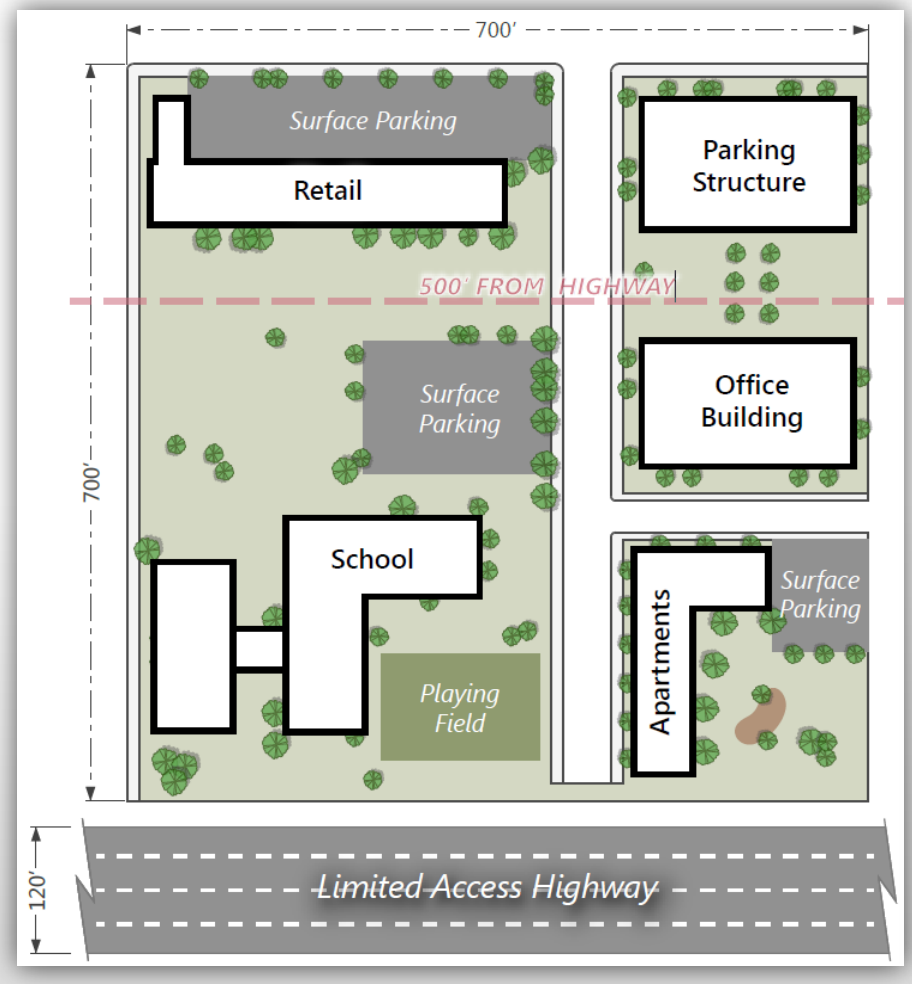
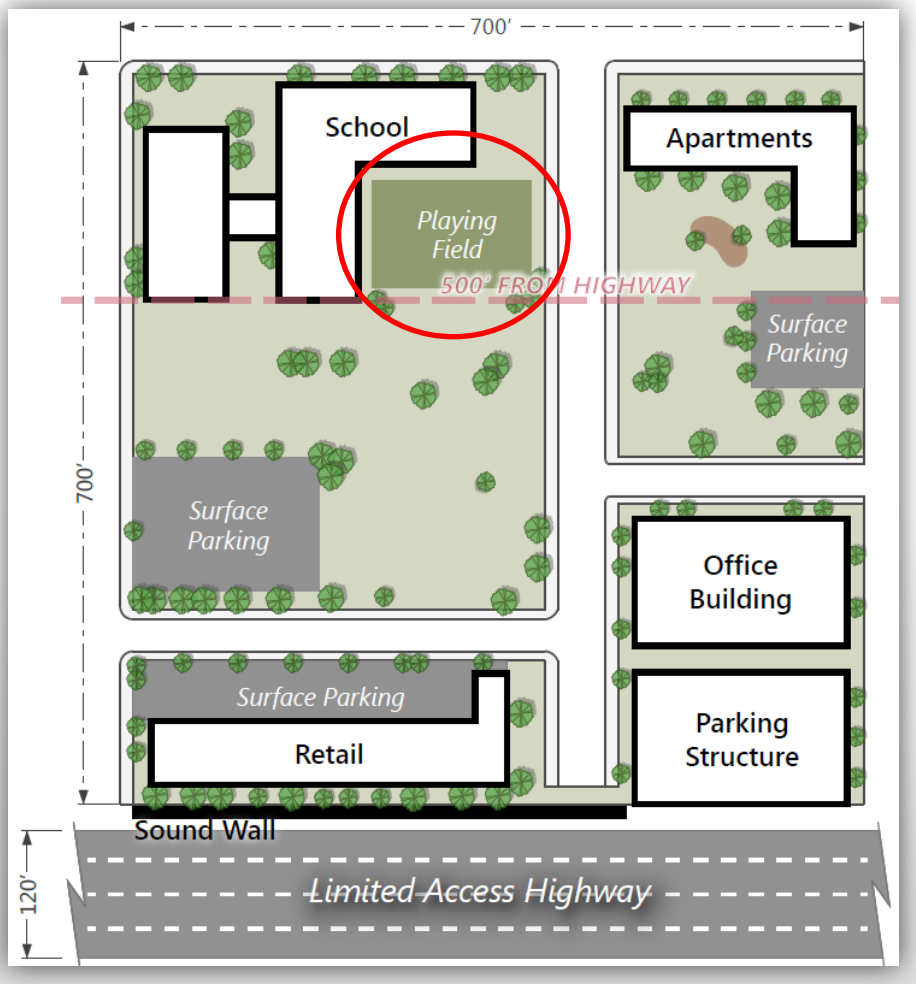


Even better



5. Building Design & 6. Operations

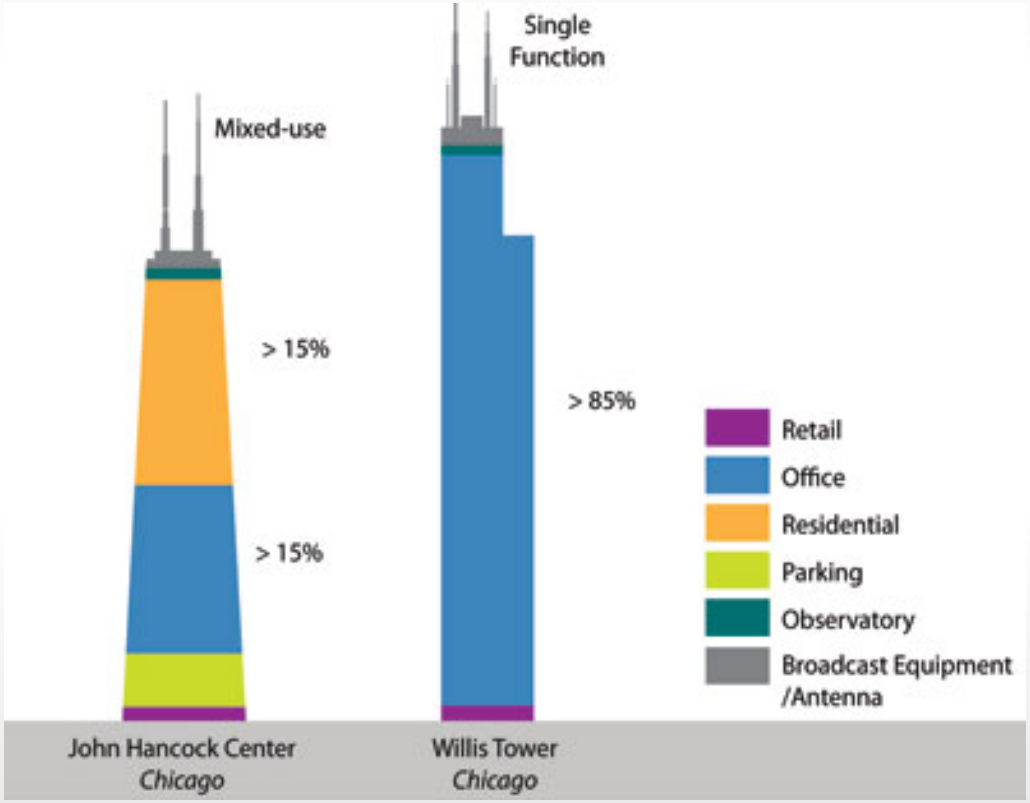
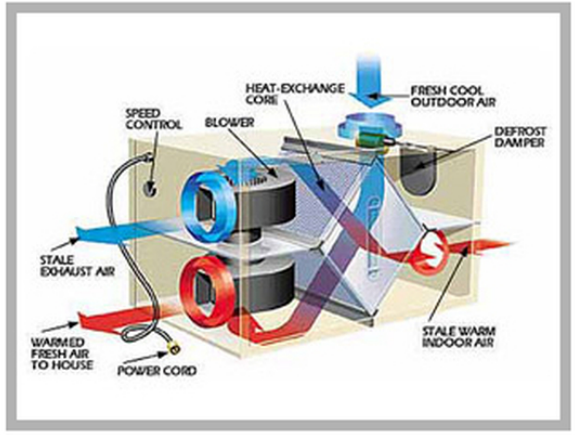


Image: ctbuh.org

Reduce Exposure

- Optimize occupant placement
- Locate air intakes away from pollutant source
- Improve filtration systems



Building Operations Case Study

Fyfe Elementary, near US 95, Las Vegas (one of several schools studied).

Before widening

After widening

Roberts et al., 2010; McCarthy et al., 2013

Building Operations Case Study

HVAC Filtration Efficiency for Black Carbon

School	Original Efficiency (old filters)	Upgraded Efficiency (2008, new filters installed)	2013 Efficiency (5 Years later)
Adcock Elem.	66%	97%	**91%**
Fyfe Elem.	50%	72%	**50%**

Roberts et al., 2013

Note: Original filter rating of MERV 6 was used in all three schools.
MERV = Minimum Efficiency Reporting Value, per ASHRAE. This is the typical efficiency of particle removal in the size range of 0.3 to 10 microns in diameter.

Mitigation Options: Consider Implementing as a Package

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Acknowledgments

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Thank you!