

From: [Karin, Bricker](#)
To: [City Council](#); [Hicks, Alison](#); [Showalter, Pat](#); [Ramirez, Lucas](#); [Kamei, Ellen](#); [Abe-Koga, Margaret](#); [Matichak, Lisa](#); [Ramos, Emily Ann](#)
Cc: [McCarthy, Kimbra](#); [Shrivastava, Aartj](#); [Yau, Ellen](#); [Anderson, Eric B.](#); [Glaser, Heather](#); housingelements@hcd.ca.gov
Subject: LWVLAMV letter re: Housing Element Adoption
Date: Sunday, April 9, 2023 5:46:49 PM
Attachments: [09 HE letter.pdf](#)

CAUTION: EXTERNAL EMAIL - Ensure you trust this email before clicking on any links or attachments.



April 10, 2023

Re: Item 6.1 – 2023-2031 Housing Element Adoption

Dear Mayor Hicks and Members of the City Council:

The League of Women Voters supports the removal of barriers that inhibit the construction of low and moderate income housing.

We thank the City for incorporating public feedback, including ours, in preparation of this draft of the Housing Element, working hard to ensure that programs are effective and accountable and the sites inventory is more accurate in order to significantly address our housing crisis.

Our remaining amendment request is to strengthen Program 4.1a by committing the City specifically to designate staff in all departments (i.e. more than Planning and Building)—relating to entitlement and permitting—to be trained and prioritized (but not limited) to work on 100% affordable housing developments. Such developments usually have tight deadlines to meet given their funding streams, many of which are from public agencies like the City. Any delays may require additional investment and threaten viability. This is especially important as the City depends on them to meet its low-income RHNA targets.

We would also ask the City that in the event edits are made afterwards, either site inventory changes or nonsubstantive edits, that they be made publicly accessible as early as possible for greatest transparency.

All in all, we are grateful to the work of staff, council, and commissioners through this long process, and we look forward to the City moving on from planning to implementation, such as with the grant funds for Downtown Phase 2 in agenda item 4.3.

(Please send any questions about this email to Kevin Ma at housing@lwvlamv.org)

Karin Bricker, President of the LWV of Los Altos-Mountain View

cc: Ellen Yau Eric Anderson Aarti Shrivastava
Kimbra McCarthy Heather Glaser HCD

From: [Yau, Ellen](#)
To: [City Clerk](#)
Cc: [Schultz, Michal](#)
Subject: FW: The Importance for the Preservation & Enhancement of Highway Vegetation Barriers (HVBs) for Public Health and the Environment
Date: Monday, April 10, 2023 9:17:30 AM
Attachments: [Letter to Lisa Krieger at Bay Area News Group .docx](#)
[List of References for Highway Vegetation Barriers 032023.docx](#)
[Richard Baldauf Poster Session on HVBs.pdf](#)

Hello,

Would you be able to file this as received as Council Correspondence related to agenda item 6.1 2023-2031 Housing Element Adoption.

Thank you,

Ellen Yau
Senior Planner
City of Mountain View
650-903-6306

From: Daniel Shane [REDACTED]
Sent: Friday, March 31, 2023 12:36 PM
To: Yau, Ellen <Ellen.Yau@mountainview.gov>
Subject: Fwd: The Importance for the Preservation & Enhancement of Highway Vegetation Barriers (HVBs) for Public Health and the Environment

CAUTION: EXTERNAL EMAIL - Ensure you trust this email before clicking on any links or attachments.

Hello Ellen.

I would like you to enter my paper and technical references in the record for comments to the City Council Meeting on Adoption of the 2023-2031 Housing Element. These two documents are attached to this email.

The paper is on the importance of the preservation and enhancement highway vegetation barriers (HVBs) as part of the Housing Element and housing development process. There is a serious public health and environmental threat to the community by the rapid removal of HVBs, trees, urban forests, and wildlife habitat. This environmental issue has far too long been under the radar of public awareness and mindful attention. Due to rising housing developments in our communities HVBs are being destroyed at a fast pace and are irreplaceable. My paper explores a number of remedies and solutions for protecting HVBs that are commonly associated with small, but disappearing, urban forests. There are solutions to protecting the HVBs, urban forests, and wildlife and at the same time allow for more housing developments to address the housing crises by innovative project designs that better integration of the natural environment and ecosystem with

the housing development. We can have both at the same time, nature and housing. I would greatly appreciate your feedback on my draft paper. I would like a response to this email that highlights those remedies or solutions to these problems that are being addressed by changes envisioned by the City of Mountain View's Housing Element, planning practices, policies and programs. Thank you for your attention to this matter. [REDACTED]

Note: I am available to the Planning Division to make a brief presentation and answer questions about my paper, and its remedies and solutions, on HVBs. This is much more than a local issue, it is a nationwide issue. It is much more than solely about HVBs. It is about the many aspects of how we can improve urban land use planning, integrating the natural environment with human infrastructure, early engagement of the community with the developer in the project plan design phase, and changing an oftentimes adversarial and contentious planning process into a more cooperative, collaborative, coordinated, and communicative process, and more.
Begin forwarded message:

From: Daniel Shane [REDACTED]
Date: March 26, 2023 at 2:24:40 PM PDT
To: Diana Pancholi <diana.pancholi@mountainview.gov>
Cc: City Of Mountain View Environmental Planning Commission <planning.division@mountainview.gov>, Alison Hicks <Alison.Hicks@mountainview.gov>
Subject: The Importance for the Preservation & Enhancement of Highway Vegetation Barriers (HVBs) for Public Health and the Environment

Hello Diana.

I would greatly appreciate your feedback on my paper and personal research on HVBs. I believe this is an important environmental issue that needs to be addressed whenever a housing or commercial development poses a potential threat to HVBs, urban forests, trees, public health, public safety, natural environment and ecosystems. This issue has far too long been under the public radar and mindful attention. I believe the Planning Division should do everything possible to integrate HVBs and urban forests into the design of the development. This can only be effectively achieved through early engagement by the developer with the community during the early phases of the project plan design work. I would recommend engagement as early as the conceptual phase before large amounts of time and money are committed to the architecture and engineering work on the proposed project. This is the pathway that can be used to effectively address and incorporate the communities issues and concerns into the project design. Please read my paper and the list of technical and scientific references I used to support and advocate the preservation of natural HVBs in the City of Mountain View. Additionally, I would take this one step further and recommend the City of Mountain develop and implement a HVB enhancement program to construct, or fill the gaps in existing natural pollution barriers, more HVBs.

I am available to do a 20-min presentation and a 10-min Q&A to the planning staff on HVBs. I have listed several recommendations in my paper that may improve the housing development and general land use planning process.

Sincerely, Daniel Shane, homeowner, Willowgate community. [REDACTED]. Sent from my iPhone

Begin forwarded message:

From: Daniel Shane [REDACTED]
Date: March 20, 2023 at 2:03:19 PM PDT
To: Lisa Krieger <krieger@bayareanewsgroup.com>
Cc: [REDACTED]
Subject: The Importance for the Preservation & Enhancement of Highway Vegetation Barriers

HELLO LISA,

I WANTED TO SEND YOU A CLEANER COPY OF THE LETTER I EMAILED TO YOU YESTERDAY. ADDITIONALLY, I PROMISED YOU A LIST OF REFERENCES FOR HVBS.

I HOPE YOU WILL RESEARCH THIS ENVIRONMENTAL ISSUE AND WRITE AN ARTICLE ABOUT THE NEED TO PROTECT HVBS FROM DESTRUCTION BY HOUSING DEVELOPMENTS IN THE SAN FRANCISCO BAY AREA. THE CONSEQUENCES OF REMOVING THESE POLLUTION BARRIERS ARE THE EXPOSURES BY THOUSANDS OF PEOPLE LIVING NEAR HIGHWAYS TO HIGHLY TOXIC AND CARCINOGENIC AIRBORNE POLLUTANTS FROM TAILGATE EMISSIONS AND INCREASES IN RESPIRATORY ILLNESSES, CANCER, AND CHRONIC DISEASES. THESE HEALTH IMPACTS FROM EXPOSURES TO AIRBORNE CONTAMINANTS ARE PARTICULARLY BAD FOR FETUSES AND INFANTS.

I AM AVAILABLE FOR YOU TO CONSULT WITH ON THIS IMPORTANT ARTICLE.

BEST REGARDS,

DANIEL SHANE
CITY OF MOUNTAIN VIEW
[REDACTED]

RE: THE IMPORTANCE FOR PRESERVATION AND ENHANCEMENT OF HIGHWAY VEGETATION BARRIERS

Hello Lisa.

I read your article entitled "Who deserves a levee? The fight to save California communities from flooding.". This was a very good article. Kudos to you. It was a good example of lessons-learned, use of innovative ideas, and bold action. It showed how putting resources into prevention can avert a major disaster (e.g., an ounce of prevention is worth a pound of cure, as Grandma used to say). One of the highlights of my career at the U.S. EPA was the stabilization of a failing 100-year-old tailings pond at Argonaut Mine located above the town of Jackson. As an emergency responder I responded to major oil and hazmat spills after the disaster had occurred. The response to the Argonaut dam was a preventative action. I learned it was difficult to convince public officials to act before a disaster happened. Most officials were skeptical. But my overwhelming evidence based on results of the preliminary assessment was key to obtaining the funding.

The purpose of this letter to you is to see if I can generate some interest in an environmental issue that I have been working on in the City of Mountain View for the past four years. This issue is the dramatic loss of highway vegetation barriers or HVBs in our residential communities. I believe there are significant impacts from the removal of HVBs to accommodate high-density housing developments has reached a critical level. These urban barriers provide a pollution buffer between freeways and expressways and those living near these busy transportation corridors. These natural barriers are oftentimes associated with small urban forests and can be highly effective in filtering particulate matter and gaseous airborne pollutants from the emissions of cars and trucks. I will send you an accompanying email with a list of technical and scientific references that support the importance of HVBs in reducing impacts to air quality.

As you know there has been a dramatic increase in housing developments spurred on by reports of a housing crises and new State legislation that mandates a rapid reduction increase in the construction of new housing units no matter the cost to public health, welfare, or the environment. A false narrative is being used by YIMBYs to make us believe our only option is preserving nature or providing new affordable homes to the masses. This is simply not true. We can absolutely have both - a healthy environment and housing developments at the same time. But it takes placing a higher value on public health and the environment and innovative housing project designs that better integrate the natural environment with housing developments and infrastructure. A critical element for success is the early engagement of the community with the developer during the planning phase before there is large commitments (investments) of time and money in the architecture and engineering project plan design. This environmental issue has been far too long under the radar of public awareness. An article and story by you about this long ignored environmental issue would provide much needed education and awareness needed to spur action to preserve and enhance our HVBs locally, statewide, and nationally. Here is a summary of the problem, why it is a major concern, and what actions could be taken to remedy the problem. The following is the first draft of my paper.

"Due to the rising demand for housing developments, cities are actively destroying highway vegetation barriers located between freeways and expressways and residential areas. The natural tree barriers are the last defense against human exposures to very toxic and carcinogenic car and truck emissions. Many mature tree barriers have grown up high above the sound walls creating effective pollution and noise barriers. Based on EPA scientific research we know how effective tree barriers are in improving air quality and noise reduction to living areas near these roadways. Tall, dense, and overlapping canopies are effective in filtering hazardous particulates and toxic gaseous air pollutants in our communities. But corporate developers with the tacit approval of city councils are being permitted to remove these barriers at an alarming rate. Sometimes the tradeoff is an additional 20-dwelling units versus exposures to toxic and carcinogenic air pollutants 24/7 for 20-30 years. This is an unacceptable tradeoff that does not fix the housing crises. It only increases the threats to public health. It is a significant public health threat where growing infants and children are the most susceptible to exposures to toxins in the air.

We need to act now to stop this public health threat to our communities because once these pollution barriers are removed it is game over. There are no artificial or natural replacements for these trees, and it takes at least 20-30 years for regrowth and maturation of canopies. But do not take my word, contact the EPA who has conducted research studies and published reports and fact sheets. A good EPA contact is Richard Baldauf, Office of Research & Development. He has been leading the effort for years to evaluate the importance of the preservation and enhancement of highway vegetation barriers. Additionally, these urban tree barriers have a host of other environmental benefits including slowing climate change, shade and cooling effects, wildlife habitat, visual aesthetics, mental health, soil, and groundwater, and more. I believe this will become a major environmental issue nationwide. The public health agencies are not even aware or informed about this important issue. But it will be too late if the top environmental organizations and advocacy groups do not act before these barriers are destroyed."

Here is a little about me. I worked as a Federal On-Scene Coordinator (OSC) for USEPA in the Emergency Response Program from 1982-2017. I am retired. As you can see, I am very passionate about this issue and I have seen firsthand how a corporate developer and a city refused to even consider alternatives to the project design plan that would protect the pollution barrier and, at the same time, was sensitive to the need for more affordable housing in our community. I had worked for three long years, and I had nothing to show for it. At the City Council hearing there was a clear majority of residents opposed to the proposed project design plan, but the council members voted for the project anyway. So much for democracy at work.

More about HVBs: These pollution barriers are often associated with small urban forests and the additional benefits of HVBs besides improving air quality and reducing chronic diseases include providing critical urban wildlife habitat, protecting the diversity of animal species, conserving topsoil and water resources, providing shade and cooling, providing aesthetic and spiritual contribution to our mental health, reducing impacts of climate change, and much more. There are practical solutions, remedies, and strategies to accomplish the preservation and enhancement of HVBs. I believe there needs to be a *paradigm shift in perception and philosophy in terms of urban land use planning and meeting the high demand for more housing developments*. Some of the solutions are early engagement, turning an adversarial development process into a cooperative process, placing a higher value on HVBs and the natural environment and its ecosystem, more creative and innovative designs for developments based on sustainability principles. Integration of the natural environment with human infrastructure, and new motivational tools to achieve these goals such as developing and legislating specific rules, codes, ordinances, and/or guidance's by city planners and leadership.

Please feel free to contact me to discuss this environmental issue. Maybe we could meet sometime at the Clocktower Coffee Shop on Middlefield Road in Mountain View to chat about environmental problems, practical remedies, and solutions.

Best regards,
Daniel M. Shane,
Homeowner, City of Mountain View


1) American Lung Association

<https://www.lung.org/clean-air/outdoors/who-is-at-risk/highways>; <https://www.urban.org/research/publication/polluted-life-near-highway>

2) The New York Times, Trees Filter Out Pollutants

<https://na01.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.nytimes.com%2F2021%2F07%2F02%2Fclimate%2Ftrees-cities-heat-waves.html&data=05%7C01%7C%7C862069e8aabb4b542b8008dafa5e5500%7C84df9e7fe9f640afb435aaaaaaaaaaaa%7C1%7C0%7C638101978359811154%7CUnknown%7CTWFpbGZsb3d8eyJWljiMC4wLjAwMDAiLCJQIjoiV2luMzliLCJBTil6lk1haWwiLCJXVCi6Mn0%3D%7C3000%7C%7C&sdata=xcTUR9DwF4mduqU5naFczEws6ubyQVXABtyxT0RcgGw%3D&reserved=0>

3) FHWA Report

<https://rosap.ntl.bts.gov/view/dot/64307>

4) California Paper in ScienceDirect

https://www.sciencedirect.com/science/article/abs/pii/S135223101730821X?casa_token=9DNoCyUrI7YAAAAA:ueYGvL1RdLJxxKAdPKF0CntWrIiADfDnhUdSMpTs0blxO0eJ6FO0YMHZlkhEavAE_GpAKM

5) California paper in ScienceDirect

https://www.sciencedirect.com/science/article/abs/pii/S0048969718350046?casa_token=mwp74LQnak8AAAAA:TCU0w1ifArXF3bbnPT37I3vIWY147ACPkbUgeUqRQjLw7oRyjRBGfoXmMA642ysmvPrFbkw

6) EPA Report and Fact Sheet on constructing highway vegetation barriers

https://cfpub.epa.gov/si/si_public_record_report.cfm?Lab=NRMRL&dirEntryId=321772&simpleSearch=1&searchAll=Recommendations+for+constructing+roadside+vegetation+barriers+to+improve+near+road+air+quality; https://www.epa.gov/sites/default/files/2016/08/documents/recommendations_for_constructing_roadside_vegetation_barriers_to_improve_near-road_air_quality.pdf;

7) **Richard Baldauf Scientific Article in PubMed**

<https://gcc02.safelinks.protection.outlook.com/?url=https%3A%2F%2Fpubmed.ncbi.nlm.nih.gov%2F30057483%2F&data=05%7C01%7CBaldauf.Richard%40epa.gov%7Cc3000d5ad3b5492f21ae08da9e97bfcc%7C88b378b367484867acf976aacbeca6a7%7C0%7C0%7C637996671854166578%7CUnknown%7CTWFpbGZsb3d8eyJWljoimc4wLjAwMDAiLCJQIjoiV2luMzliLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000%7C%7C%7C&sdata=geOpsI5qSJMrF4YVShyFwcEzBhRdsLTfWht8%2B%2BcBpPA%3D&reserved=0>

8) **CalEPA/ARB Report from Gita Dev**

https://ww2.arb.ca.gov/sites/default/files/2017-10/rd_technical_advisory_final.pdf

9) **Sacramento AQMD Report**

<https://na01.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.airquality.org%2FLandUseTransportation%2FDocuments%2FSMAQMDFinalLandscapingGuidanceApril2017.pdf&data=05%7C01%7C%7C6aa59bbda6e1485284d508dae374d70f%7C84df9e7fe9f640afb435aaaaaaaaaaaa%7C1%7C0%7C638072388213866004%7CUnknown%7CTWFpbGZsb3d8eyJWljoimc4wLjAwMDAiLCJQIjoiV2luMzliLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000%7C%7C%7C&sdata=nIOspdlAqelLuiGrBl2JmKwRdsdUksazpamp9bLo3OA%3D&reserved=0>

10) **Chicago Schools Tree Planting**

<https://chicagorti.org/resources/vegetation-barrier-toolkit-for-schools-and-communities/>

11) **Urban Institute Report "The Polluted Life Near the Highway"**

<https://www.urban.org/research/publication/polluted-life-near-highway;>

12) **Richard Baldauf Poster Session**

Set-Backs for Carbon Capture (D'Souza)

<https://na01.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.foodandwaterwatch.org%2F2022%2F09%2F08%2Fin-california-big-win-on-setbacks-big-setback-on-carbon-capture%2F&data=05%7C01%7C%7C9cc1db2a8fa4f3d467d08dafef49882%7C84df9e7fe9f640afb435aaaaaaaaaaaa%7C1%7C0%7C638102625746819170%7CUnknown%7CTWFpbGZsb3d8eyJWljoimc4wLjAwMDAiLCJQIjoiV2luMzliLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000%7C%7C%7C&sdata=hVUXGPoX8DqAZwSNw0ZbHo0StD11hEtDqnBW2tSqWI%3D&reserved=0>

13) BAAQMD -Policy Strategy A: Strategy for Vegetative Barriers/Buffers

<https://www.baaqmd.gov/~media/files/planning-and-research/sb-1000/policy-initiatives/policy-a-stripped-pdf.pdf?la=en>



www.epa.gov/research

Integrating Air Pollution and Climate Mitigation into Roadside Green Infrastructure Projects

Richard Baldauf

U.S. Environmental Protection Agency, Office of Research & Development, Washington, DC, USA
U.S. Environmental Protection Agency, Office of Transportation & Air Quality, Ann Arbor, MI, USA

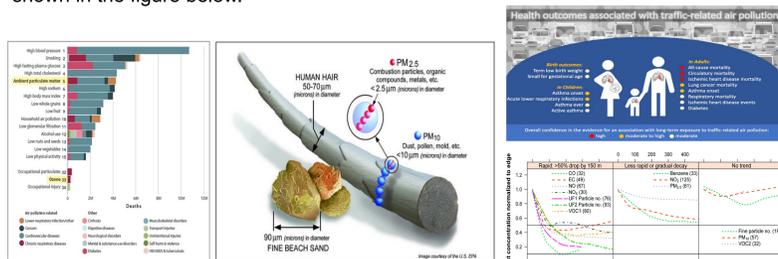
EPA-420-H-23-001

Abstract

Air pollution is one of the leading causes of death and illness worldwide according to the World Health Organization. Exposures to air pollution for people who live, work, and go to school near large transportation sources has been shown to be of especially high risk due to the proximity and frequency of these exposures to vehicle emissions. While many roadside green infrastructure projects focus on stormwater management and other ecosystem services, recent research shows that roadside vegetation can also have a significant impact on local air quality as well. This research shows that certain roadside vegetation designs can greatly reduce local air pollution levels by 50% or more; however, other vegetation characteristics can have detrimental effects and deteriorate local air quality. Guidance is needed to support roadside vegetation plantings that do not adversely impact local air quality. In addition, this guidance can be used to promote roadside plantings that improves local air quality while also achieving other ecosystem services including mitigation of greenhouse gases, improved urban cooling, and improved stormwater management. Since many communities located near large transportation facilities are already overburdened by environmental impacts, improved roadside planting designs for air quality and climate benefits will support equitable, sustainable, and safer transportation systems while avoiding unintended consequences and public health concerns from urban green infrastructure projects in these neighborhoods. This poster will review the concerns related to air pollution exposures near transportation sources, previous research on the positive and negative air quality impacts created by roadside vegetation, and design characteristics and opportunities to provide air pollution and climate mitigation benefits. The poster will also review how integrating roadside vegetation with solid structures like noise barriers and fencing can further reduce local air pollution concentrations and avoid some of the potential negative impacts of roadside vegetation alone

Air Pollution Impacts from Transportation

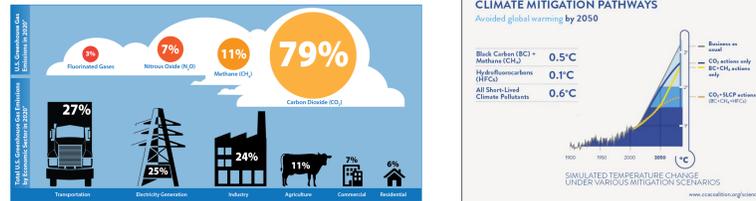
The World Health Organization (WHO) reports that air pollution is a leading cause of death and illness worldwide.¹ Exposures to particles in the air are especially damaging to human health and welfare. These airborne particles are very small and are categorized as PM10 (particles less than 10 µm in diameter) and PM2.5 (particles less than 2.5 µm in diameter). These particles are smaller than a human hair as shown in the figure below.



Numerous health studies have shown that exposures to air pollutants emitted by transportation sources, especially when exposures to these emissions occur near the source of emissions such as highways and other large roadways, can be especially harmful to human health. A recent meta-analysis by the Health Effects Institute showed that people who live, work, and go to school within approximately 300-500 meters of large roadways face increased risks for numerous adverse health effects including asthma and other respiratory effects, cardiovascular illnesses, birth and developmental effects, and even premature mortality.² Other studies have shown increased risks for additional adverse health effects including childhood leukemia, cognitive development, and neurological effects including autism. These studies generally show increased risks out to 500 meters from the road, air pollution measurement studies show that air pollution concentrations are especially high within the first 100-150 meters of the road.³ While this is a relatively short distance, the EPA estimates that over 50 million people live within just 100 meters of a major road and as many as 17,000 schools are located within 250 meters of a large roadway.⁴ Thus, mitigating these air pollution impacts on human health near the source are extremely important.

Climate Impacts from Transportation

As of 2020, transportation sources emitted the highest amount of greenhouse gases (GHGs) for the fifth year in a row. The majority of these emissions occurred as carbon dioxide (CO2) followed by methane (CH4) and nitrous oxide (N2O). Not included in this inventory is the short-lived climate pollutant (SLCP) black carbon (BC), often referred to as soot. Transportation sources, especially diesel-powered vehicles, can emit significant amounts of BC. As noted by the United Nations, reducing ambient air concentrations of SLCPs, especially BC and CH4, will be critical in achieving the goal of limiting climate change to 1.5°C.



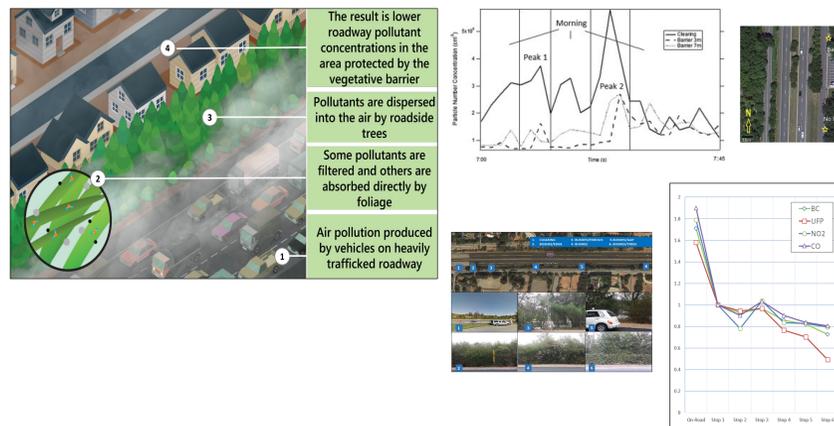
Air Pollution Emissions from Transportation

Motor vehicles emit air pollution when operating through tailpipe emissions from gasoline and diesel fuel combustion, evaporation and leaking of fuel and fluids, wear from brake and tire use, rusting and deterioration of vehicle components, and the re-entrainment and suspension of dust and other materials deposited on the roadway. These emissions include PM2.5, PM10, and BC along with many other forms of airborne particles and gases. While strategies have been implemented to reduce vehicle emissions, notably the increased electrification of the motor vehicle fleet, this fleet transition will take decades to fully implement, and emissions will continue from brake and tire wear and the re-suspension of roadway materials. Thus, methods will continue to be needed to reduce air pollution exposures from traffic emissions, especially close to large highways and arterial roads.



Roadside Vegetation Research

Research has demonstrated that roadside vegetation can reduce air and climate pollutants when located adjacent to large roadways. Studies indicate that PM concentrations, including BC, can be reduced by as much as 50%, depending on the particle size and composition. PM concentration reductions are highest for larger, coarse PM10 as well as for very small particles below 100 nm in diameter (often called ultrafine particles). BC particles are typically in the ultrafine particle size range. Research also shows that concentrations of some gaseous pollutants can be reduced as well. Roadside vegetation reduces air pollution concentrations by two mechanisms: increasing the dispersion of pollutants after being emitted by nearby motor vehicles and deposition of particles and gases on vegetation leaf and branch surfaces. In order to effectively remove air and climate pollutants, the design and characteristics of the vegetation are extremely important.



Roadside Vegetation Recommendations

Research shows the characteristics of the roadside vegetation are critical in determining whether traffic-emitted air pollution concentrations will be reduced, or if the presence of roadside vegetation will potentially cause increased air pollution concentrations in the near-road environment. In general, roadside vegetation must be tall, thick, and have the leaves and branches completely cover from the ground to the top of the canopy to achieve pollutant reductions. If the vegetation has gaps and/or is highly porous, the vegetation can allow the air pollutants to pass through while also stagnating wind flow, leading to an increase in downwind air pollution concentrations. The U.S. EPA developed recommendations to highlight the characteristics needed by roadside vegetation to improve local air quality.⁷ This report also summarizes other important considerations to achieving air quality benefits from roadside vegetation including species types, site characteristics, and maintenance. The report also describes methods to combine vegetation with solid barriers such as noise walls and fencing to achieve air quality benefits, which research shows can be more effective than vegetation alone.

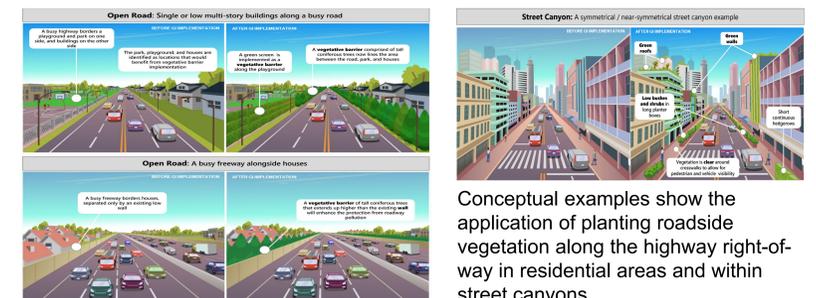


Roadside vegetation designs and characteristics that can result in **decreased** downwind air pollution concentrations.



Roadside vegetation designs and characteristics that can result in **increased** downwind air pollution concentrations.

Combining solid barriers with trees and hedges can result in the highest reductions of downwind air pollution concentrations compared with either solid barrier or vegetation alone.



Conceptual examples show the application of planting roadside vegetation along the highway right-of-way in residential areas and within street canyons.

Disclaimer, Acknowledgements, References

This presentation has been subjected to the Agency's review process and has been approved for publication. These are the views of the authors and do not necessarily reflect official policy of the EPA. Mention of trade names or commercial products does not constitute endorsement or recommendation for use. The author would like to acknowledge the contributions of Sheila Batka and Ken Davidson of the U.S. EPA who lead the implementation of pilot studies in Detroit and Oakland, respectively, and Olivia Ryder of Sonoma Technology who contributed to many of the graphics used in this presentation. The author also acknowledges John Gallagher (Trinity College Dublin), Prashant Kumar (Univ. Surrey), and K. Max Zhang (Cornell Univ.) for collaboration on the research efforts and guidance materials that informed this summary.

¹ World Health Organization (<https://www.who.int/health-topics/air-pollution>)
² Health Effects Institute (<https://www.healtheffects.org/publication/systematic-review-and-meta-analysis-selected-health-effects-long-term-exposure-traffic/>)
³ Karner et al. 2010, Environ Science & Tech, 44(14), pp.5334-5344
⁴ U.S. EPA Best Practices for Reducing Near-Road Pollution Exposure at Schools (<https://www.epa.gov/mobile-source-pollution/how-mobile-source-pollution-affects-your-health/best-practices-for-schools>)
⁵ Baldauf, 2017, Transport Res Part D: Transport & Environ, 52, pp.354-361
⁶ Abhijith et al, 2017, Atmospheric Environment, 162, pp.71-86
⁷ U.S. EPA Recommendations for Constructing Roadside Vegetation Barriers to Improve Near-Road Air Quality (<https://www.epa.gov/air-research/recommendations-constructing-roadside-vegetation-barriers-improve-near-road-air>)