Land-Use Design Elements and Mitigation Measures

The San Joaquin Valley Air Pollution Control District (District) has prepared the following Tables, listing mitigation measures to help land use agencies and developers identify ways to reduce air impacts associated with development projects occurring within the San Joaquin Valley Air Basin. Please note that this is not an exhaustive list, and both land use agencies and developers are encouraged to suggest new mitigation measures to add to the Tables.

Table 1: Mitigation Measures by Project Type

Project	Impact	Mitigation
General plan updates, large specific plans, new towns	Regional ozone impact, PM10 impact, CO hot spots, toxic air emissions, odors	• Adopt air quality element/general plan air quality policies/specific plan policies. • Discuss the feasibility of Voluntary Emission Reduction Agreements (VERAs) for certain types of projects. • Adopt air quality enhancing design guidelines or standards. • Designate pedestrian and transit oriented development areas on general and specific plan land use maps. • Adopt ordinance limiting wood burning appliances and fireplace installations. • Coordinate fugitive dust regulation enforcement with the SJVAPCD. • Adopt energy efficiency incentive programs. • Adopt local alternative fuels programs. • Coordinate location of land uses to separate odor generators and sensitive receptors. • Adopt operational zero or near-zero (0.02 g/bhp-hr NOx) emission Heavy Duty (HHD) fleets. • Adopt buffer distances associated with various types of common sources (e.g. distribution centers, chrome platers, gasoline dispensing facilities, etc.) based on the California Air Resources' (CARB) *Air Quality and Land Use Handbook: A Community Health Perspective.* Document can be found at: https://ww3.arb.ca.gov/ch/handbook.pdf. • Adopt best practices designed to address air pollution impacts as defined in the *CARB Freight Handbook.* Document can be found at: https://ww2.arb.ca.gov/resources/documents/concept-paper-freight-handbook. • Adopt the use of Construction Clean Fleets.

Table 1: Mitigation Measures by Project Type (continued)

Project	Impact	Mitigation
General plan amendments, small specific plans, and some zone changes	Potential regional Ozone impact, Cumulative impacts, CO hot spots, toxic air emissions, odors	• Apply general plan policies, local ordinances, and programs from above to the project site or adopt similar site specific programs. • Restrict residential traditional wood fireplaces, and incentivize natural gas fireplaces or inserts. • Encourage pedestrian/transit oriented project designs. • Discuss the feasibility of VERAs for certain types of projects. • Commit to on-site improvements, bikeways, transit infrastructure, and pedestrian enhancements. • Provide traffic flow improvements for areas impacted by development projects. • Adopt operational zero or near-zero (0.02 g/bhp-hr NOx) emission Heavy Duty (HHD) fleets. • Adopt buffer distances associated with various types of common sources (e.g. distribution centers, chrome platers, gasoline dispensing facilities, and etc.) based on the California Air Resources' (CARB) *Air Quality and Land Use Handbook: A Community Health Perspective.* Document can be found at: https://ww3.arb.ca.gov/ch/handbook.pdf. • Adopt best practices designed to address air pollution impacts as defined in the *CARB Freight Handbook.* Document can be found at: https://ww2.arb.ca.gov/resources/documents/concept-paper-freight-handbook. • Adopt the use of Construction Clean Fleets.
Tentative maps, site plans, conditional use permits	Cumulative ozone impacts, CO, toxic air emissions, odors	• Apply general plan policies, local ordinances, and programs from above to the project site. • Encourage pedestrian/transit oriented site designs. • Provide on-site improvement: bikeways, transit infrastructure, pedestrian enhancements. • Contribute to Air Quality Mitigation Fee Fund. • Energy conservation measures above and beyond requirements. • Require residences to install natural gas fireplaces or inserts in lieu of traditional open hearth wood fireplaces. • Pay for fleet vehicle conversions to alternative fuels.

Table 2: Regulation VIII Control Measures for Construction PM10 Emissions

Regulation VIII Control Measures - The following controls are required to be implemented at all construction sites
• All disturbed areas, including storage piles, which are not being actively utilized for construction purposes, shall be effectively stabilized of dust emissions using water, chemical stabilizer/suppressant, covered with a tarp or other suitable cover or vegetative ground cover. • All on-site unpaved roads and off-site unpaved access roads shall be effectively stabilized of dust emissions using water or chemical stabilizer/suppressant. • All land clearing, grubbing, scraping, excavation, land leveling, grading, cut & fill, and demolition activities shall be effectively controlled of fugitive dust emissions utilizing application of water or by presoaking. • When materials are transported off-site, all material shall be covered, or effectively wetted to limit visible dust emissions, and at least six inches of freeboard space from the top of the container shall be maintained. • All operations shall remove the accumulation of mud or dirt from adjacent public streets at the end of each workday *(the use of dry rotary brushes is expressly prohibited except where preceded or accompanied by sufficient wetting to limit the visible dust emissions. Use of blower devices is expressly forbidden).* • Following the addition of materials to, or the removal of materials from, the surface of outdoor storage piles, said piles shall be effectively stabilized of fugitive dust emissions utilizing sufficient water or chemical stabilizer/suppressant. • Within urban areas, trackout shall be immediately removed when it extends 50 or more feet from the site. • An owner/operator of any site with 150 or more vehicle trips per day, or 20 or more vehicle trips per day by vehicles with three or more axles shall implement measures to prevent carryout and trackout.
Enhanced Control Measures. The following measures should be implemented at construction sites when required to mitigate significant PM10 impacts
• Post speed limit signs on unpaved roads limiting traffic to no more than 15 mph. • Install sandbags or other erosion control measures to prevent silt runoff to public roadways from sites with a slope greater than one percent.
Additional Control Measures. The following control measures are strongly encouraged at construction sites that are large in area, located near sensitive receptors, or for any other reason warranting additional emissions reductions
• Install wheel washers for all exiting trucks, or wash off all trucks and equipment leaving the site. • Construct and maintain wind barriers sufficient to limit visible dust to 20% opacity. • Suspend excavation and grading activity when winds exceed 20 mph. • Limit the size of areas subject to excavation, grading, and other construction activity occurring at any one time.

Table 3: Construction Equipment Mitigation Measures

Emissions Source	Mitigation Measure
Heavy duty equipment (scrapers, graders, trenchers, earth movers, etc.)	• Use of alternative fueled or catalyst equipped diesel construction equipment. • Minimize idling time (e.g., 5 minute maximum). • Limit the hours of operation of heavy duty equipment and/or the amount of equipment in use. • Replace fossil-fueled equipment with electrically driven equivalents (provided they are not run via a portable generator set). • Curtail construction during periods of high ambient pollutant concentrations. This may include ceasing of construction activity during the peak-hour of vehicular traffic on adjacent roadways. • Implement activity management (e.g. rescheduling activities to reduce short-term impacts).

Table 4: Infrastructure-Based Mitigation Measures – Transit Enhancements

Mitigation Measures	Supporting Factors to Enhance Effectiveness
Provide transit enhancing infrastructure that includes: transit shelters, benches, street lighting, route signs and displays, and bus turnouts	• Type of transit service (heavy rail, light rail, bus) – rail attracts more riders • Distance from home to transit station and transit station to work - ridership 2-4 times higher within ½ mile • Density of land use - higher densities provide greater ridership • Mix of uses at either end of transit trip - mixed use increases transit use • Pedestrian accessibility to transit system
Provide a Bus Rapid Transit (BRT) System	• Design features for high quality and cost effective transit service

Table 5: Infrastructure-Based Mitigation Measures – Reducing Vehicle Miles Traveled (VMT)

Mitigation Measures	Supporting Factors to Enhance Effectiveness
Provide park and ride lots and/or satellite telecommuting centers	• Distance to employment centers - long commute attracts park and ride users and telecommuters • Degree of congestion on routes to employment centers • Availability of high occupant vehicle (HOV) lanes, express transit, rail, rideshare incentives • Type of employers - information based jobs have higher telecommuting potential
Market Commute Trip Reduction Options	• Market strategies to reduce commute trips (e.g. new employee orientation of trip reduction and alternative mode options, event promotions, and publications)

Table 6: Infrastructure-Based Mitigation Measures – Pedestrian Enhancements

Mitigation Measures	Supporting Factors to Enhance Effectiveness
Provide pedestrian enhancing infrastructure that includes: sidewalks and pedestrian paths, direct pedestrian connections, street trees to shade sidewalks, pedestrian safety designs/infrastructure, street furniture and artwork, street lighting, and/or pedestrian signalization and signage	• Degree of sidewalk/path coverage within walking distance. • Mixture of uses to attract pedestrians within walking distance. • Pedestrian circulation provides direct access (streets interconnected/pedestrian shortcuts). • Degree of street tree coverage along most used routes. • Street system designed to enhance pedestrian safety (traffic calming, signalization, separation from traffic, limited curb cuts, etc.). • Pedestrian routes provide safety from crime (eyes on the street, high activity levels, lack of gangs). • Walking routes to important destinations provide visual interest for pedestrians.

Table 7: Infrastructure-Based Mitigation Measures – Bicycle Enhancements

Mitigation Measures	Supporting Factors to Enhance Effectiveness
Provide bicycle enhancing infrastructure that includes: bikeways, paths connecting to a bikeway system, secure bicycle parking, and/or employee lockers and showers	• Degree area within bicycling distance (5 miles max.) is served by interconnected bikeways. • Degree area within bicycling distance has wide paved shoulders and limited curb cuts. • Speed limits on routes to frequent destinations - low speed limits enhance cycling. • Presence of college or university within cycling distance. • Mixture of uses that attract bicyclists within cycling distance. • Availability of bicycle parking within cycling distance - communities with bike parking ordinance tend to have high availability.

Table 8: Operational Mitigation Measures – Ridesharing

Mitigation Measures	Supporting Factors to Enhance Effectiveness
Implement carpool/ vanpool program e.g., carpool ride matching for employees, assistance with vanpool formation, provision of vanpool vehicles, etc.	• Employer provides support measures such as carpool/vanpool subsidies, preferential parking, guaranteed ride home program, etc. • Coordinate with regional ridesharing organizations, e.g., Commute Connection, Central Valley Ridesharing, Kern Rideshare. • Multiple smaller worksites coordinate programs. • Limited parking supply and/or implementation of parking fees or parking cash-out.

Table 9: Operational Mitigation Measures – Employee Services

Mitigation Measures	Supporting Factors to Enhance Effectiveness
Provide on-site shops and services for employees, such as cafeteria, bank/ ATM, dry cleaners, convenience market, etc.	• Sufficient number of employees at worksite, or cooperation among multiple worksites. • Safe, direct pedestrian access between employment and retail areas. • Jurisdiction provides density bonuses, other incentives to encourage mixed land uses.
Provide on-site child care, or contribute to offsite child care within walking distance	• Sufficient number of employees at worksite, or cooperation among multiple worksites.

Table 10: Operational Mitigation Measures – Shuttle Services

Mitigation Measures	Supporting Factors to Enhance Effectiveness
Establish mid-day shuttle service from worksite to food service establishments and commercial areas	• Sufficient number of employees at worksite, or cooperation among multiple worksites. • Commercial area located within 3 miles. • Frequent, scheduled service during lunch hours. • Coordination among multiple employers, e.g., at business parks. • Provide commute shuttle to transit station, use same vehicle for mid-day shuttle.
Provide shuttle service to transit stations and multimodal centers	• Major transit facility/multimodal center located within 3 miles of project. • Transit use incentives for employees, e.g., on-site distribution of passes, subsidized transit passes, etc. • Frequent, scheduled service during peak commute periods • Coordination among multiple employers, e.g., at business parks. • Free or subsidized service. • Provide mid-day shuttle to commercial areas, use same vehicle for commute shuttle.

Table 11: Operational Mitigation Measures – Parking Strategies

Mitigation Measures	Supporting Factors to Enhance Effectiveness
Provide preferential parking (e.g. near building entrance, sheltered area, etc.) for carpool and vanpool vehicles	• Most effective if parking supply is limited and/or located far from building entrance.
Implement parking fees for single occupancy vehicle commuters	• Reduced or waived fees for carpools and vanpools. • Complemented by transit, ridesharing programs, other commute alternatives. • Revenues used to support commute alternatives. • Provisions in place to avoid off-site parking spillover.
Implement parking cash-out program for employees (i.e., non-driving employees receive transportation allowance equivalent to value of subsidized parking)	• Complemented by transit, ridesharing programs, other commute alternatives. • Implement at worksites not subject to state parking cash-out requirements. • Tax benefits if travel allowance offered as transit / ridesharing subsidy. • Provisions in place to avoid off-site parking spillover.

Table 12: Operational Mitigation Measures – Transit Services

Mitigation Measures	Supporting Factors to Enhance Effectiveness
Provide transit incentives	• Transit use incentives for employees, e.g., on-site distribution of passes, subsidized transit passes, etc. • Transit route maps and schedules posted at worksite. • Design and locate buildings to facilitate transit access, e.g., locate building entrances near transit stops, eliminate building setbacks, etc.

Table 13: Other Operational Mitigation Measures

Mitigation Measures	Supporting Factors to Enhance Effectiveness
Implement compressed work week schedule (e.g. 4/40, 9/80)	• Consult with employees prior to program implementation.
Implement home-based telecommuting program	• Participation increased if employer provides/assists with provision of equipment (modem, computer, etc.). • Especially effective if employee commute trips are long.
Implement School Bus Program	• Restore or expand school bus service in project area and local community by working with school districts.

Table 13: Other Operational Mitigation Measures (continued)

Mitigation Measures	Supporting Factors to Enhance Effectiveness
Unbundle Parking Costs from Property Costs	• Separate parking from property costs requiring those who wish to purchase parking spaces to do so at an additional cost from the property cost. • This removes the burden from those who do not wish to utilize a parking space.
Implement Market Price Public Parking (On Street)	• Implement pricing strategy for parking by pricing all central business district/employment center/retail center on street parking • It will be priced to encourage 'park once' behavior. • The benefit of this measure above that of paid parking at the project only is that it deters parking spillover from project-supplied parking to other public parking nearby, which undermine the vehicle miles traveled benefits of project pricing.
Integrate Affordable and Below Market Rate Housing	• Strategy encourages building a greater percentage of smaller units that allow a greater number of families to be accommodated on infill and transit-oriented development sites within a given footprint and height limit. • Lower income families tend to have a lower level of auto ownership, allowing buildings to be designed with less parking.
Implement NEV Network	• Create local 'light' vehicle network such as NEV networks • NEV are classified as 'low speed vehicles' and are electric powered and must conform to applicable federal automobile safety standards. • NEV offer an alternative to traditional vehicle trips and can legally be used on roadways with speed limits of 35 mph or less, ideal for short trips up to 30 miles in length. • Project will implement necessary infrastructure, including NEV parking, charging facilities, striping, and educational tools. • NEV routers will be implemented throughout the project and will double as bicycle routes.
Clean Operational Zero or Near-Zero Fleet	• Use of operational fleets that utilize the cleanest available HHD truck technologies, including near-zero (0.02 g/bhp-hr NOx) technologies as feasible. • Use of on-site service equipment (cargo handling, yard hostlers, forklifts, pallet jacks, etc. from development projects to utilize zero-emissions technologies as feasible.

Table 13: Other Operational Mitigation Measures (continued)

Mitigation Measures	Supporting Factors to Enhance Effectiveness
Buffer Distances	• Use of recommended buffer distances associated with various types of common sources (e.g. distribution centers, chrome platers, gasoline dispensing facilities, and etc.) as identified in the California Air Board Resources' (CARB) *Air Quality and Land Use Handbook: A Community Health Perspective.* Document can be found at: https://ww3.arb.ca.gov/ch/handbook.pdf.
Best Freight Practices	• Use of best practices which apply to the siting, design, construction, and operation of freight facilities to minimize health impacts on nearby communities as identified in the CARB *Freight Handbook.* Document can be found at: https://ww2.arb.ca.gov/resources/documents/concept-paper-freight-handbook.

Table 14: Area Source Mitigation Measures

Mitigation Measures	Supporting Factors to Enhance Effectiveness
Residential Water Heaters	• Use solar or low-emission water heaters (beyond Rule 4902). • Use central water heaters.
Residential Energy Efficiency	• Orient buildings to take advantage of solar heating and natural cooling and use passive solar designs. • Increase wall and attic insulation beyond Title 24 requirements.
Commercial Water Heaters	• Use solar or low-emission water heaters. • Use central water heating systems.
Commercial Energy Efficiency	• Orient buildings to take advantage of solar heating and natural cooling and use passive solar designs. • Increase wall and attic insulation beyond Title 24 requirements.
Industrial Heating	• Orient buildings to take advantage of solar heating and natural cooling and use passive solar designs.
Landscape Maintenance	• Provide electric maintenance equipment.
Residential Heating	• Eliminate or limit the amount of traditional fireplaces installed (i.e. natural gas fireplaces/inserts or at least EPA certified wood stoves or inserts instead of open hearth fireplaces).

Additional Mitigation Measures

1. Increase residential density.

2. Designate a portion of residential units as deed-restricted below-market-rate (BMR) housing; Affordable Housing.

3. Provide Class I and Class II bicycle parking/storage facilities on-site. Bicycle parking facilities should be near destination points and easy to find. At least one bicycle parking space for every 20 vehicle parking spaces.

4. Provide shower and locker facilities to encourage employees to bike and/or walk to work, typically one shower and three lockers for every 25 employees.

5. Provide Class I bicycle parking at apartment complexes or condos without garages.

6. Install Class I or II bike lanes on arterial/collector streets, or where a suitable route exists.

7. Provide building access and paths which are physically separated from street parking lot traffic and that eliminate physical barriers such as walls, berms, landscaping and slopes that impede the use of pedestrians, bicycle facilities, or public transportation vehicles.

8. Provide continuous sidewalks separated from the roadway by landscaping and on-street parking.

9. Provide on and off-site pedestrian facility improvements such as trails linking them to designated pedestrian commuting routes and/or on-site overpasses and wider sidewalks.

10. Link cul-de-sacs and dead-end streets to encourage pedestrian and bicycle travel.

11. Provide traffic reduction modifications to project roads, such as: narrower streets, speed platforms, bulb-outs and intersection modifications designed to reduce vehicle speeds and to encourage pedestrian and bicycle travel.

12. Provide a parking lot design that includes clearly marked and shaded pedestrian pathways between transit facilities and building entrances.

13. Provide pedestrian access between bus service and major transportation points and to destination points within the project.

14. Provide a display case or kiosk displaying transportation information in a prominent area accessible to employees, residents, or visitors.

15. Display Bike Route Maps, Bus Schedules, and any other transportation information such as carpooling, car sharing.

16. Utilize project design models by the Local Government Commission (LGC) such as: street block patterns that form an interconnected grid, short block faces, numerous alleys and narrow streets (https://www.lgc.org/resources/community-design)

17. Develop and implement parking pricing strategies, such as charging parking lot fees to low occupancy (single occupant vehicles) vehicles.

18. Provide preferential parking spaces near the entrance of buildings for those who carpool/vanpool/rideshare and provide signage.

19. Install efficient heating and other appliances, such as water heaters, cooking equipment, refrigerators, furnaces and boiler units beyond Title 24 requirements (see Title 24, Part 6, Energy Efficiency Standards for Residential and Nonresidential Buildings: http://www.energy.ca.gov/title24)

20. Improve the thermal integrity/efficiency of buildings, and reduce the thermal load with automated and timed temperature controls or occupant sensors.

21. Incorporate solar power systems as an emission reduction strategy.

22. Install high efficiency Energy Star heating or ground source heat pump.

23. Install energy efficient interior lighting.

24. Install built-in energy efficient appliances.

25. Install electrical outlets on the exterior walls of both the front and back of residences or all commercial buildings to promote the use of electric landscape maintenance equipment.

26. Install electric vehicle recharging stations in parking garages and parking lots.

27. Install a gas outlet for use with outdoor cooking appliances, and in any proposed fireplaces, including outdoor recreational fireplaces or pits.

28. Install HEPA (High Efficiency Particulate Air) filters.

29. Install "whole-house" or "fresh-air" ventilation systems.

30. Reduce the use of Wood Burning Fireplaces and/or Woodstoves beyond that required by District Rule 4901.

31. Provide guaranteed ride home for employees.

32. Provide carpool support system.

33. Implement a rideshare program.

34. Provide incentives to employees to carpool/vanpool, take public transportation, telecommute, walk, bike, etc.

35. Provide transit pass subsidy (100%) and/or commute alternative allowances.

36. Provide an employer subsidized shuttle service to connect to existing transit sites.

37. Implement a lunchtime shuttle to reduce single occupant vehicle trips.

38. Provide electric shuttle or minibus service to transit stops.

39. Provide free transfers between all shuttles and transit.

40. Operation of a shuttle bus to shopping, health care, public services sites, etc. to reduce automobile use.

41. Implement alternative work schedules such as compressed workweek schedules where weekly work hours are compressed into fewer than five days. Examples of these options are: 9/80, 4/40, 3/36.

42. Project provides and/or requires use of electric maintenance equipment; including, but not limited to electric lawn mowers, electric leaf blowers, etc.

43. Prohibit gas powered landscape maintenance equipment within developments.

44. Replace diesel fleet with alternative fuel engine technology and infrastructure.

45. Retrofit existing equipment to reduce emissions using methods such as particulate filters, oxidation catalysts, or other approved technologies.

46. Adopt a Vehicle Idling Policy requiring all vehicles under company control to adhere to a 5 minute idling policy.

47. Add-on control devices, e.g., particulate traps, catalytic oxidizers on construction equipment.

48. Repower/Retrofit heavy-duty diesel fleet with cleaner diesel engine technology and/or diesel particulate filter after-treatment technology.

49. Replace auxiliary power units with cleaner engine technology, alternative fuels, or require electric connection while at loading dock.

50. Replace diesel fleet vehicles with cleaner fueled low emission vehicles (i.e. school buses, buses, on- and off- road heavy duty vehicles, lighter duty trucks and passenger vehicles).

51. Improve destination accessibility such as locating the project within 12 miles from the downtown or a job center.

52. Use of a “Construction Clean Fleet” that will reduce construction emissions by 20% for oxides of nitrogen (NOx) and 45% for particulate matter of 10 microns or less in size (PM10) from the statewide average as estimated by the Air Resource Board ARB. A Construction Clean Fleet for a project includes all the pieces of construction equipment that are greater than 50 horse power and generate emissions from the use of an internal combustion engine related to construction activity. On average a mix of construction fleet with engine model years five (5) years or newer from the current calendar year would likely achieve the required reduction for NOx and PM10. Please note, the construction start year, fleet engine year mix, equipment type, and the number of hours used by each piece of equipment all can affect the ability to achieve the required reductions.