

TECHNICAL APPENDICES

# Moving Cooler

An Analysis of  
Transportation Strategies  
for Reducing  
Greenhouse Gas Emissions

**Prepared for**  
*Moving Cooler Steering Committee*

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# Appendix A

*Moving Cooler Emission Reduction Strategies and Actions*



# *Moving Cooler* Emission Reduction Strategies and Actions

The attached table summarizes the greenhouse gas emission reduction strategies selected as the focus for *Moving Cooler* analysis.

The actions are organized into nine strategy categories:

1. Pricing Strategies;
2. Land Use and Smart Growth Strategies;
3. Nonmotorized Transportation Strategies;
4. Public Transportation Improvement Strategies;
5. Regional Ride-Sharing, Car-Sharing and Commuting Strategies;
6. Regulatory Strategies;
7. Operational and Intelligent Transportation Systems (ITS) Strategies;
8. Bottleneck Relief and Capacity Expansion Strategies; and
9. Multimodal Freight Strategies.

## ■ Levels of Deployment

The cost and effectiveness for each of these strategies will be assessed at three levels of implementation that assume increasingly aggressive scope, speed, and scale of effort:

- A. **Expanded Current Practice: Expansion of Current Trends and State of Innovation.** This level of deployment assumes that the strategies are expanded and steadily implemented, consistent with existing practices for reducing GHG emissions, and focusing predominantly on major metropolitan areas.
- B. **More Aggressive: Faster, Broader, Stronger Implementation.** Strategies are implemented sooner, more broadly, and more intensively. For example, pricing strategies would be implemented in a wide range of metropolitan areas, and requirements would be established for the penetration of PAYD insurance in all 50 states.

- C. **Maximum Effort: Comprehensive, Rapid, Intense Implementation.** At this level, substantial policy changes and very significant increased levels of funding would be required to ensure that timely implementation of strategies at very high levels of intensity is achieved nationwide.

Illustrative specific thresholds for each strategy are defined below for each of these levels of implementation.

The parameters in Table A.1 include for each strategy the following dimensions: 1) the intensity of implementation; 2) disaggregated by the metropolitan/region type; 3) referencing the timing of implementation; and 4) describing the targeted area or activity (e.g., CBD, commute trips). The short hand for metropolitan/region type is as follows:

- **LH** – Large metropolitan areas (over 1M population, with higher per capita baseline transit use);
- **LL** – Large metropolitan areas (over 1M population, with lower per capita baseline transit use);
- **MH** – Medium metropolitan areas (between 400K and 1M population, with higher per capita baseline transit use);
- **ML** – Medium metropolitan areas (between 400K and 1M population, with lower per capita baseline transit use);
- **SH** – Smaller metropolitan areas (between 50K and 400K population, with higher per capita baseline transit use);
- **SL** – Smaller metropolitan areas (between 50K and 400K population, with lower per capita baseline transit use); and
- **NU** – Nonurban areas: outside a metropolitan area and rural, exurban, or with a population center of less than 50K inhabitants.

## ■ **Timeframe for Analysis**

The cumulative level of greenhouse gas reduction achieved by 2020, 2030, and 2050 will be calculated for each action, as will annual reductions through 2050. These benchmark years provide a common timeframe for analysis across strategies and actions. It is important to note that the amount of time required to implement individual strategies varies considerably: Implementation of some actions is underway now and will occur incrementally over several years (for example, many operational strategies); some actions can be initiated and put in place relatively easily within a few years; other actions require long lead times. Therefore the number of years a strategy is in place – and the resulting length of time it is assumed to contribute to GHG reductions – varies in this analysis.

Four approximate start-up dates are used: 2010, 2015, 2020, or 2025. These provide the estimated timeframe within which an action is started and begins to effect GHG levels. In instances where these dates do not fit a reasonably anticipated approach to a specific strategy, the Cambridge Systematics team used professional judgment to adjust these standardized dates.

**Table A.1 Moving Cooler Greenhouse Gas Emission Reduction Strategies**

Where not otherwise indicated, all measures are cumulative at higher levels of implementation.

GHG Reduction Strategy	A. Expanded Best Practice	B. More Aggressive	C. Maximum Effort
<b>Pricing Strategies</b>			
Parking Pricing	<p><b>2015:</b> [LH, MH] <b>2020:</b> [LL, ML, SH] <b>2020:</b> [SL] Begin pricing all CBD/employment center/retail center street parking; price to encourage “park-once” behavior; complete over eight years.</p>	<p><b>2010:</b> [LH, LL, MH] <b>2015:</b> [ML, SH, SL] Begin pricing all CBD/employment center/retail center street parking; price to encourage “park-once” behavior; complete over six years.</p> <p><b>2020:</b> [LH, LL, MH] <b>2025:</b> [ML, SH, SL] Introduce tax/higher tax on free private parking lots with &gt;100 spaces (retail and employer). This includes employer-subsidized/paid spots for employees and validated parking</p> <p><b>2020:</b> [LH, LL, MH] <b>2025:</b> [ML, SH, SL] Require residential parking permit for on-street parking in residential areas; minimum cost: \$200 biannually.</p>	<p><b>2010:</b> [LH, LL, MH] <b>2015:</b> [ML, SH, SL] Begin pricing all CBD/employment center/retail center street parking; price to encourage “park-once” behavior; complete over four years.</p> <p><b>2015:</b> [LH, LL, MH, ML, SH, SL] Introduce tax/higher tax on all free private parking lots with &gt;50 spaces (retail and employer). This includes employer-subsidized/paid spots for employees and validated parking</p> <p><b>2015:</b> [LH, LL, MH, ML, SH, SL] Require residential parking permit for on-street parking in residential areas; minimum cost: \$400 biannually. Delivery and service vehicles must purchase multi-zone permit at double cost; visitor’s permits at \$3 per day. Phase in by 2020.</p>
Cordon Pricing	<p>Expanded best practice defined as implementation of currently proposed area pricing programs plus new implementation in longer term.</p> <p><b>2015</b> LH; <b>2025</b> MH, SH; <b>2035</b> ML, LL, SL. Implement area pricing in CBD and major employment and retail centers. Ramp up over 10 years</p> <p>GHG emission benefits includes congestion reduction effects.</p>	<p><b>2015</b> LH; <b>2020</b> MH, SH; <b>2025</b> ML, LL, SL. Implement area pricing in CBD and major employment and retail centers. Ramp up over 10 years.</p> <p>GHG emission benefits includes congestion reduction effects.</p>	<p><b>2010</b> LH; <b>2015</b> MH; <b>2020</b> LL, ML, SH, SL. Implement area pricing in CBD and major employment and retail centers. Ramp up over 10 years.</p> <p>GHG emission benefits includes congestion reduction effects.</p>

GHG Reduction Strategy	A. Expanded Best Practice	B. More Aggressive	C. Maximum Effort
Congestion Pricing	<p>Expand existing congestion pricing proposals to include all large regions starting in 2015 with pricing completed within 15 years. Average peak hour per mile price of \$0.49 on congested segments</p> <p>GHG emission benefits includes congestion reduction effects.</p>	<p><b>2015</b> LH and LL; <b>2020</b> MH and ML; <b>2025</b> SH and SL. Begin implementing areawide congestion pricing on all congested urban highways and roads with prices sufficient to maintain LOS D on facilities previously LOS F. Complete pricing within 10 years. Average peak hour per mile price of \$0.65 on congested segments.</p> <p>GHG emission benefits includes congestion reduction effects.</p>	<p><b>2015</b> LH and LL; <b>2015</b> MH and ML; <b>2020</b> SH and SL. Begin congestion pricing on urban roads with prices sufficient to maintain LOS D. Begin implementing congestion pricing on congested rural freeways and arterials with prices sufficient to maintain LOS C. Average peak hour per mile price of \$0.65 on congested segments.</p> <p>GHG emission benefits includes congestion reduction effects.</p>
Intercity Tolls	<p><b>2020</b> [All regions] Toll all intercity (rural) Interstates at a minimum of \$0.02 per mile</p>	<p><b>2015</b> [All regions] Toll all intercity (rural) Interstates at a minimum of \$0.03 per mile</p>	<p><b>2010</b> [All regions] Toll all intercity (rural) Interstates at a minimum of \$0.05 per mile</p>
Pay-As-You-Drive (PAYD) Insurance	<p><b>2010:</b> Require all states to permit the offering of per-mile insurance rates</p>	<p><b>2010:</b> Require all states to permit the offering of per-mile insurance rates</p> <p><b>2015:</b> At least 50 percent of policies in each state must have at least 50 percent mileage-based premiums.</p> <p>Assume increasing penetration due to market forces to 75 percent by 2025.</p>	<p><b>2010:</b> Require all states to permit the offering of per-mile insurance rates</p> <p><b>2015:</b> All auto insurance policies must have at least 75 percent of premiums paid for on a mileage basis, allowing but not mandating adjustments in mileage rates based on time of day, location, driving style or other factors.</p> <p>Assume 100 percent penetration by 2025.</p>
VMT Fee	<p><b>2015:</b> Introduce a \$0.01 per mile VMT fee to be paid based on odometer audit during each vehicle inspection/sale. Transition to electronic monitoring. [Include making annual inspections mandatory.]</p>	<p><b>2015:</b> Introduce a \$0.03 per mile VMT fee to be paid based on odometer audit during each vehicle inspection/sale. Transition to electronic monitoring.</p>	<p><b>2015:</b> Introduce a \$0.12 per mile VMT fee to be paid based on odometer audit during each vehicle inspection/sale. Transition to electronic monitoring.</p>

GHG Reduction Strategy	A. Expanded Best Practice	B. More Aggressive	C. Maximum Effort
<p>Motor Fuel Tax and Carbon Price</p>	<p><b>2015:</b> Increase the Federal and/or state gasoline and diesel taxes by \$0.01 per mile (current \$0.02 per mile). New tax is \$0.40 per gallon indexed to fuel economy.</p> <p>Includes effect on fuel economy/carbon content.</p>	<p><b>2015:</b> Increase the Federal and/or state gasoline and diesel taxes by \$0.03 per mile (current \$0.02 per mile). New tax is \$0.82 per gallon indexed to fuel economy.</p> <p>Includes effect on fuel economy/fuel carbon content.</p>	<p><b>2015:</b> Increase the Federal and/or state gasoline and diesel taxes to equivalent of current European fuel taxes; \$0.12 per mile. New tax is \$2.71 per gallon indexed to fuel economy.</p> <p>Includes effect on fuel economy/fuel carbon content.</p>
<b>Land Use and Smart Growth Strategies</b>			
<p>Combined Land Use Strategies</p>	<p><b>2015 [Urban]</b></p> <p>All MPOs (or another regional agency designated by the MPO) develop a regional transportation and land use plan meeting-defined criteria for process and content. Plans collectively provide for at least 60 percent of new development in attached or small-lot detached units, in pedestrian- and bicycle-friendly neighborhoods (e.g., sidewalks, bicycle facilities, good connectivity) with mixed-use commercial districts and high-quality transit. The majority (nearly three-quarters) of communities adopt zoning and planning standards allowing for sufficient densities and requiring pedestrian-friendly design in these areas. State, regional, and local agencies work collaboratively on other implementation policies identified through these efforts.</p>	<p>2015 [Urban]</p> <p>Metropolitan land use plans call for at least 70 percent of new development in neighborhoods as described under [A]. Local plan/zoning code compliance is higher than under [A] (about 90 percent) as a result of stronger funding incentives.</p> <p><b>2015 [all]</b></p> <p>All states adopt comprehensive planning laws similar to Washington State’s Growth Management Act, requiring local comprehensive plans meeting-defined objectives, designation of urban growth/priority funding areas, and interagency plan review. Require comprehensive plan adoption and revision of zoning and other municipal codes for consistency by 2020. Require consistency with regional plans in metro areas (see above).</p>	<p><b>2015 [all]</b></p> <p>States and metro agencies adopt enforceable growth boundaries around urban areas consistent with Oregon’s model.</p> <p><b>2015 [NU]</b></p> <p>Communities outside of metro areas adopt designated growth areas around town/village centers, accommodating growth at a minimum of eight units/acre.</p> <p><b>2015 [all excluding NU]</b></p> <p>Metropolitan land use plans and local zoning collectively provide for at least 90 percent of new development in neighborhoods as described under [A]. Local plan/zoning code compliance is 100 percent.</p> <p>Density minimums are established inside urban growth boundaries.</p> <p>Requirements are established for minimum fractions of new jobs and housing to be located within walking distance of high-frequency transit service.</p>

GHG Reduction Strategy	A. Expanded Best Practice	B. More Aggressive	C. Maximum Effort
Combined Land Use Strategies (continued)	<p><b>2015 [all]</b>                      Provide Federal and state transportation funding incentives/set-asides for: a) regional comprehensive planning activities; and b) local planning and implementation (infrastructure) activities that support land use objectives as described above.</p>	Federal and state housing, community development, and economic development programs include requirements for consistency with regional plan and smart growth objectives. State, regional, and local governments work collaboratively on other implementation strategies.	<p><b>2015 [all excluding NU]</b>                      MPOs have authority to disapprove local land use plans and ordinances if not consistent with regional plan; enforced through withholding of funding for transportation projects.                       Continuation of cooperative action on implementation strategies.</p>
<b>Nonmotorized Transportation Strategies</b>			
Combined Strategies – Pedestrian	<p><b>2015 [Urban]</b>                      All new developments have buffered sidewalks on both sides of the street, marked/signalized pedestrian crossings at intersections on collector and arterial streets, lighting                      New or fully reconstructed streets in denser neighborhoods (&gt;4,000 persons/sq mi and business districts) incorporate traffic calming measures such as bulb-outs and median refuges to shorten street-crossing distances                      “Complete streets” policies adopted by state and local transportation agencies, requiring appropriate pedestrian accommodations on all roadways  <b>2025 [Urban]</b>                      Existing streets within one-quarter mile of transit stations, schools, and business districts are audited for pedestrian accessibility and retrofitted with curb ramps, sidewalks, and crosswalks</p>	<p><b>2020 [Urban]</b>                      Existing streets within one-half mile of transit stations, schools, and business districts are audited for pedestrian accessibility and retrofitted with curb ramps, sidewalks, crosswalks, and limited traffic calming measures as appropriate to improve pedestrian accessibility.</p>	<p><b>2020 [Urban]</b>                      Same as Level B, but with more extensive traffic calming.</p>

GHG Reduction Strategy	A. Expanded Best Practice	B. More Aggressive	C. Maximum Effort
<p>Combined Strategies – Bicycling</p>	<p><b>2015 [all]</b></p> <p>“Complete streets” policies adopted by state and local transportation agencies, requiring appropriate bicycle accommodations on all roadways</p> <p>Bicycle parking provided at all commercial destinations</p> <p>All new commercial buildings &gt;100,000 square feet required to provide showers, lockers, and covered/protected bicycle parking; all new multi-unit residential buildings have indoor bicycle parking</p> <p>Buses fitted with bicycle carriers, rapid transit stations have bicycle parking, all rapid transit lines are bike-accessible during off-peak hours</p> <p>School curriculums include safe cycling skills for children</p> <p><b>2015 [Urban]</b></p> <p>Primary central business districts have a “bike station” that provides services, including parking, rentals, repair, changing facilities, and information</p>	<p><b>2015 – plan/2020 – implementation [all excluding NU]</b></p> <p>Bicycle accommodations provided to create a continuous network of routes with approximately one-half-mile spacing. The bicycle network consists of a combination of bicycle lanes, bicycle boulevards, and shared-use paths provided at combined one-half-mile spacing (half bicycle lanes and one-quarter each bicycle boulevards and shared-use paths), implemented in areas with population density &gt;2,000 persons per square mile. Bicycle boulevards (on residential streets) include traffic diverters to limit automobile traffic on these routes.</p>	<p><b>2015 [all excluding NU]</b></p> <p>New development areas are planned with a network of off-street paths at approximately one-quarter to one-half-mile intervals. City-level plans support linkages among local paths.</p> <p><b>2015 – plan/2025 – implementation [all excluding NU]</b></p> <p>The bicycle network consists of a combination of bicycle lanes, bicycle boulevards, and shared-use paths provided at combined one-quarter-mile spacing (half bicycle lanes and one-quarter each bicycle boulevards and shared-use paths), implemented in areas with population density &gt;2,000 persons per square mile.</p> <p><b>2015 [all excluding NU]</b></p> <p>“Bike stations” are located at all major activity centers and transit hubs as well as in the CBD.</p>

GHG Reduction Strategy	A. Expanded Best Practice	B. More Aggressive	C. Maximum Effort
Combined Strategies – Bicycling (continued)	<p><b>2015 – plan/2025 – full implementation</b>                      [all excluding NU]</p> <p>Citywide and/or regional plans developed and implemented for on-street bicycle accommodations to create a continuous network of routes. The network includes bicycle lanes at one-mile intervals, and other facilities (shared-use markings, signed routes using neighborhood streets) at one-mile intervals, for a combined network density of one-half mile, implemented in areas with population density &gt;2,000 persons per square mile.</p>		
<b>Public Transportation Improvement Strategies</b>			
Fare Measures	<p><b>2010 [LH] 2015 [LL, MH, SH] 2020 [ML, SL]</b> Lower fares by 25 percent except where already at capacity. Decrease the cost of passes so as to provide at least a further 25 percent discount from the cost of equivalent single-fare purchases.</p>	<p><b>2010 [LH] 2015 [LL, MH, SH] 2020 [ML, SL]</b> Lower fares by 33 percent. Decrease the cost of passes so as to provide at least a further 33 percent discount from the cost of equivalent single-fare purchases.</p>	<p><b>2010 [LH, LL, MH, SH, ML, SL]</b> Lower fares by 50 percent</p>

GHG Reduction Strategy	A. Expanded Best Practice	B. More Aggressive	C. Maximum Effort
<p>Increased Levels of Service/Improved Travel Times</p>	<p><b>2015</b> [LH] <b>2020</b> [LL, MH, SH] <b>2025</b> [ML, SL] Implement signal prioritization, limited stop service, etc. over five years to improve travel speed an additional 10 percent</p> <p><b>2010</b> [LH] <b>2020</b> [LL, MH, SH] <b>2025</b> [ML, SL] Increase transit level of service by 1.5 times trend revenue mile expansion rates. Investments targeted in areas with at least 4,000 persons/square mile or that otherwise facilitate increases in pax/VRM</p>	<p><b>2010</b> [LH] <b>2015</b> [LL, MH, SH] <b>2020</b> [ML, SL] Implement signal prioritization, limited stop service, signal synchronization, intersection reconfiguration, etc. over five years to improve travel speed an additional 15 percent</p> <p><b>2010</b> [LH] <b>2020</b> [LL, MH, SH] <b>2025</b> [ML, SL] Increase transit level of service by two times trend revenue mile expansion rates. Investments targeted in areas with at least 4,000 persons/square mile or that otherwise facilitate increases in pax/VRM</p>	<p><b>2010</b> [LH] <b>2015</b> [LL, MH, SH] <b>2020</b> [ML, SL] Implement signal prioritization, limited stop service, signal synchronization, intersection reconfiguration, AVS, etc. over three years to improve travel speed an additional 30 percent; boost reliability by 40 percent; boost ridership attraction through integrated transit fare systems; full scale BRT deployment where it makes sense.</p> <p><b>2010</b> [LH] <b>2020</b> [LL, MH, SH] <b>2025</b> [ML, SL] Increase transit level of service by four times trend revenue mile expansion rates. Investments targeted in areas with at least 4,000 persons/square mile or that otherwise facilitate increases in pax/VRM</p>
<p>Expanded Urban Public Transportation</p>	<p><b>2010</b> Expand service proportional to 3 percent per year ridership growth. Includes all transit modes.</p>	<p><b>2010</b> Expand service proportional to 3.53 percent per year ridership growth. Includes all transit modes.</p>	<p><b>2010</b> Expand service proportional to 4.67 percent per year ridership growth. Includes all transit modes.</p>
<p>Intercity Bus and Rail/High-Speed Rail</p>	<p><b>2010</b> [all] Increase Federal capital and operating assistance over baseline trend by 5 percent per year for 20 years to improve service in existing markets and expand operation of Amtrak-associated motor coach service.</p> <p><b>2015</b> Provide an additional pool of funding for high-speed rail, either incremental or in new rights-of-way, for 3-5 selected key markets, with a 20-year full implementation horizon</p>	<p><b>2010</b> [all] Increase Federal capital and operating assistance over baseline trend by 10 percent per year for 20 years to improve service in existing markets, introduce rail in new markets, expand operation of Amtrak-associated motor coach service, and fund/subsidize intercity bus service in additional markets.</p> <p><b>2015</b> Provide an additional pool of funding for high-speed rail, either incremental or in new rights-of-way, for 5-7 selected key markets, with a 15-year full implementation horizon.</p>	<p><b>2010</b> [all] Double Federal capital and operating assistance over baseline trend in 2010 then increase by an additional 10 percent per year for 20 years to improve service in existing markets, introduce rail in new markets, and fund/subsidize a national network of intercity bus service.</p> <p><b>2010</b> Provide an additional pool of funding for high-speed rail, either incremental or in new rights-of-way, for regional networks and additional selected key markets, with a 15-year full implementation horizon</p>

GHG Reduction Strategy	A. Expanded Best Practice	B. More Aggressive	C. Maximum Effort
<b>Regional Ride-Sharing, Car-Sharing and Commuting Strategies</b>			
HOV Lanes	<p><b>2010</b> [LH, LL] <b>2015</b> [MH, ML] <b>2020</b> [SH, SL] Introduce (through lane conversion using Quickchange moveable barriers QMB)) a HOV-2 lane on all expressways with 3+ lanes per direction or at LOS F over 10 years</p> <p><b>2020</b> [All] for existing HOV lanes, otherwise 10 years after introduction convert HOV lanes to 24/7 applicability</p>	<p><b>2010</b> [LH, LL] <b>2015</b> [MH, ML] <b>2020</b> [SH, SL] Introduce (through lane conversion using QMB) a HOV-2 lane on all expressways with 3+ lanes per direction or at LOS D over eight years. Convert to HOV-3 if HOV lane is at LOS D after two years</p> <p><b>2015</b> [All] for existing HOV lanes, otherwise eight years after introduction convert HOV lanes to 24/7 applicability</p>	<p><b>2010</b> [LH, LL] <b>2015</b> [MH, ML] <b>2015</b> [SH, SL] Introduce (through lane conversion using QMB) a HOV-2 lane on all expressways over four years. Convert to HOV-3+ if HOV lanes are LOS D. If 4+ lanes and general purpose lanes are at LOS D, introduce a second HOV lane starting at HOV-2.</p> <p><b>2010</b> [All] for existing HOV lanes, otherwise 4 years after introduction convert HOV lanes to 24/7 applicability</p>
Car-Sharing	<p><b>2010</b> [LH] <b>2015</b> [LL, MH, SH] <b>2020</b> [ML, SL] Provide subsidy or public procurement sufficient to allow two-year start-up of a public, private or nonprofit car-sharing organization. Provide long-term auctioned usage of convenient public street parking for car-sharing vehicles.</p>	<p><b>2010</b> [LH] <b>2015</b> [LL, MH, SH] <b>2015</b> [ML, SL] Provide subsidy or public procurement sufficient to ensure two-year start-up of a public, private or nonprofit car-sharing organization. Provide free or subsidized lease usage of convenient public street parking for car-sharing vehicles. Ten-year goal of one car per 2,000 inhabitants of medium and 1,000 inhabitants of high-density census tracts.</p>	<p><b>2010</b> [LH] <b>2010</b> [LL, MH, SH] <b>2015</b> [ML, SL] Provide subsidy or public procurement sufficient to ensure continuous presence of one or more public, private or nonprofit car-sharing organizations per market. Provide free or subsidized lease usage of convenient public street parking for car-sharing vehicles. Five-year goal of one car per 1,000 inhabitants of medium-density and per 500 inhabitants of high-density census tracts.</p>

GHG Reduction Strategy	A. Expanded Best Practice	B. More Aggressive	C. Maximum Effort
Employer-Based Telework and Compressed Work Week Programs	<p><b>2015 [Urban]</b></p> <p>Private Sector: Provide employer goals and tax incentives for the offering and adoption of telecommuting and compressed work week targets. Provide public funding or subsidies for the private provision of regional telework centers and shared satellite offices.</p> <p>Require elimination of telecommuting barriers in state and local tax codes (e.g., double taxation)</p> <p>Public Sector: All government agencies allow option of telecommuting and compressed work week for eligible employees</p>	<p><b>2015 [Urban]</b></p> <p>Private Sector: Included as part of employer-based TDM requirements (see below).</p> <p>Public Sector: All government agencies require four-day work weeks</p>	<p><b>2015 [Urban]</b></p> <p>Included as part of employer-based TDM requirements (see below).</p> <p>Public Sector: All government agencies require four-day work weeks</p>
Employer-Based TDM Requirements, Outreach, and Support	<p><b>2015 [Urban]</b></p> <p>States and/or MPOs provide on-line ride matching and vanpool services and guaranteed ride home program for all areas where services already are not provided by TDM service providers.</p> <p>MPO or other designated agencies (such as TMAs) implement aggressive outreach program to inform major employers (100+ employees) of alternative travel options, assist with providing information and incentives to employees. Transit agencies make monthly passes available through employers at discounted rates.</p>	<p><b>2015 [Urban]</b></p> <p>Establish requirements for employers w/50+ employees to develop and implement plans to reduce SOV trips by 10 percent compared to baseline levels; offer technical assistance to employers for these plans; provide Federal tax incentives/disincentives for compliance. Continues regional ridematching, vanpool, GRH, and transit discount services.</p> <p>Value of parking benefits is taxed; value of cash-out or transit benefits is not.</p>	<p><b>2015 [all]</b></p> <p>Federal/state tax levied on all commercial parking spaces (\$5/space/weekday); employers required to pass along this cost to employees; proceeds used to provide free transit passes for employees and other TDM activities (e.g., transit shuttles).</p> <p>Coordinate with parking pricing measures above.</p> <p>Continues regional ridematching, vanpool, GRH, transit discount, and employer outreach programs (but no TDM plan requirement).</p>

GHG Reduction Strategy	A. Expanded Best Practice	B. More Aggressive	C. Maximum Effort
<b>Regulatory Measures</b>			
Urban Nonmotorized Zones	<b>2015</b> [LH] <b>2020</b> [LL, MH, SH] <b>2025</b> [ML, SL] Over 10 years, convert 2 percent of CBD and regional employment and retail center centerline miles to transit malls, linear parks, or other nonmotorized zones.	<b>2010</b> [LH] <b>2015</b> [LL, MH, SH] <b>2020</b> [ML, SL] Over 10 years, convert 4 percent of CBD and regional employment and retail center centerline miles to transit malls, linear parks, or other nonmotorized zones.	<b>2010</b> [LH] <b>2015</b> [LL, MH, SH] <b>2020</b> [ML, SL] Over 10 years, convert 6 percent of CBD and regional employment and retail center centerline miles to transit malls, linear parks, or other nonmotorized zones.
Urban Parking Restrictions	<b>2015</b> [LH] <b>2020</b> [LL, MH, SH] <b>2025</b> [ML, SL] Implement a parking freeze on new parking supply (similar to Boston and San Francisco), capping the absolute number of commuter spaces in CBDs and regional employment and retail centers. Exceptions may be made for carpool-designated spaces. Includes effect on noncommute trips	<b>2010</b> [LH] <b>2015</b> [LL, MH, SH] <b>2020</b> [ML, SL] Implement a parking freeze on new parking supply (similar to Boston and San Francisco), capping the absolute number of commuter spaces in CBDs and regional employment and retail centers. Exceptions may be made for carpool-designated spaces. Includes effect on noncommute trips	<b>2010</b> [LH] <b>2015</b> [LL, MH, SH] <b>2015</b> [ML, SL] Implement a parking freeze on new parking supply (similar to Boston and San Francisco), capping the absolute number of commuter spaces in CBDs and regional employment and retail centers. Over 10 years phase-in the conversion of 10 percent of spaces to carpool-designated. Includes effect on noncommute trips
Speed Limit Reductions	<b>2015</b> [All] Lower the national speed limit to 65 mph. <b>2020</b> [All] Lower the national speed limit to 60 mph.	<b>2010</b> [All] Lower the national speed limit to 65 mph for light-duty and 60 mph for heavy-duty vehicles and provide significantly increased enforcement, including speed cameras. <b>2015</b> [All] Lower the national speed limit to 60 mph. <b>2020</b> [All] Lower the national speed limit to 55 mph.	<b>2010</b> [All] Lower the national speed limit to 65 mph for light-duty and 60 mph for heavy-duty vehicles and provide significantly increased enforcement, including speed cameras. <b>2012</b> [All] Lower the national speed limit to 60 mph for light-duty and 55 mph for heavy-duty vehicles. <b>2015</b> [All] Lower the national speed limit to 55 mph.
<b>Operations and Intelligent Transportation System (ITS) Strategies<sup>a</sup></b>			
Eco-Driving Training and Vehicle Maintenance Programs	Implement program, 10 percent of population reached, 5 percent net adoption	Implement program, 20 percent of population reached, 8 percent net adoption	Implement program and fund public awareness campaigns and driver education, 50 percent of population reached, 20 percent net adoption

<sup>a</sup> 1) Different congestion thresholds are used to get distinction in the scenarios; 2) Deployment of strategies except for VII is assumed to occur continuously throughout the analysis period; 3) V/C = Volume to Capacity ratio, a measure of roadway congestion that compares the traffic volumes to the roadway capacity.

GHG Reduction Strategy	A. Expanded Best Practice	B. More Aggressive	C. Maximum Effort
<b>Operations and Intelligent Transportation System (ITS) Strategies (continued)</b>			
Ramp Metering (Centrally Controlled)	Implement with electronic roadway monitoring in large urban areas where V/C >1.05 by 2030 with new and expanded Traffic Management Centers (TMC)	Implement in with electronic roadway monitoring large/medium urban areas where V/C >1.0 by 2025 with new and expanded Traffic Management Centers (TMC)	Implement with electronic roadway monitoring in all locations where V/C >0.90 by 2020 with new and expanded Traffic Management Centers (TMC)
Variable Message Signs (VMS)	Implement with electronic roadway monitoring where V/C >1.05 by 2030	Implement with electronic roadway monitoring where V/C >1.0 by 2025	Implement with electronic roadway monitoring where V/C >0.9 by 2020
Active Traffic Management	Not deployed	Implement on facilities in large/medium regions with V/C >1.0 (speed harmonization + lane control + queue warning)	Implement in all locations where V/C >0.90 (speed harmonization + lane control + queue warning + hard shoulder running)
Integrated Corridor Management	Not deployed	<b>2010-2025:</b> Large/medium with V/C >1.0	<b>2010-2020:</b> All locations where V/C >0.90
Incident Management	<b>2010-2030:</b> V/C >1.05 (detection algor/free cell call, CCTV cameras, on-call service patrols, TMC integration/coordination)	<b>2010-2025:</b> V/C >1.0 (detection algor/free cell call, CCTV cameras, on-call service patrols, TMC integration/coordination)	<b>2010-2020:</b> V/C >0.90 (detection algor/free cell call, CCTV cameras, on-call service patrols with aggressive on-scene management, TMC integration/coordination)
Road Weather Management (Snow/Ice/Fog; Freeways)	<b>2010-2030:</b> Fully deployed on freeways by 2030	<b>2010-2025:</b> Fully deployed on freeways by 2025	<b>2010-2020:</b> Fully deployed on freeways by 2020
Arterial Management	<b>2010-2030:</b> Upgrade to closed loop or traffic adaptive when V/C >1.0	<b>2010-2025:</b> Upgrade to closed loop or traffic adaptive when V/C >1.0	<b>2010-2020:</b> Upgrade to traffic adaptive when V/C >0.90
Traveler Information	<b>2010-2030:</b> V/C >1.05 (511 + DOT web site)	<b>2010-2025:</b> V/C >1.0 (511 + DOT web site + DOT-sponsored personalized info)	<b>2010-2020:</b> V/C >0.90 (More aggressive, superseded as VII is enabled)
Vehicle Infrastructure Integration (VII) <sup>b</sup>	50 percent of light-duty vehicles equipped by 2025, 100 percent by 2040	50 percent of light-duty vehicles equipped by 2020, 100 percent by 2030	50 percent of light-duty vehicles equipped by 2015, 100 percent by 2020

<sup>b</sup> VII deployment is based on the deployment curve in Volpe VII BCA Report ([http://www.intellidriveusa.org/documents/vii-benefits-cost-analysi-\(Draft\).pdf](http://www.intellidriveusa.org/documents/vii-benefits-cost-analysi-(Draft).pdf)) (Chart 3.1: Projected Phase-In of VII Equipped Vehicles in the U.S. Fleet). The “More Aggressive” scenario uses these forecasts and they are adjusted for “Current Practice” and “Maximum Effort” scenarios.

GHG Reduction Strategy	A. Expanded Best Practice	B. More Aggressive	C. Maximum Effort
<b>Bottleneck Relief and Capacity Expansion Strategies</b>			
Bottleneck Relief	Improve 25 percent of top 200 bottlenecks to level of service “E” by 2030	Improve 50 percent of top 200 bottlenecks to Level of Service E by 2030	Improve all top 200 bottlenecks to level of service “D” by 2020 using pricing, system management, enhanced alternatives and capacity expansion in the mix best supported by cost/benefit analysis that accounts for indirect, secondary and cumulative impacts and costs.
Capacity Expansion	25 percent of the economically justified investments increased over current funding levels.	50 percent of the economically justified investments increased over current funding levels.	100 percent of the economically justified investments increased over current funding levels.
<b>Multimodal Freight Strategies</b>			
<i>Freight Strategies – Modal Diversion</i>			
Rail Capacity Improvements	<b>2025:</b> Address choke points in rail system for carload and double-stack service so that currently expected 2025 capacity restrictions are reduced by 20 percent.	<b>2020:</b> Address choke points in rail system for carload and double-stack service so that currently expected 2025 capacity restrictions are reduced by 30 percent.	<b>2020:</b> Address choke points in rail system for carload and double-stack service so that currently expected 2025 capacity restrictions are reduced by 50 percent.
Marine Transportation System Maintenance and Improvement	2010: Maintain the current state of the system for channel depth, lock and dam conditions, harbor channels and terminals, and similar system elements for inland waterways, intracoastal waterways, the Great Lakes, and marine coastal shipping.	As per Scenario A and:  2025: Restore major components of the system to a state of good repair with all system elements fully functional.	As per Scenarios A and B and:  2010-2020: Restore the entire system to a state of good repair with all system elements fully functional.

GHG Reduction Strategy	A. Expanded Best Practice	B. More Aggressive	C. Maximum Effort
<i>Freight Strategies – Mode Optimization</i>			
Overweight Load Permits for Trucks Carrying Shipping Containers	<b>2025:</b> [All Regions] Allow indivisible load permits for trucks carrying shipping containers at GVWs up to 110,000 pounds for distances up to 250 miles. Permit fees would cover all resulting pavement cost. Would increase efficiency of access hauls between interior origins and destinations and rail intermodal facilities, and also access hauls between ports and nearby origins and destinations. 250-mile limit would prevent use of these permits from diverting current intermodal movements to/from ports to all-truck movements.	<b>2020:</b> [All Regions] Allow indivisible load permits for trucks carrying shipping containers at GVWs up to 110,000 pounds for distances up to 250 miles.	<b>2015:</b> [All Regions] Allow indivisible load permits for trucks carrying shipping containers at GVWs up to 110,000 pounds for distances up to 250 miles.
Overweight Load Permits for Longer Combination Vehicles (LCV)	<b>2025:</b> [All Regions] Allow divisible load permits for LCVs carrying natural resources on designated non-IS truck routes at weights up to 105,500 pounds. Eligible truck routes would be limited to routes meeting appropriate structural and geometric criteria for accommodating these vehicles. Permit fees would cover all resulting costs of upgrading and maintaining these roads. Limitation to non-IS roads (and to carriage of natural resources) would limit resulting diversion from rail.	<b>2020:</b> [All Regions] Allow divisible load permits for LCVs carrying natural resources on designated non-IS truck routes at weights up to 129,000 pounds	<b>2015:</b> [All Regions] Allow divisible load permits for B-Train LCVs carrying natural resources on designated non-IS truck routes at weights up to 129,000 pounds and up to 138,000 pounds for eight-axle B-Trains.
WIM Screening	<b>2025:</b> Mainline Weigh-in-motion (WIM) systems installed at all 24-hour truck weigh stations and used to allow all vehicles with transponders to bypass static scales.	<b>2020:</b> Mainline WIM installed at all 24-hour truck weigh stations and used to allow all vehicles with transponders to bypass static scales.	<b>2015:</b> Mainline WIM installed at all truck weigh stations and used to allow all vehicles with transponders to bypass static scales.

GHG Reduction Strategy	A. Expanded Best Practice	B. More Aggressive	C. Maximum Effort
Use of Electronic Credentialing to Allow Vehicles to Bypass Weigh Stations and Safety Inspections	<b>2025:</b> Expand the PrePass and NORPASS electronic credentialing systems so that they cover all 49 mainland states and both systems are recognized at all weigh stations and inspection sites in these states. Also implement an equivalent system in Hawaii.	<b>2020:</b> Expand the PrePass and NORPASS electronic credentialing systems so that they cover all 49 mainland states and both systems are recognized at all weigh stations and inspection sites in these states. Also implement an equivalent system in Hawaii.	<b>2010-2015:</b> Expand the PrePass and NORPASS electronic credentialing systems so that they cover all 49 mainland states and both systems are recognized at all weigh stations and inspection sites in these states. Also implement an equivalent system in Hawaii.
Truck Stop Electrification	<b>2025:</b> Increase the number of truck stops that allow trucks to plug in to local power to 1,500 (out of 5,000).	<b>2020:</b> Increase the number of truck stops that allow trucks to plug in to local power to 3,000.	<b>2015:</b> Allow trucks to plug in to local power at all truck stops.
Heating and Cooling Systems for Sleeper Cabs	<b>2025:</b> Require the installation of battery-operated heating and/or cooling systems in all sleeper cabs.	<b>2020:</b> Require the installation of battery-operated heating and/or cooling systems in all sleeper cabs.	<b>2015:</b> Require the installation of battery-operated heating and/or cooling systems in all sleeper cabs.
Truck-Only Toll Lane Networks	Start implementation in 2010, complete by 2025. Apply to 10 percent of interstate VMT in Large/High density urban areas.	Start implementation in 2010, complete by 20-25. Apply to 25 percent of interstate VMT in Large/High density urban areas.	Start implementation in 2010, complete by 2025. Apply to 40 percent of interstate VMT in Large/High density urban areas. Plus, start implementation in 2015, complete by 2030 applied to 10 percent of interstate VMT in large/low-density urban areas.
<b>Freight Strategies – Logistics</b>			
Urban Consolidation Centers and Limitations on Pickup and Delivery (PUD) Service in Dense Urban Areas	<b>2025:</b> [LH] Consolidation Centers would be established on the periphery of large urbanized areas. Time-of-Day restrictions would be instituted on most deliveries to the CBD, and all LTL and parcel deliveries to the CBD would be subject to a permitting system that would result in consolidation of shipments to nearby destinations.	<b>2020:</b> [LH] 2020[LL] Consolidation Centers would be established on the periphery of large urbanized areas. Time-of-Day restrictions would be instituted on most deliveries to the CBD, and all LTL and parcel deliveries to the CBD would be subject to a permitting system that would result in consolidation of shipments to nearby destinations.	<b>2010-2015:</b> [LH] 2015-2020[LL, MH] Consolidation Centers would be established on the periphery of large urbanized areas. Time-of-Day restrictions would be instituted on most deliveries to the CBD, and all LTL and parcel deliveries to the CBD would be subject to a permitting system that would result in consolidation of shipments to nearby destinations.