Strategies for Reducing Greenhouse Gas Emissions as a Co-Benefit of Transportation Improvements … With a Special Look at Latin America

Elizabeth Deakin
Professor of City and Regional Planning
University of California, Berkeley
June 24, 2010

Current Transportation Problems – Everywhere in the World!

- Uneven access and affordability
- Congestion
- Air pollution
- Noise
- Neighborhood disruption
- Other environmental impacts
- Global warming

For many countries, global warming is not a high priority …

- Significant increases in transportation are needed to serve the growing population boost economic development
- Some do not have enough access to transportation, jobs, housing, services
- Congestion plagues cities
- Noise and air pollution harm public health and reduce the quality of life
- Global warming affects countries differently, some worse than others

Yet global warming threatens us all….

- Loss of glaciers, snowpack – major source of drinking & irrigation water in many areas
- Changes in rainfall – more extreme events: flooding and drought
- Increases in wildfires
- Sea level rises and damage to coastlines
- Heat waves more common
- More smoggy days
- Heightened exposure and increased range for serious tropical diseases, vectors
- Stress on the functioning and integrity of key ecosystems

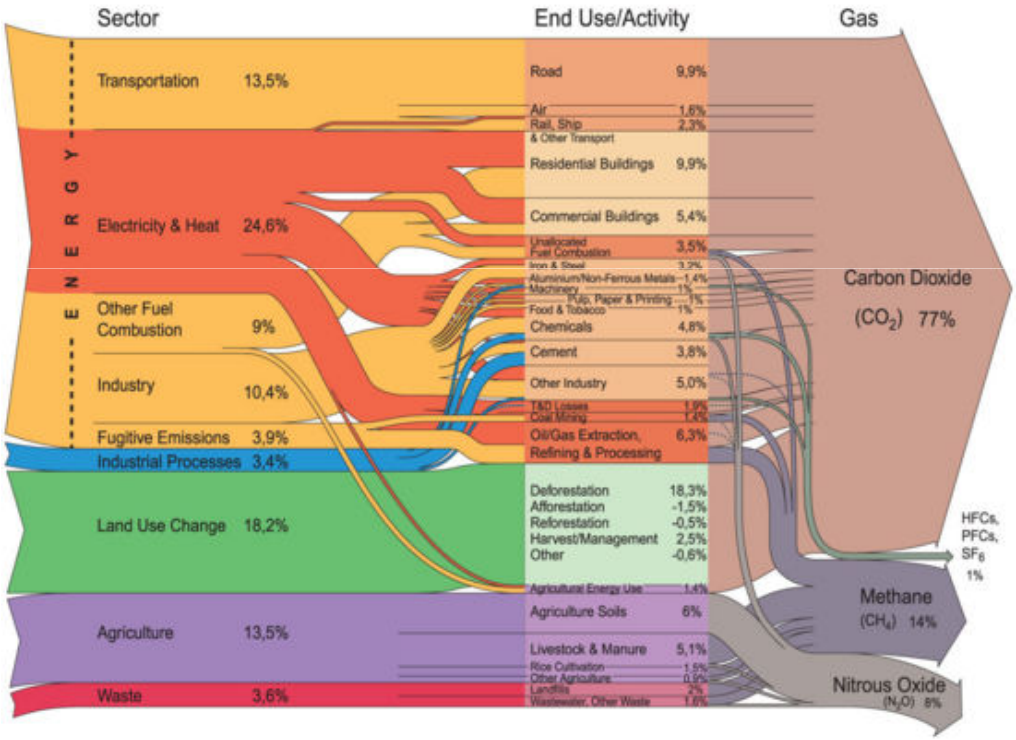
RESULT: political stress worldwide?

Potential Latin American impacts of global warming (seeing some already)

- Coral bleaching in the Caribbean and off Ecuador
- Retreat of glaciers
- Loss of many species in the Andes
- Drought in some locations, heavy rains and flooding in others
- Increase in hurricanes
- Greater area at risk of tropical diseases

Greenhouse gases come from all sectors, and their reduction will require contributions from all sectors

World Greenhouse gas emissions by sector



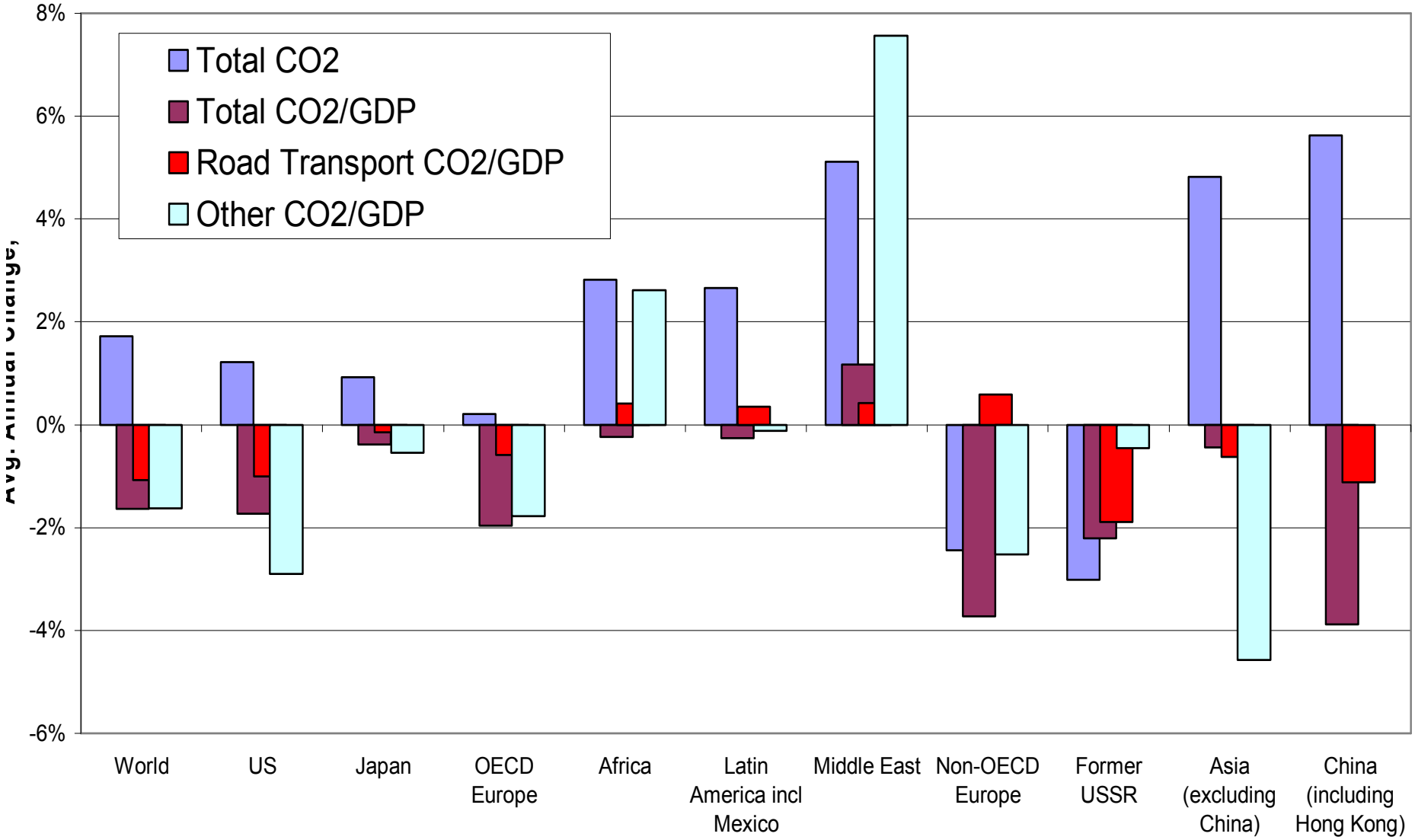
All data is for 2000. All calculations are based on CO_2 equivalents, using 100-year global warming potentials from the IPCC (1996), based on a total global estimate of 41 755 $MtCO_2$ equivalent. Land use change includes both emissions and absorptions. Dotted lines represent flows of less than 0.1% percent of total GHG emissions.

Source: World Resources Institute, Climate Analysis Indicator Tool (CAIT), Navigating the Numbers: Greenhouse Gas Data and International Climate Policy, December 2005; Intergovernmental Panel on Climate Change, 1996 (data for 2000).

Use of carbon is growing, but use is more efficient

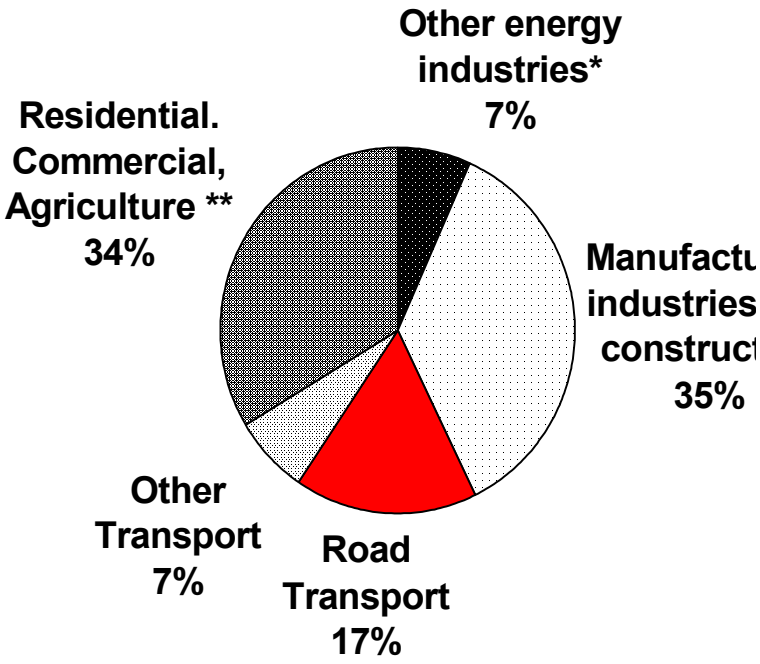
World CO2 Emissions Growth 1990-2005

CO2/GDP Falling- But Road Transport Falling Less Or Rising

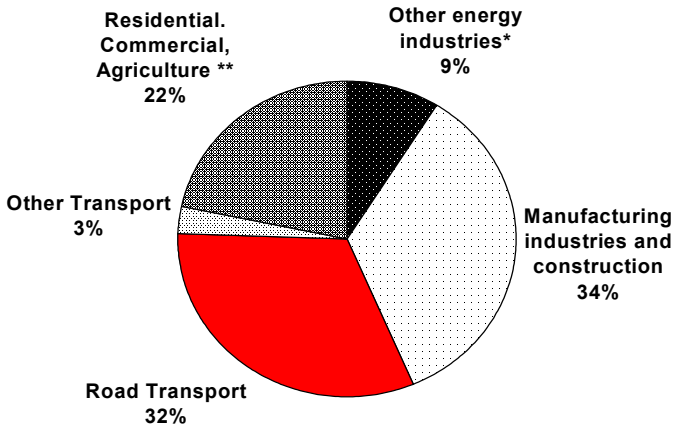


Transport share of carbon emissions is larger in Latin America than elsewhere

CO2 Emissions for World in 2006 (total 4.3 tonnes/capita)

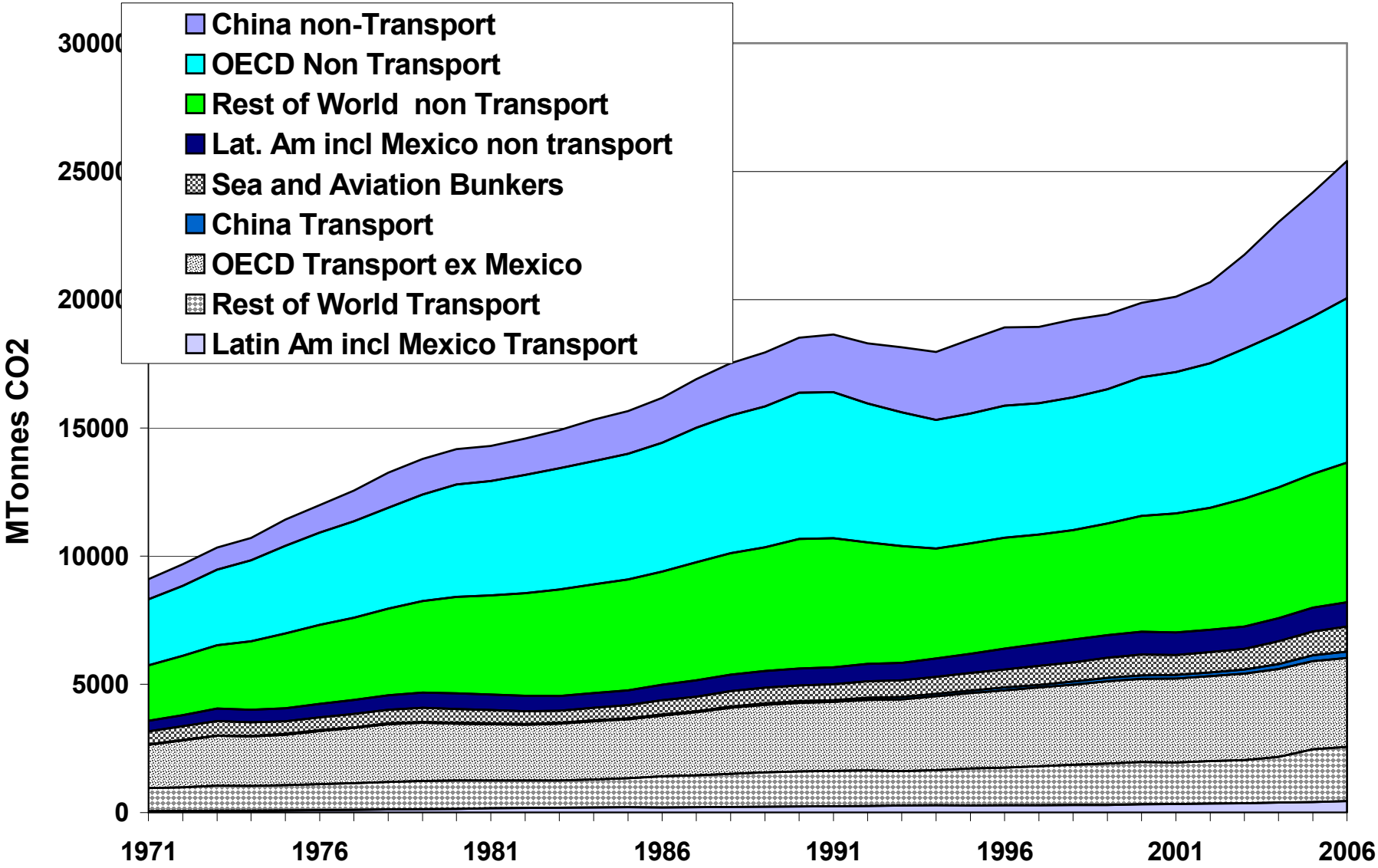


CO2 Emissions for LAC in 2006 (total 2.5 tonnes/capita)



Data for Latin America and Caribbean (LAC)

And the transport share in Latin America is growing



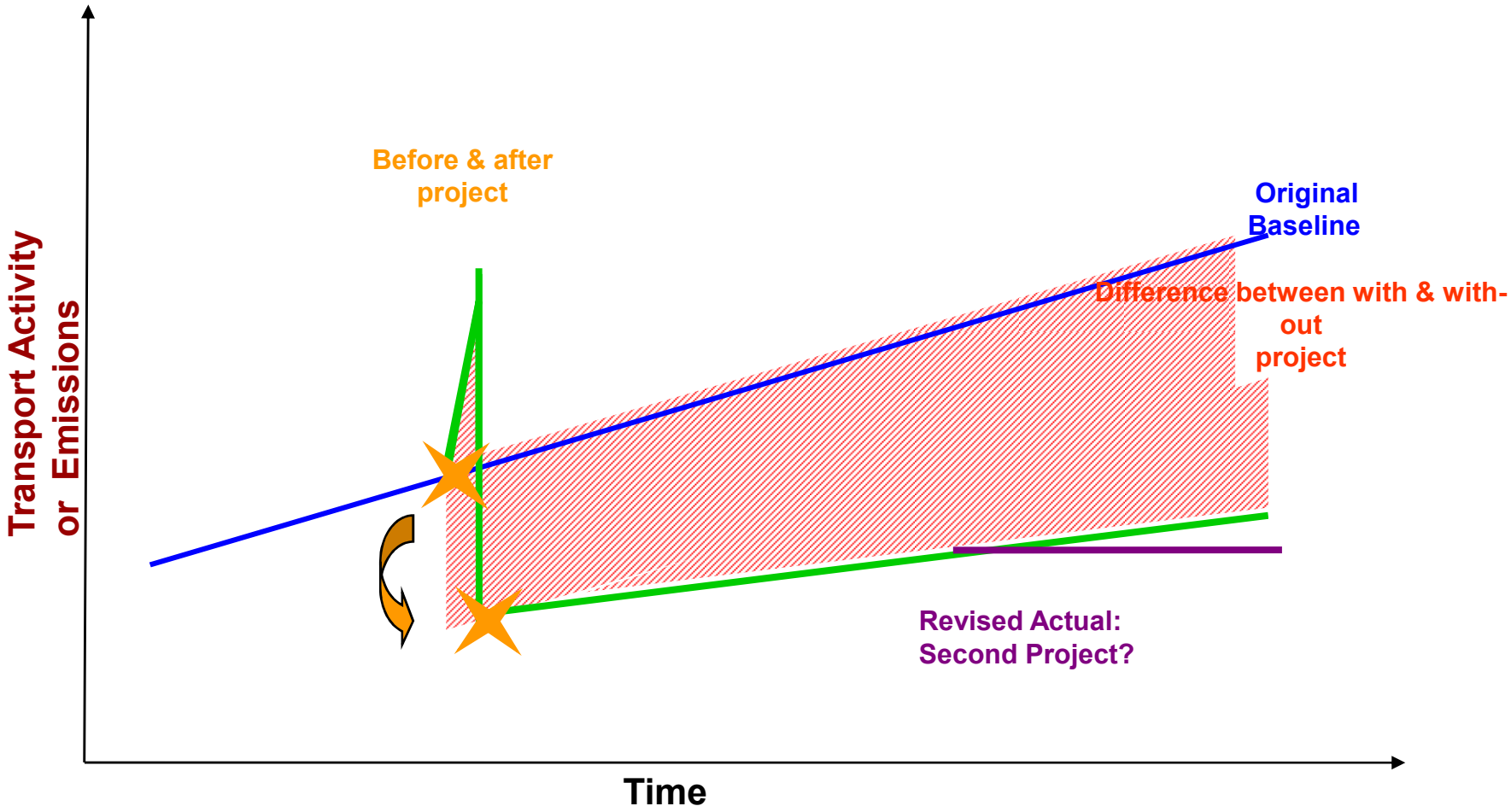
So the question is: How can we expand and improve transportation services while curbing greenhouse gas emissions?

The good news:

Actions that reduce congestion, cut noise and air pollution, and provide much-needed improvements in transit, pedestrian and bicycle options work to lower GHG, compared to business-as-usual.

Efficient use of carbon is a fair standard of performance for economies that are still growing and developing (countries like the US have bigger obligations.)

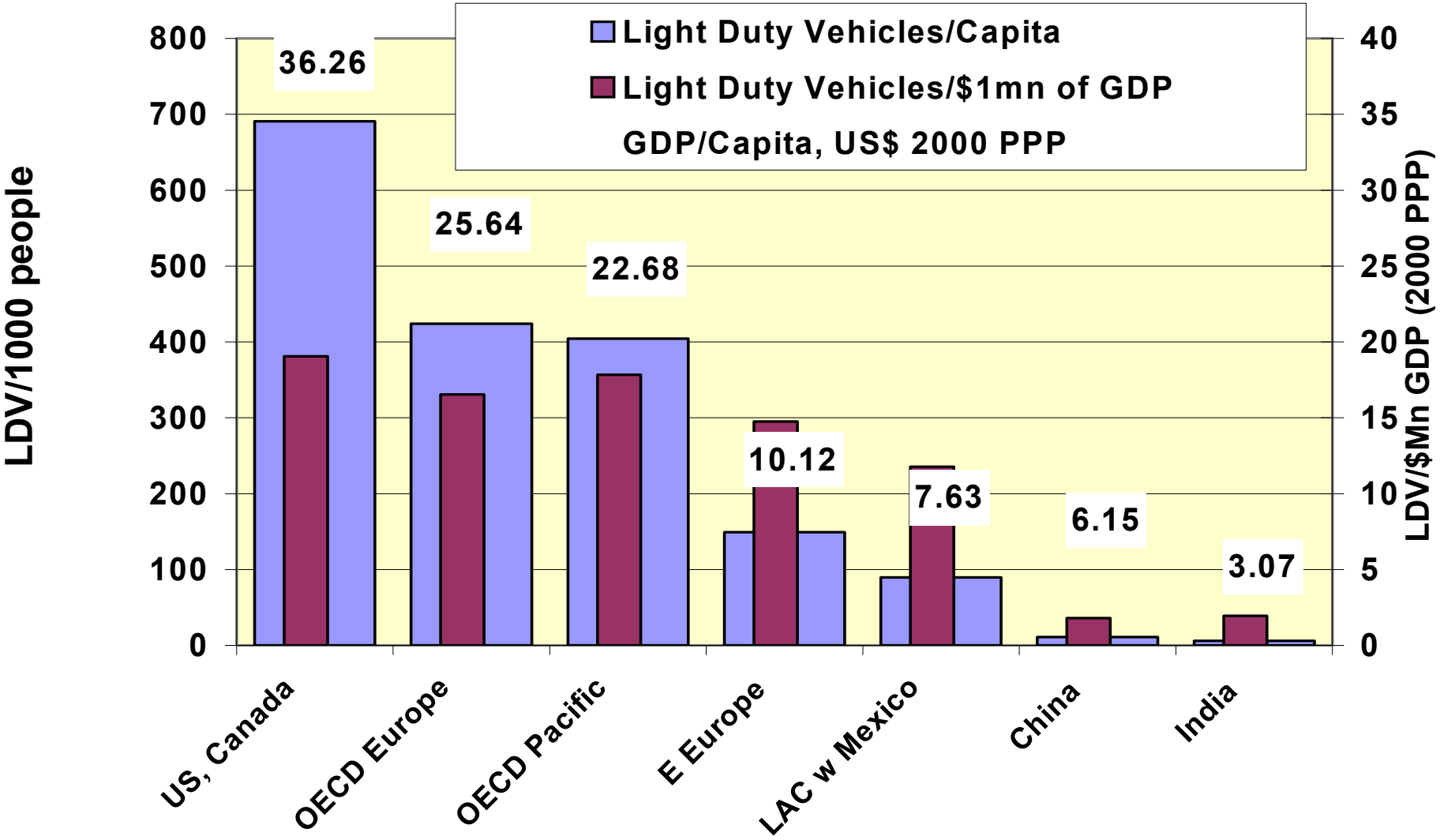
Impact of Intervention: Difference Between BAU (no intervention) and actual



Transport strategies for fighting global warming

- Cleaner fuels
- More efficient and cleaner vehicles – cars, trucks, buses
- High quality transit
- High quality bike facilities
- High quality pedestrian facilities
- Efficient traffic operations
- Congestion pricing
- Telecommuting , teleconferencing, teleshopping
- Logistics and operations improvements for freight

Light Duty Vehicle Ownership and Income
LAC is High for Its Income – Suggesting Other Modes Need Improvement

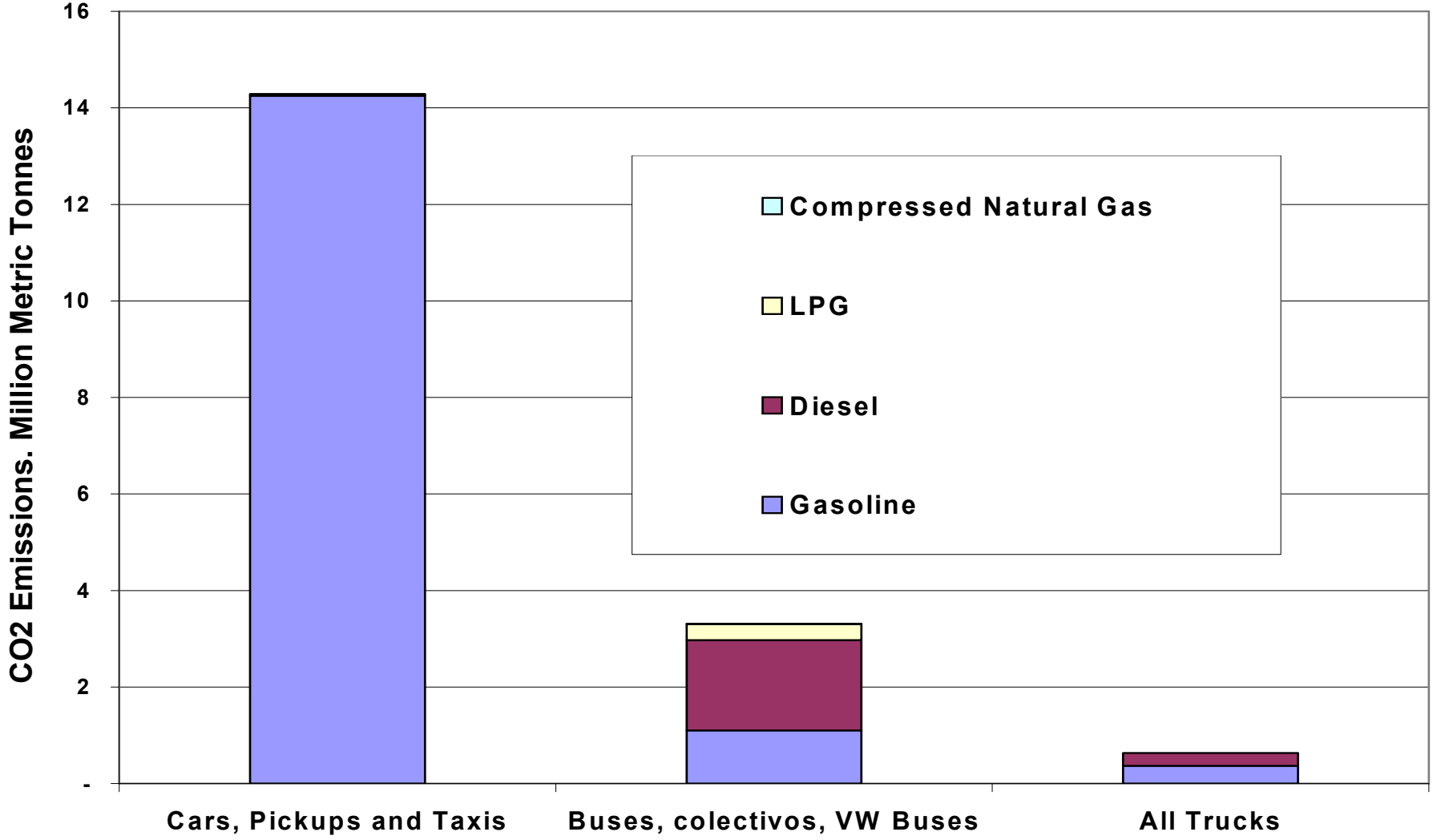


Light Duty Vehicles Dominate Urban Streets and CO2 Emissions

- World Business Council on Sustainable Development: Urban light-duty vehicles are 80% of VKT and 55% of emissions in Latin America
- Similar results from local emissions Inventories
  - Mexico City, Bogota, S Paolo and Santiago
  - High car share is often accompanied with heavy congestion
  - Heavy congestion worsens fuel use, local pollution

Implication:
Hard to Address CO2 without Improving Urban Transport

CO2 Emissions from Road Transport, Mexico City Metro Area – Similar Patterns for Bogota, Santiago, S Paulo*



***Source: MCMA Bottom-up Emissions Inventory**

S. Paulo has lower emissions from LDV because of alcohol, but still bad traffic

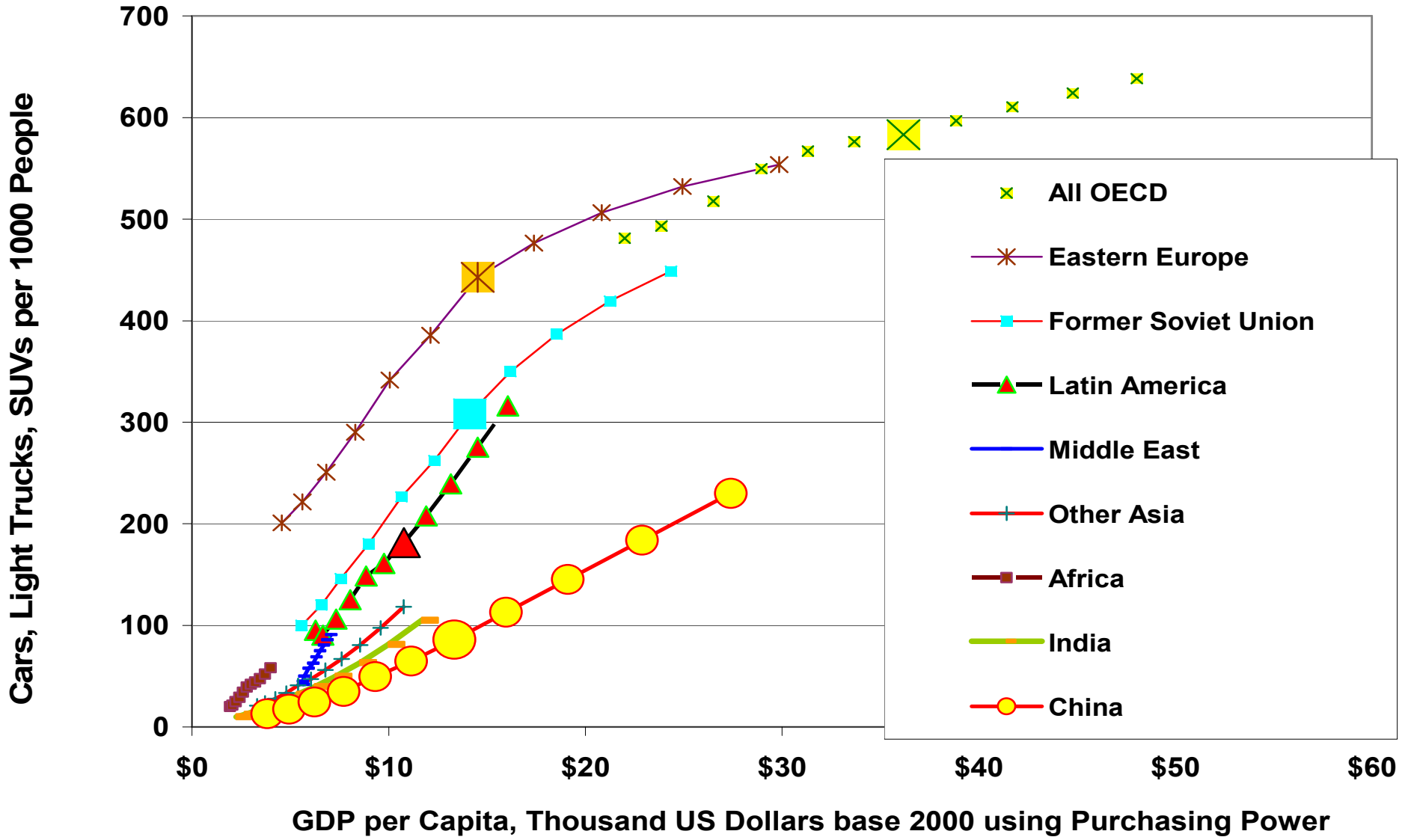
2030 Transport and Emissions in Latin America:
Business as Usual Forecast

- 20% lower fuel/km
- BUT
- 2030 emissions 250% of 2000 because of rapid increases in motor vehicle ownership and use
  - More congestion, noise, emissions (since improvements are outstripped by growth)

Projections of GDP/Capita and Cars/Capita

LAC Remains Highly Motorized / GDP

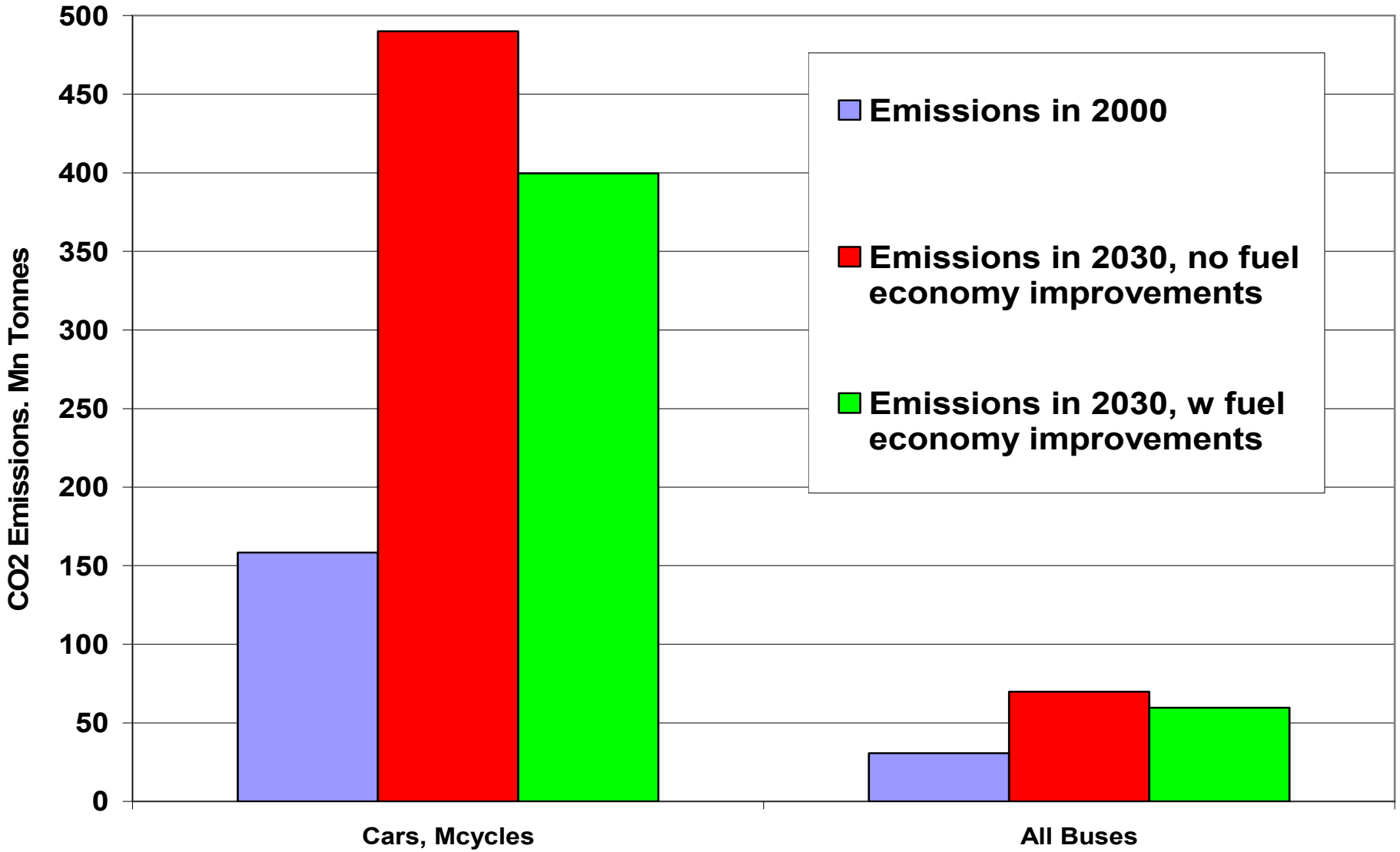
Source WBCSD *Sustainable Mobility Project*



Future Latin America Passenger Road Transport

Driving Force is LDV Ownership and Use

(Source WBCSD *Sustainable Mobility Project*)



So what to do?

- Important changes that require national or even international action
  - Cleaner fuels
  - More efficient vehicles
- HOWEVER, research indicates this won’t happen fast enough to take care of transportation’s proportionate share of needed reductions

Low Emission Vehicles & Fuels
Usually Depend on National Policies


MADE IN
AUTO.SOHU.COM


3M
HORTON

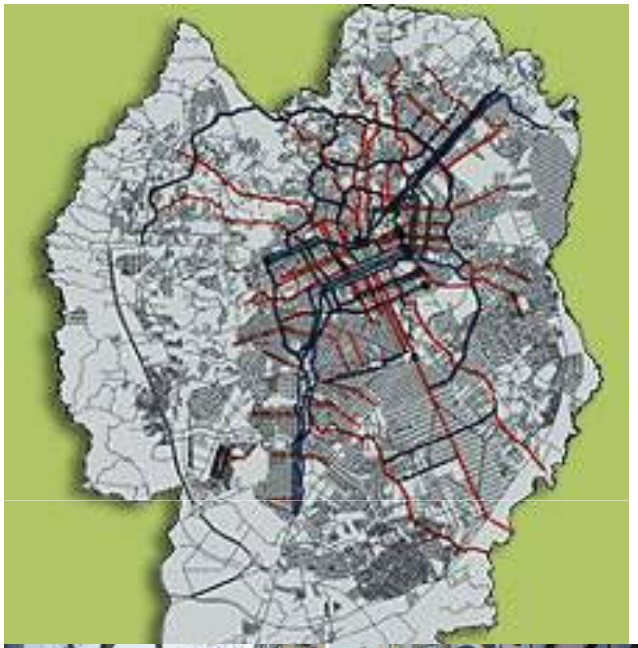
What else to do? Things that really make a difference – and don’t cost much

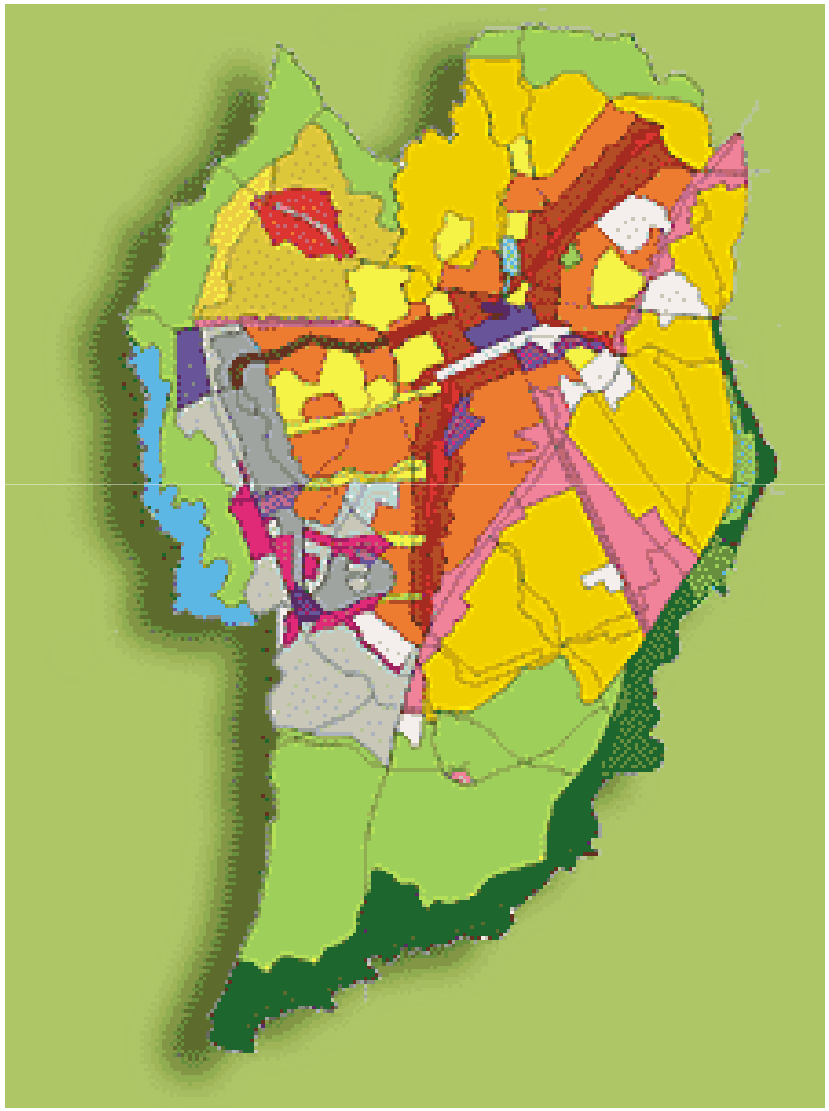
- Bus rapid transit
- Well repaired sidewalks and safe crossings
- Bike lanes and parking
- Traffic calming in urban residential neighborhoods
- Transit network clarification
- Strategic capital investments to improve capacity and service

Measures that matter cont.

- Fuel-efficient traffic signal timing
- Strategic rail transit capital investments to relieve congestion in high density areas
- Land use planning & controls for easy access
- Congestion pricing – if you can do it politically, it can pay for many of the earlier measures!

Latin America has provided examples for the world: Curitiba's BRT tied to land use system





Bogota has demonstrated that fast improvements can be made in big cities

- Bus rapid transit
- Improved pedestrian access
- Bike lanes
- Downtown improvements

San Francisco Muni BRT

Supplement rail , deliver services fast: keep promises to voters

Rail-ready corridors

Complete streets – current issue is how to fit bike lanes in

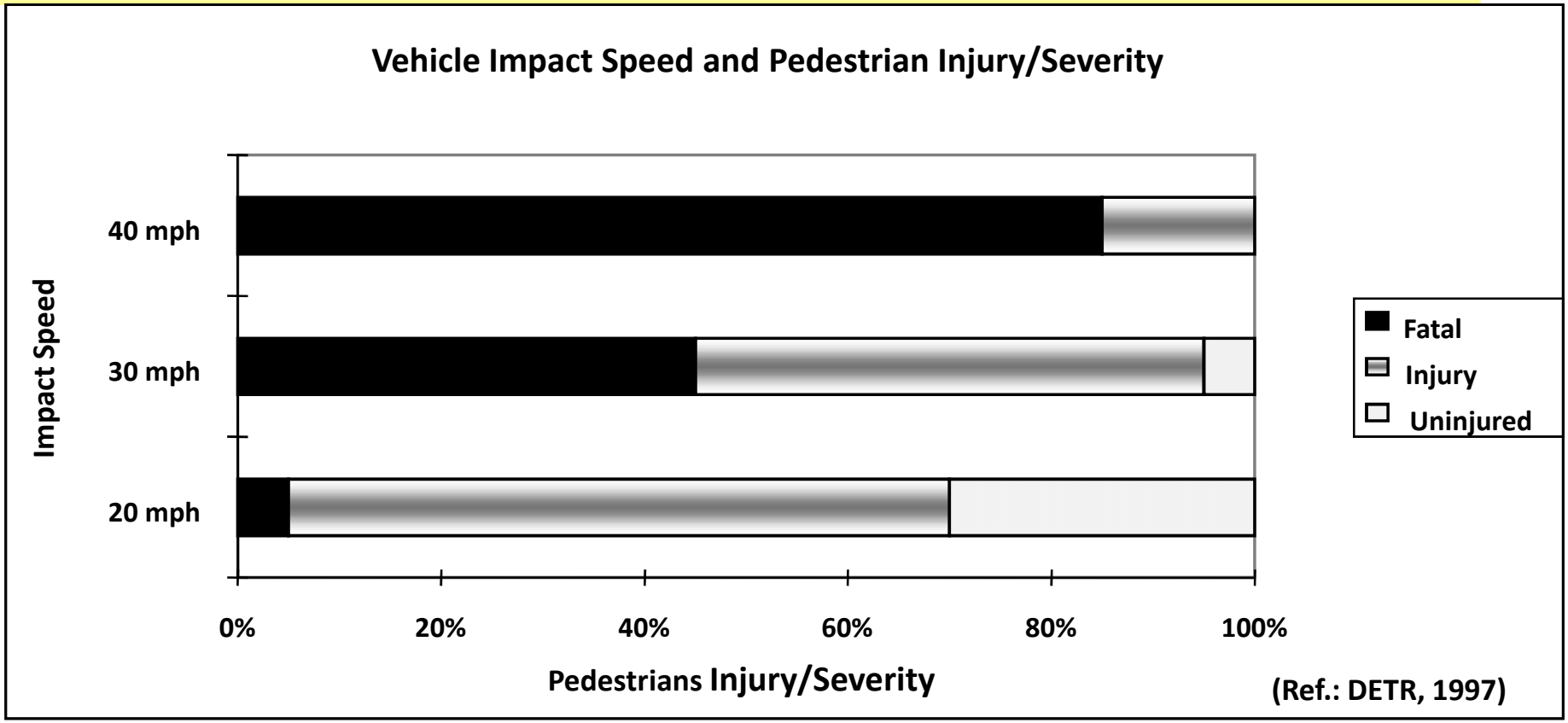
Bicycle Facilities

Pedestrian improvements – making cities safer and more enjoyable

Times Square, San Francisco, Copenhagen

A variety of street types: Complete streets, transit streets, traffic calmed streets, pedestrian streets

Why traffic calming matters



(

Evaluating Costs and Benefits of Transport Actions (from US & Canadian studies, cents per mile)

Range External Costs in Cost-of-Driving Studies	Low	High	(JEL)Journal Of Economic Literature	Comments on LAC situation
Air Pollution	1	14	2.3	Values are probably higher for LAC cities because of higher levels of air pollution, even after adjusting for Quality-adjusted value of life. See Vergara et al 2002 and Harvard School of Public Health 2003
Climate Change	0.3	1.1	0.3-3.5	Value widely disputed (Nordhaus 2008; Stern 2006) and certainly dependent on national and local situation. 0.3 cents/mile = $10/tonne CO2; 3.5 cents/mile= $80/tonne CO2
Congestion	4	15	5-6.5	Does not apply to all travel. Depends on value of time (60% of wage rate?) and actual wages
Accidents	1	10	2-7	Depends on valuation of accidents and life. See INE 2006 for MC perspective
Energy Security	1.5	2.6	0-2.2	Values depend on local energy supply situation.

Even at highest value of CO2, external costs per mile relatively small

=>CO2 should be a co-benefit of transport strategies

Metrobus as a Case Study in Co-Benefits

- Scope of Project
  - BRT in Mexico City's heavily traveled Insurgentes corridor
  - Reform of operations in a corridor
  - Little direct concern for CO2, focus on transit service improvements
- Impacts – 50 000 tonnes/CO2 year saved
  - Roughly 1/3 from better buses and operations, 1/3 from better traffic, 1/3 from mode switch
  - Large benefits: time savings, pollution reduction, fewer accidents
  - CO2 small benefit even at $85/tonne CO2
- Lessons: Transport Improvements First, CO2 as a Co-benefit
  - Most of CO2 saving comes from non-project vehicles (!)
  - Having good long-term data was extremely valuable
  - 1 good transport project can spark many more (Insurgentes II, Eje 4)

Case Study: Metrobus – Mexico's 1st BRT Line

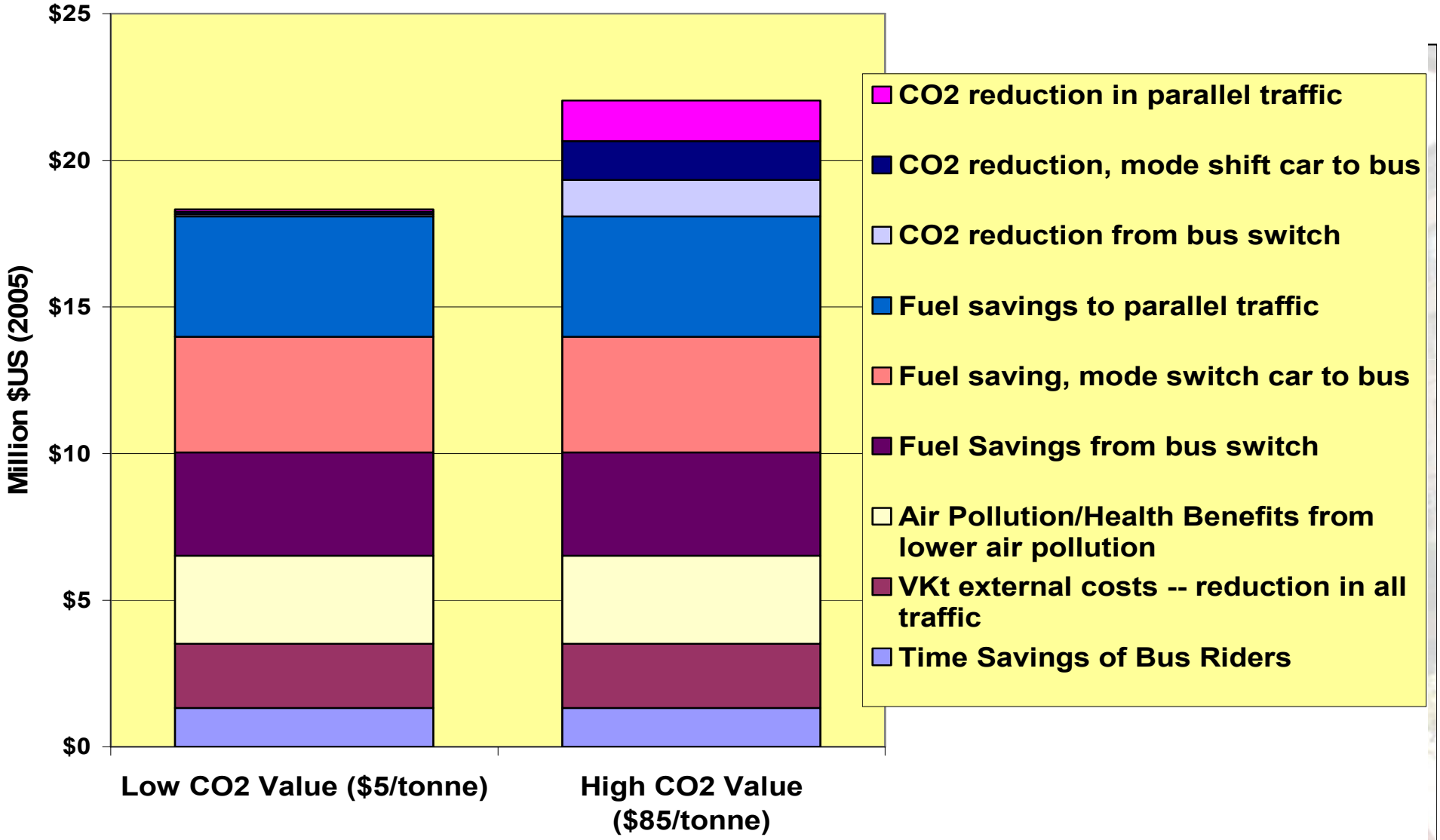
260,000 people/day (1st year) over 19km for US $80mn
Lower emissions, CO2, reduced car traffic

Mexico City Analysis Approach

- Measured changes along the BRT corridor before and after (John Rogers)
  - Used City's mobile source emissions inventory, counted cars, measured travel time, monitored, bus & colectivo fuel use on insurgentes and parallel routes
  - Surveyed passengers to estimate mode shift
- Simplified Cost Benefit Analysis
  - Used values of time - Impact of faster corridor travel
  - Estimated reduced road wear due to fewer vehicles by type
  - Included value of air pollution emissions, fuel, and CO2

Benefits from Metrobus

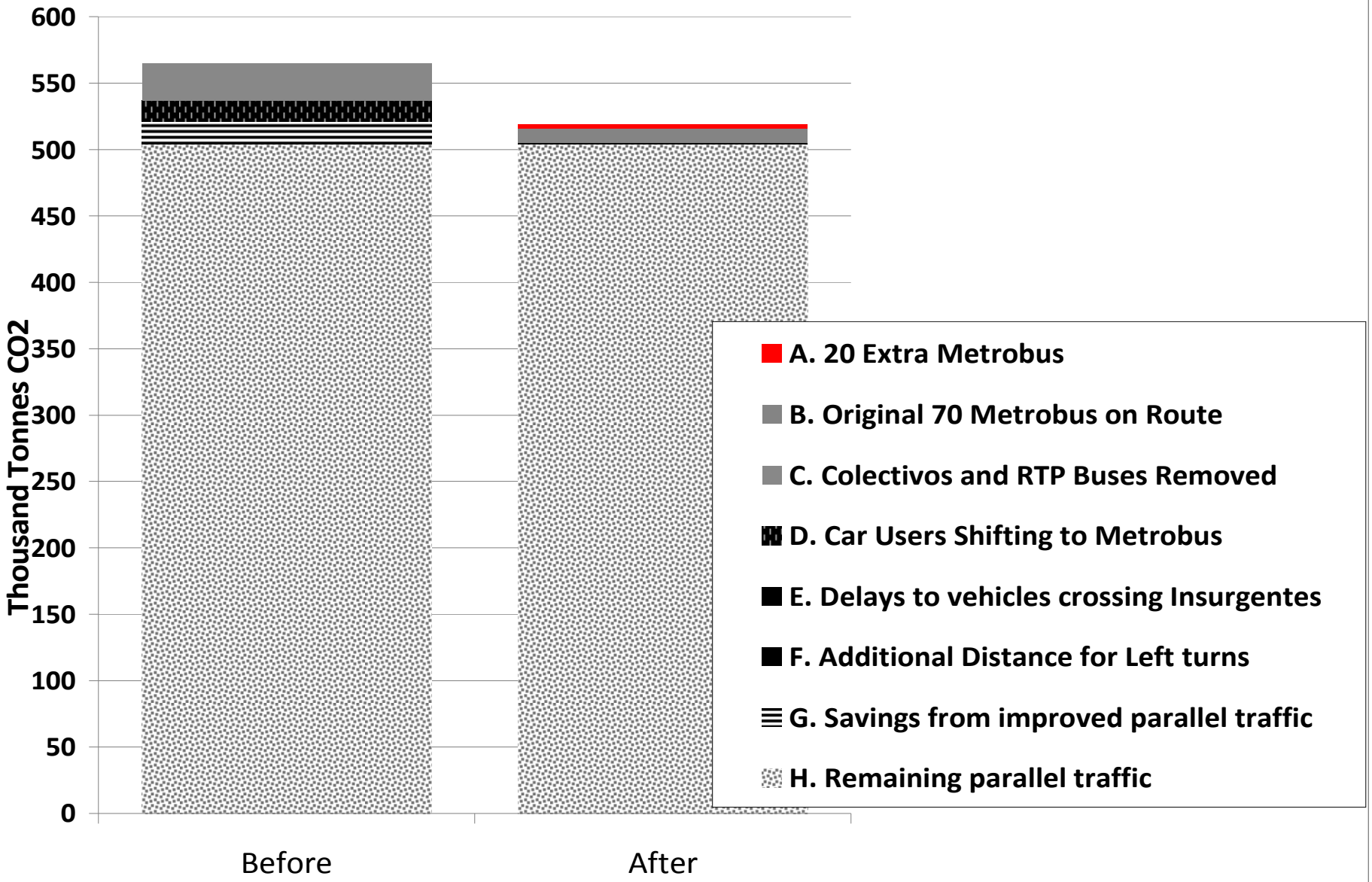
Transport, Health Benefits >> CO2 Benefits



Metrobus CO2 Changes by Component

Savings roughly 1/3 mode shift, 1/3 parallel traffic, 1/3 bus switching)

Source Rogers 2006, 2009



Case 2: Ciclovías in Santiago de Chile

- Mid-1980s: Bicycle facilities pilot projects in Santiago
- 2003: Bikeways were neighborhood initiatives (Santiago, Ñuñoa, and Providencia); partly financed by neighborhoods
- Built on existing bike infrastructure in the neighborhoods
- Part of larger bike plan, goal ~700km bikeways by 2012
- New infrastructure: bikeways in medians, separated bikeways, and bike lanes; complemented with safety education programs
- Perceived as neighborhood assets by neighbors
- Promoted and supported by strong bicycle advocacy in Santiago

Evaluation: Ciclovía Rider Survey

- 80-90% men, depending on the season
- 60% of trips were work trips on weekdays; 65% were for recreation on weekends
- Ciclovías attracted new riders: 30% of riders would not have made the trip without the bikeway
- Other riders switched from other modes: bus (47%), walking (8%), metro (6%), drive (5%), motorcycle, or taxi (4%)
- Estimates of CO2 reductions: 600-1,000 tons/yr depending on growth scenario

Source: Steer Davies Gleave. 2007. "Plan de Seguimiento del Programa de Fomento al Uso de la Bicicleta en las Comunas de Santiago, Providencia y Ñuñoa, Informe Final 2006, Vol. 1, Mediciones de Tránsito y Evaluación Económica y Ambiental." and June 2007.

Santiago bike lanes

Santiago bike lanes

Conclusions

- CO2 emissions from LAC are modest, but growing
  - Overall, Latin America is not CO2 intensive per capita or per $
  - Latin America emissions in road transport are higher than would be expected – other modes need attention
  - But the reason to do it is better transportation – CO2 reduction as co-benefit
- Urban transport issues are serious, but fixable
  - Light Duty Vehicles dominate VKT and emissions in urban regions
  - Congestion problems are tied to high LDV use
- Good urban transport will improve urban performance and reduce CO2 emissions
  - Cleaner cars and fuels are certainly part of the picture but
  - Better transit, pedestrian and bike facilities will help address equity, service, congestion, pollution, AND reduce greenhouse gas emissions