Dual in the town

Mark A. Delucchi's new proposal for discrete road systems for high-speed vehicles and low-speed modes of transportation seeks to enhance sustainability without compromising the benefits of motor vehicle use

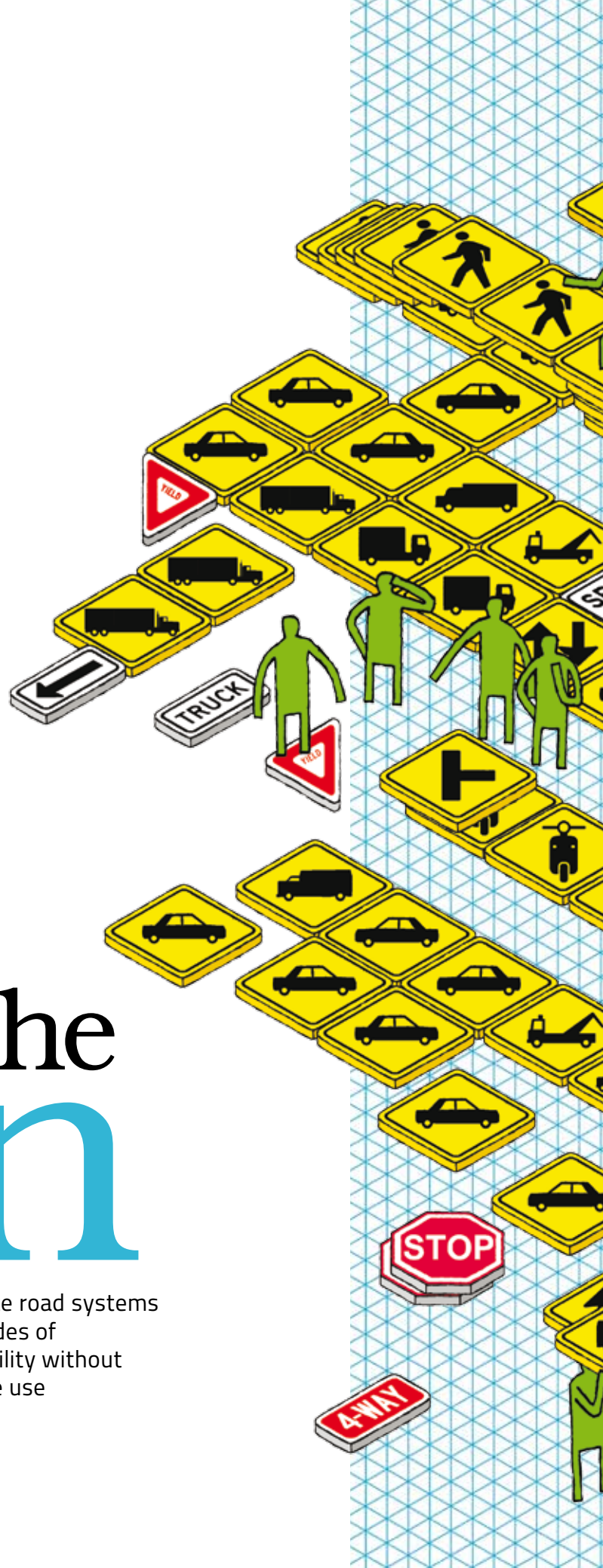


Illustration courtesy of Tim Ellis

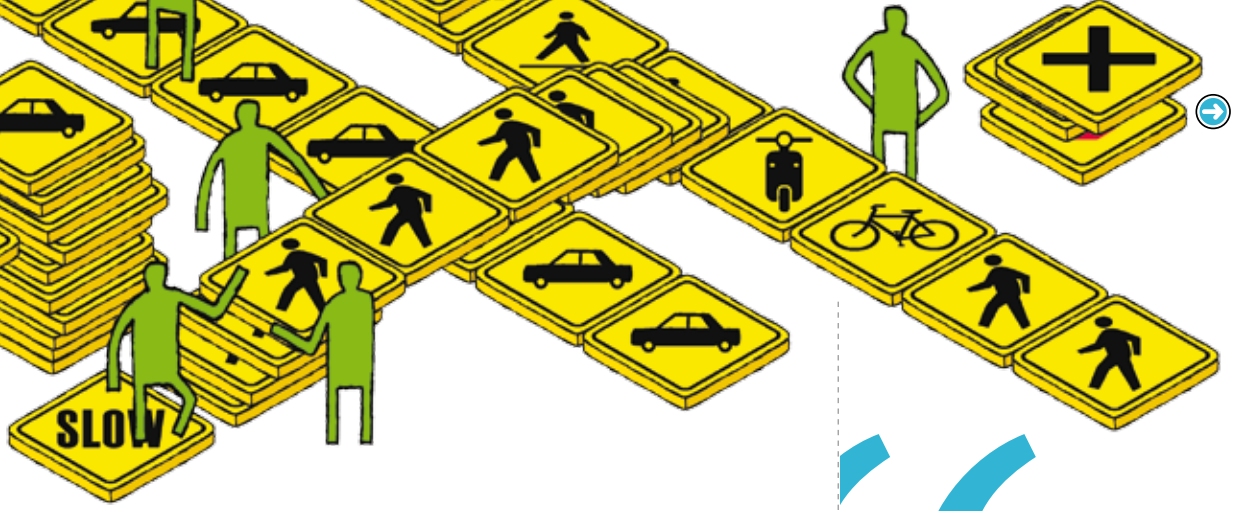
We complain about suburban sprawl, pollution, and gridlock on the highways, yet many of us live in single-family homes, and most of us drive automobiles. We bemoan the loss of 'community' yet choose to live in faceless suburbs. We think we want more 'livable cities' but are unwilling to sacrifice the perceived benefits of a suburban lifestyle to have them. For decades, city planners, transportation planners, and policy analysts have struggled to reconcile what we say we want with what we actually choose. By and large, they have failed. Around the world, car use has grown unabated. When people get wealthy, they buy cars and live in bigger homes further away from central cities. Nothing short of outright prohibition or economic catastrophe – not high gasoline prices, not better public transit, not better zoning – has stopped this trend. The result is a host of seemingly intractable problems: unacceptable congestion and fatalities, environmental degradation, ugly infrastructure, social fragmentation and insularity, and cultural impoverishment.

The plan explained

To address these problems, we take what we believe is a distinctive approach. First, we start by accepting that many people want to live in single-family homes, in relatively low density, and to be auto-mobile. We design a town that accommodates those preferences, yet at the same time offers qualitative improvements in safety, aesthetics, travel pleasure, infrastructure cost, social organization, pedestrian space, and so on. Second, in order to accomplish this we separate travel according to the kinetic energy of modes, because many transportation problems are attributable at least partly to the high kinetic energy of fast, heavy motor vehicles. Finally, we develop a particular land use and transportation infrastructure layout that accomplishes what we want.

We design a city with a dual-road system, based on the complete separation of high-speed, high-mass vehicles from low-speed, low-mass vehicles on a citywide scale. Instead of having a single road system that serves everything from 50 lb children walking at 2mph to 150,000 lb trucks traveling at 65mph, we propose to plan new


STOP
ONE WAY
SLOW
SPEED LIMIT 65
TRUCK ROUTE
YIELD
YIELD
SLOW
SLOW
SPEED LIMIT 25
SLOW



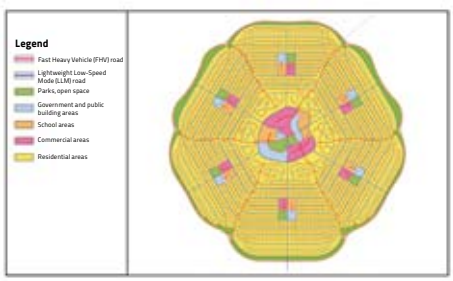
towns with two separate road systems, segregated according to the maximum mass and speed (i.e. kinetic energy) of the modes. Cut points of 25mph top speed and 1,100 lb (500kg) maximum curb weight will distinguish low-speed, lightweight modes (LLMs) from fast, heavy vehicles (FHVs). LLMs include any mode of transport under the mass and speed limit: pedestrians, bicycles, pedicabs, mopeds, motor scooters, motorcycles, golf cars, minicars, and so on. FHVs range from the conventional cars, trucks, and vans we drive every day to the tractor-trailers that deliver most of the goods we buy. The physical infrastructure of the LLM network can range from an undifferentiated narrow lane that handles all LLMs (where traffic volumes are very low) to a multi-lane roadbed for motorized traffic with a paved bicycle path and an unimproved pedestrian path alongside (where traffic volumes are high). FHV roads will be similar to present conventional roads.

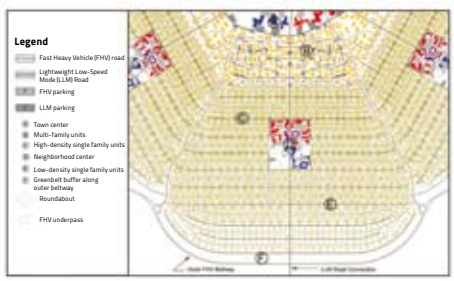
The entire town lies within an outer, high-speed beltway for FHVs (Figure 1). A central LLM road rings the commercial and civic center of the town (Figure 4). Neighborhoods, accessible everywhere by LLMs and FHVs, lie between the outer FHV beltway and the central LLM ring (Figure 2). The LLM streets all radiate outward from the LLM ring road around the town center, and the FHV roads radiate inward from the FHV beltway around the entire town.

The FHV roads have two main functions: to provide households direct access, via the outer beltway, to outside of the town, and to provide people- and goods-movers from outside the town direct access to the inner civic, commercial, and service core of the town center, via two or three FHV roads that penetrate all the way to the town center (see Figure 4). These FHV roads go underneath the central LLM ring road and come up into roads and parking on the 'back' side of all of the businesses, offices, schools, and so on.

> We propose to plan new towns with two separate road systems, segregated according to the maximum mass and speed (i.e. kinetic energy) of the modes

(Below left) **Figure 1 shows plan of dual road system for new towns, with land uses** (Below right) **Figure 2 shows plan of neighborhood branch** (Bottom left) **Figure 3 shows details of driveways and residentials street** (Bottom right) **Figure 4 shows the town center**





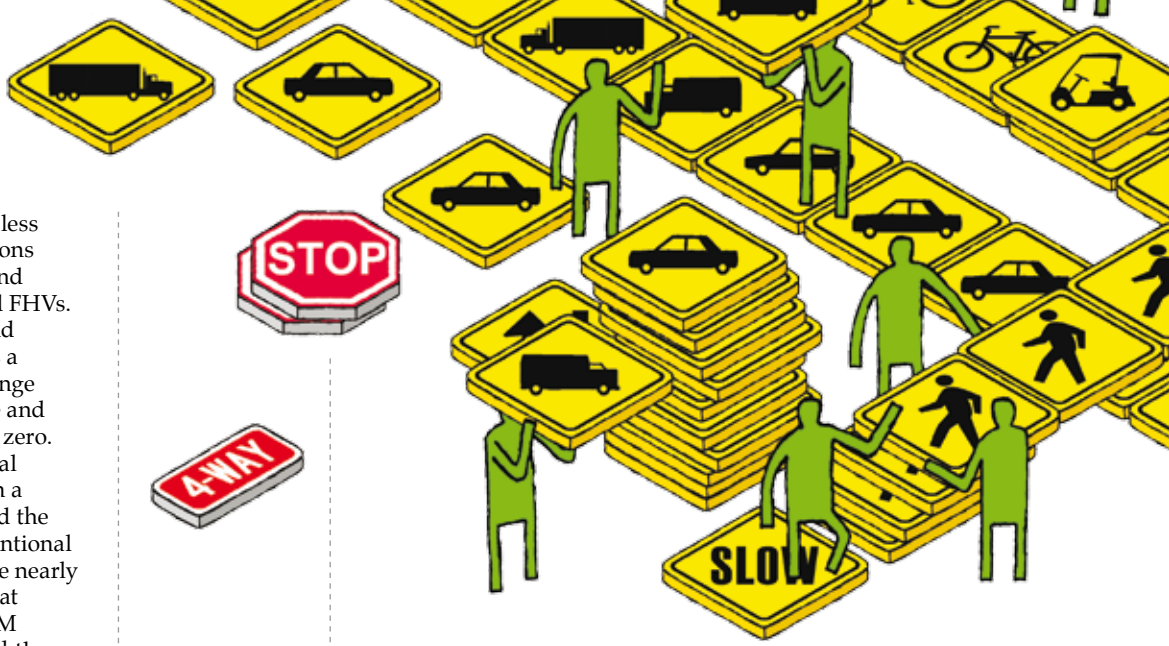
By contrast, the main function of the LLM streets is to provide access inside the town, especially to and from the town center, via the central LLM ring road. The FHV network and the LLM network thus complement each other functionally: the LLM network is designed mainly for trips within the town, and the FHV network is designed for all other trips.

Analysis

This transportation and town plan gives rise to appealing town characteristics and provides substantial safety, social, environmental, and economic benefits, while at the same time enlarging choices for travel and living.

Stores, offices, schools, civic buildings, churches, parks, inter-city transit stations, and so on are in the center of town (Figure 4) and neighborhood centers (Figure 2), not sprawled disjointedly over a suburban landscape. This coherent social and commercial geography identifies the town and neighborhoods. High-density multi-family housing units are around the core (Figures 2 and 4), and provide convenient pedestrian, bicycle, and other LLM access to the town center for those who prefer higher-density, more urban living.

The LLM network dramatically improves transportation safety, without increasing the time or cost of travel. In fact, it should be possible to virtually eliminate fatal crashes on the LLM without sacrificing travel convenience. As they are low-speed, safe, inexpensive, and convenient, LLMs are attractive to four groups for whom ownership and use of FHVs is now problematic: the young, the elderly, the poor, and those otherwise without licenses



to drive FHVs. LLMs also use much less energy and have much lower emissions of air pollutants, water pollutants, and greenhouse gases than conventional FHVs. If LLMs are powered by batteries and electric motors – which is feasible as a result of the low power and short-range requirements of LLMs – then oil use and local air-pollutant emissions will be zero. And even though there are more total miles of roadway in our plan than in a conventional plan, both the FHV and the LLM roads are narrower than conventional roads, and the LLM roads will not be nearly as thick as conventional roads, so that overall the total cost of the FHV+LLM street system in our plan will be slightly less than the total cost of a comparable conventional suburban road network.

LLMs, even fully featured, will be relatively inexpensive, and certainly will cost less to operate than a conventional FHV. To the extent that LLMs replace FHVs, they will lower total household travel costs.

Of course, the plan does involve some tradeoffs compared with a traditional plan and there are some drawbacks. In some designs, travel on the FHV network will be less convenient. The convenience of the FHV network depends mainly on how many of the radial FHV roads go all the way to the town center, and whether the FHV roads in the town center go all the way through and connect to each other.

Vehicle holding may cost more: if LLMs are additional vehicles in households, i.e., additional with respect to FHVs, then garaging and registration costs increase.

Our plan requires either that each single-family household share a driveway with one or even two other households or have an LLM road along the 'front' and an FHV road along the 'back' (Figure 3). It is not possible to have only one road along the house and not share a driveway. Some people may not like this.

The dual-road system would separate pedestrians from high-mass, high-speed traffic to eliminate conflicts and enhance safety

Implementation

In the preceding sections we have discussed a wide range of potentially significant personal and social benefits of the LLM network: nearly perfect safety, reduced congestion, a unified street space and coherent community feel, very low environmental impacts, near-zero petroleum use, and so on. Of course, the overall magnitude of these benefits, and hence the desirability of the entire system, depends directly on the extent to which LLMs are used. However, there is nothing yet in the real world quite like what we have proposed, and consequently it is not possible to provide a straightforward empirical answer to the question of how much might LLMs be driven. Our inferences from studies of the use of small electric vehicles, and our own analysis of trip-making behavior and the potential of LLMs to displace certain kinds of trips, suggest that LLMs can displace in the range of 30-50% of vehicle miles of travel by current light-duty vehicles.

The final question is where might towns like this be built? In many of the growing urban areas around the world, from South America to Asia to the American West, the urban newcomers are developing the exurban fringe. This kind of exurban-fringe expansion can be accommodated well by the town and transportation plan we propose. However, in rapidly expanding cities in developing countries, it may be difficult to commit the necessary capital up front to establish the basic dual-network transportation infrastructure. Thus, the plan perhaps is more naturally suited to large new subdivisions on the urban fringe of cities in the American West, such as in California's Central Valley.

Many transportation-related problems, from accidents to climate change, are attributable to the high kinetic energy of fast, heavy motor vehicles. The challenge is to find a way to dramatically lower the kinetic energy of personal travel, without compromising any of the benefits of motor vehicle use and suburban living. This is achieved by creating two autonomous and universally accessible travel networks: one for fast-heavy vehicles, the other for low-speed, light transportation modes.

The town plan and transportation system we propose is safe, convenient, clean, and pleasant. It should be attractive to households without economic or regulatory incentives or injunctions. The requisite technologies, and analyses of their economic and social impacts, are available now. The challenge is to interest city planners and developers in the idea.

• Further reading

M. A. Delucchi, K. Kurani & J. Koo, How We Can Have Safe, Clean, Convenient, Affordable, Pleasant Transportation Without Making People Drive Less or Give Up Suburban Living, *UCD-ITS-RR-02-08-rev.1, Institute of Transportation Studies, University of California, Davis, October (2010). www.its.ucdavis.edu/people/faculty/delucchi/*