



THE CAR IN 2035

MOBILITY PLANNING FOR THE NEAR FUTURE



Editor:
KATI RUBINYI

Design:
COLLEEN CORCORAN

Photography (unless otherwise noted)
MONICA NOUWENS

Project developed by the
CAR FUTURE GROUP:

Marco Anderson, Southern California Association
of Governments

Chris Gray, Fehr and Peers

Terry A. Hayes, Terry A. Hayes Associates

Stuart Macey, Hyundai Design North America and Art
Center College of Design

Steve Mazor, Automobile Club of Southern California

Eric Noble, The Car Lab and Art Center College
of Design

Simon Pastucha, Los Angeles Department of
City Planning

Kati Rubinyi, The Planning Center

John M. Stutsman, Fehr & Peers

Bill Trimble, City of Pasadena

Geoff Wardle, OnGoing Transportation and Art Center
College of Design

Other Contributors

Sean Donahue, Research Centered Design and
Art Center College of Design

Steve Finnegan, Automobile Club of Southern California

John Chris Jones

SangEun Lee

Shannon S. McDonald, Southern Illinois University

John Thackara, Doors of Perception

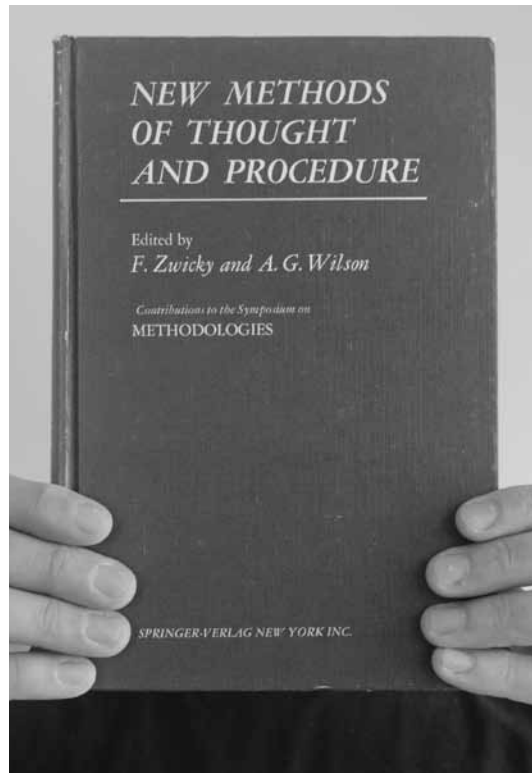
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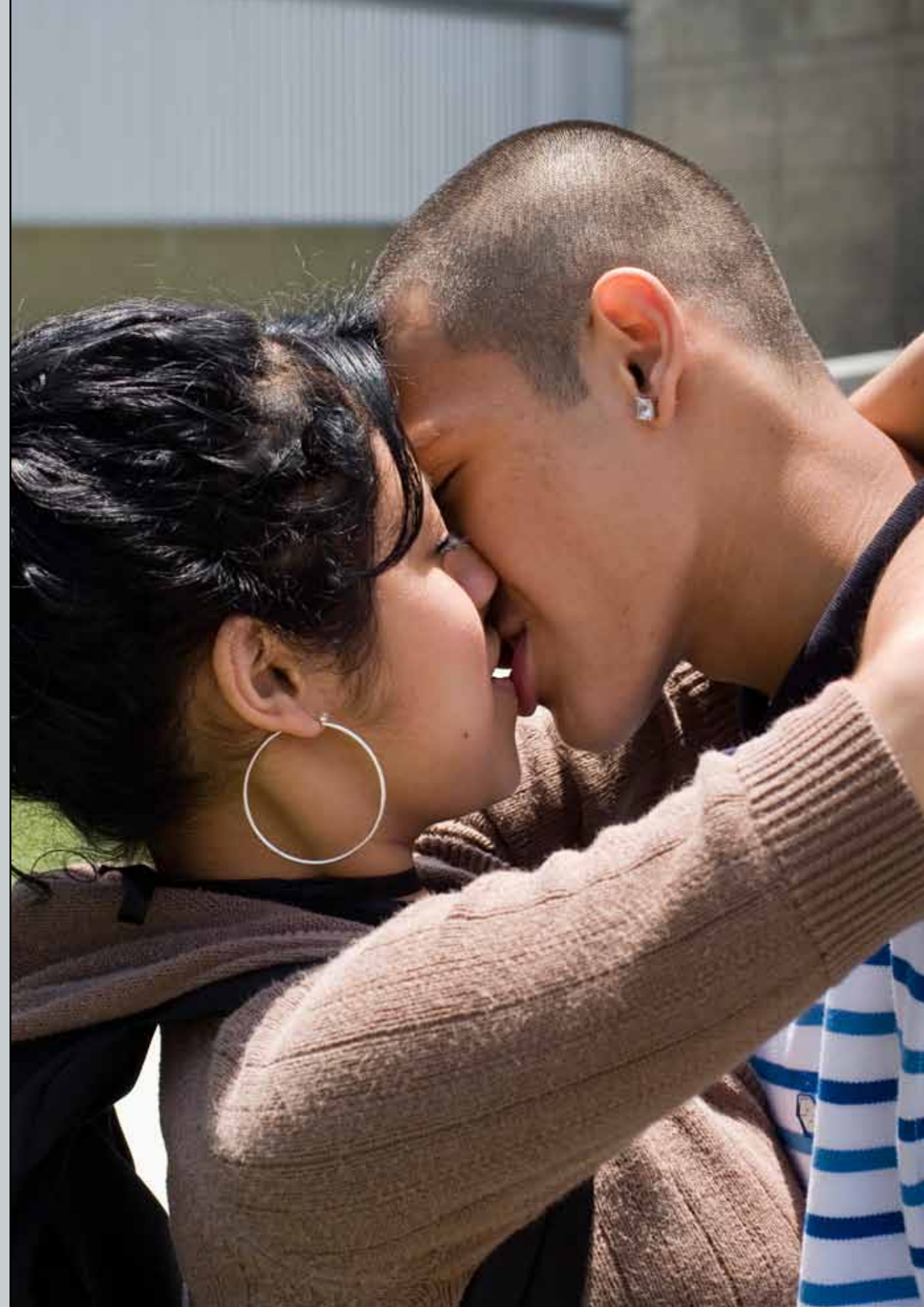
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PREFACE

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THE OTHER FUTURISM

Kati Rubinyi

Giacomo Balla, *The Speeding Automobile*,



The story of the future of the car in the Southern California in 2035 that emerges from this project is a multi-layered composite built up from careful analysis, well-grounded assumptions and personal responses to the Southern California of the present. This is a discursive project for generating dialogue not only between domain-experts, but between methodologies with radically different ways of apprehending, projecting, predicting and shaping the future. Core-samples extracted from a range of professional and personal preoccupations yield insights about technological advances, trends in design, and factors shaping our region and its inhabitants. The result is a fragmentary picture that is neither comprehensive, nor air-tight; although it does produce a realistic and vivid insight into what in our region will be the same as today, and what is going to be different. The contributors come at the subject at hand from a number of non-coplanar directions, notably weaving together their experiences of “how things work”, which in itself will have agency in creating the future.

What we find out about the future of cars establishes an underlying theme: We are realizing the ultimate dream of quantitative research as computation finally succeeds in creating a full-scale map of the world . Every point and movement in space and time will have a corresponding data representation that can be used to enhance efficiency, precision, prediction and customization. This plays out in a number of ways: Networks of sensors will guide our autonomous vehicles safely through our cities in a ballet of efficient traffic flow and real-time control. Transportation planning will benefit from a much finer-grained accuracy of modeling and prediction about performance capability

It's not coincidental that there's a link between Futurist paintings and writings to cars.

It's not as if excellence in urban design hasn't been achieved; lucky for us, we don't have to reinvent the wheel.

of cars, roads, and even complex networks of modes of travel. Planners, designers and developers will be able to generate more realistic visualizations and make more precise assumptions to aid in decision-making - financial and otherwise. Historical trends suggest that individually custom-tailored revenue collection for infrastructure-use appears to be a very likely outcome of having a full scale map of the world, challenging the paradigm of the commons with its attendant demand for fairness and shared responsibility.

The overarching trend is for our systems - our cities, and transactions - to become more efficient due to almost instantaneous prediction and control, and for this to produce and support a greater variety of modes of travel and a greater variety of types of cars. A countervailing trend is for some species of future-cars, such as autonomous pods accessed by individuals through a mobility-package lease, to become more uniform and generic. But these pod-cars, at least in the near future of 2035, will be sharing the road with a huge range of old and new cars, plus bikes, buses, streetcars and new variants of vehicles we don't see yet today. It will become feasible for individuals to spontaneously access different cars for specific uses, and the shapes and sizes of cars we buy or use will be more accurately tailored to our desires and needs. More fuel types will become commonly available, and different modes of refueling will proliferate. Advances in material science and production methods will make it practical for companies to design and manufacture editions of cars in smaller numbers.

Even with new imperatives for safety and sustainability, it seems clear that our world continues to be shaped by the legacy of the car-utopian Futurama . There is broad consensus that, since we've come this far, our streets, cities and region will only benefit from quicker acceptance of technological and design advances in cars. We just need to overcome the obstacles to that happening. However, the technological and design improvements will not take place in a vacuum, despite the seamlessness of the full-scale data-map of the world. One careful study indicates that both the vehicle mix on the roads, and any qualitative and technological enhancements to the roads themselves, will strongly reflect economic disparity between neighborhoods. Advances in cars and roadway improvements will not be shared equally. And how will we cope with the increased variety of both modes and cars, given a physical infrastructural context that will remain largely the same as what we have now? For example, what kinds of adaptations will be required of users of roads given an increased heterogeneity of sizes and speeds of vehicles, especially since a great many more of the drivers and pedestrians will be elderly?

Within the Car Future Group, our versions of 2035 are notably contradictory beyond a small number of basic assumptions that we can all agree on. This reflects the gap between design and planning; between planning and engineering; between local and regional planning; between social sciences and design; and between design and art. The gap in approaches seems more like a chasm most of the time, and anyone familiar with one way of thinking is confronted by an alien landscape when faced with the other. For example, the area of design with which I'm most familiar, architecture, is a highly emotionally charged domain in which the practitioner learns early and often that the stakes are both personal and could hardly be higher, explaining an attendant degree of investment and disappointment very difficult to relate to for those in other lines of work - made all the more pathetic given its alternately real and perceived frivolity. By contrast, planning is sober, bureaucratic,

level-headed and business-like. Its main operating principle is that the future can be extrapolated - literally numerically extrapolated - from the past. It assumes control of the future by objectifying and generalizing it. Design, on the other hand, is subjective and editorial and at its best (which doesn't always happen) challenges the status quo through making a proposition about the future. By definition, any kind of design activity is a fresh opportunity founded on a tabula rasa. The pressure is on for bringing something brand new to a tiny corner of the world, whether that corner of the world is a cereal box, a skyscraper or a spoon. Planning is more realistic, with its indefatigable commitment to turning lemons into lemonade. Planners gather the members of the public into fluorescent-lit meeting halls, nudging along their agenda of gradual, if not imperceptible movement towards the good life that comes from economic prosperity, security, fresh air, and exercise. Because it's reliance on trends, planning does not cope well with change. Rapid change in particular, like the sudden appearance of technological advances or new consumer habits, is like a boulder thrown in its path. The trend-calculators cannot recalibrate to account for the appearance of a new phenomenon or individual occurrence that resists being generalized, however in the future planning practices, including policy planning, will stand to gain from the full scale map of the world, since the increased accuracy of prediction will demand a corresponding

Our versions of 2035 are notably contradictory beyond a small number of basic assumptions that we can all agree on.

response in the form of policy from all levels of government.

Our admittedly self selecting group attempts and sometimes succeeds in communicating across our different areas of expertise and interests toward the goal of producing a body of knowledge around the topic of the car in Southern California in 2035. Many of the participants, and I'm sure many of you, know "how things work" - how deals are struck, how projects move forward, how power and authority function to deliver results. But luckily, as we also know, there is actually an infinite number of ways that things work and these can be due to our own biases and actions. Engaging problems from multiple points of view, and at multiple scales, by new arrangements of disciplinary expertise can re-arrange "how things work" to surprising results. Admittedly, these kinds of ideas are nothing new. They were put forward with great eloquence and originality in 1970 in Design Methods by John Chris Jones, the contributor of the last chapter of this book.

(not finished) One of the most important premises of our project is that representation creates the conditions of its own use . The design of the book and the photographs are as important to the predictive value of as the written content. The photographs are not illustrations but statements about the present that throw light on the future. This is the first step in a larger project asking what can be produced by disrupting planning through art. The logic of the two ways of understanding - art and planning - are irredeemably opposed, which has been fruitful for art (on the topic of Southern California, the work of Ed Ruscha, among many others, springs to mind). But what, if anything, can art do for planning? In imagining an art/planning confluence, the word futurism bears consideration. (not finished)

There are two different meanings of futurism: One refers to the Italian art movement of early 20th century that glorified speed, motion, youth, violence and modernization. The other is the humanistic/empiricist analysis of possible, probable or preferred futures. Despite sharing a name, the two

definitions have little to do with each other, except they are both, in radically different ways, concerned with the future. The historical art movement – Futurism (dirty) – caused a proliferation of radically new forms in every artistic medium, but was undeniably fascist, brutal and dark. This stands in distinction to futurism (clean) – the application of techniques of social science for predicting and shaping the future for the purposes of improving on the present, as widely practiced by designers, planners, policy makers and other professions. The car is a link between the two futurisms. It is the focus of the Futurist's leader Marinetti's gleeful, but now hopelessly corny Manifesto of 1909 in which he celebrates the car's dark side through his high speed encounter with a ditch. In the era of GOOD magazine, we all know that cars have other, even darker, sides including but not limited to fatalities, injuries, pollution and depletion of natural resources. As distant as the two are from each other, there is something to be gained by clean-futurism from the other Futurism. The dirty-Futurists undeniably helped create the world in which we live. Their influence on our lives can

My first thought is always about why there isn't a way to operate a car that allows you to move your right leg. This is an unforeseen and unintended consequence of well-intentioned and carefully-made design decisions.

still be directly felt in art and music, and especially in popular culture, including car-culture. The car and its attendant problems are a complex subject, and material and visual culture can play a productive role in advancing the discussion through offering an appropriately multifaceted and relevant way of apprehending what is at stake. Many people, as we know, love cars and will continue to do so (they are physical objects, they move, they come in colors and shapes – they have a lot of compelling attributes that cannot be ignored). Our current clean-futurists are right to anticipate and hasten the recuperation of other modes of mobility besides the car, but their cannon of Smart (-street, -growth) brackets out essential factors. More significantly, it perpetuates the organizations and processes that invented the Smart-cannon through studies, reports, regulations, and implementation schemes. Looking at the car through the lens of futurism and Futurism creates a productive tension that reframes the issue and points the way toward new practices. There is good reason to assume that our reliance on mobility in Southern California will only increase and that cars are here to stay. It will be difficult, if not impossible, for people in this region to afford to be less mobile, at least in the near-future of 2035. Historically, cars did not so much create the mobility-dependence of Southern California, but rather reinforced the interdependence of its far-flung human and natural resources. Even in the earliest days of American settlements here, people routinely traveled twenty miles to access raw lumber for construction, or moved agricultural and mining products sixty miles or more. There was brisk trade between Anaheim, Long Beach, Riverside, San Bernardino and Los Angeles long before there were freeways. The heavy reliance on mobility was characteristic of Southern California from the beginning and continues to offer a spectacularly huge range of options for people: opportunities for work, cultural activities – everything. Mobility is one of the factors that turned Southern California into an international Mecca for creative activity. But at the writing of this book, we can observe the public commons in parts of Southern California decaying

and deteriorating to levels typically found in the developing world. This, in the midst of a longstanding but pathetically misdirected campaign on the part of urban designers to gloss our cities over with veneers suggestive of parochial Midwestern towns. Luckily, examples do abound in the great and even the not-so-great cities of the world of how to create beautiful, uplifting public spaces; great shopping streets; great walking streets; extraordinary bike lanes; ingenious solutions for how to deal with cars, including how to park them. It's not as if excellence in urban design and planning hasn't been achieved; we don't have to reinvent the wheel. But we have chosen to de-value and underfund our public commons, and although more money would certainly help, it's just a part of the problem. Beneath our physical infrastructure, there is an underlying decision-making infrastructure in which different kinds of knowledge production assume their roles in a hierarchy categorized by professional expertise (architecture, design, planning, and art, to name a few). These relationships helped establish, and now perpetuate, the conventions for how our cities are planned, designed and maintained - and it's time for them to be reconfigured. Multiple physical scales in the city should be addressed together, with different types of knowledge production leveraging each other's strengths instead of operating in silos. We need more flexible relationships not only between professional roles, but between the usual sequences of steps in a project in order to achieve synergy between scales of operation. The new hybrid approach has to be efficient, adaptable, project-driven and implementation-centric. Like design, it requires leaps of faith because, among other things, it is understood that you don't know the outcome when you start. It also requires open-mindedness and a willingness to experiment and build new sources for funding, sharing ideas across disciplines and collaborating through hierarchies. A rethinking of cars, their roadway infrastructure and their public policy apparatus is a good subject with which to begin moving this larger project forward. We predict that a variety of sizes, shapes, cost and degree of automation are poised to comingle on the streets of Southern California. Car-design is sprouting shoots in

We owe it to our future to make space for the cultural producers of today.

multiple directions, and the acceptance of new types of cars is expanding throughout the world. Our decision-making infrastructure should take this challenge as an opportunity and become a facilitator instead of a barrier for experimentation in car design, and positively influence an industry that even in the recent past has been notoriously inadaptably and typically slow to change. Our physical infrastructure, in turn, needs to learn to be responsive to the mobility and urban design implication of new types of cars. If transportation and planning professionals considered vehicles and their use from multiple points of view and multiple scales, it would smooth the path towards new and improved approaches to vehicle design. If this could become a conscious and widely accepted goal, transportation professionals and planners would have an opportunity for fresh thinking about the implementation, maintenance and funding of our streetscapes. We are at an excellent juncture at which to approach these issues more creatively, armed with what we've learned in the past three decades since the first oil-crisis, and with a new moral confidence resulting from the widespread acceptance of the concept of Smart Growth. We can design and plan our policies and physical environment to accommodate multiple modes of transit including bicycle and pedestrian while acknowledging the continuing importance, and the prevalence, of individual automobile travel in our region's future.

Remembering Futurism as we engage in futurism provides not only much needed critical perspective of the currents of thought of the 20th century, but it also reminds us the extent to which the legacy of cultural producers can change the world. We owe it to our future to make space for the cultural producers of today.

CARS

I'm sure one reason I've taken such an interest in cars and the road is the fact that I occasionally spend hours on end sitting in traffic, driving at an average of twenty miles an hour from Orange County back to Northeast Los Angeles. As I sit there, often with my lower back in agony, I have a lot of time to think. My first thought is always about why there isn't a way to operate a car that allows you to move your right leg. This is an unforeseen and unintended consequence of well-intentioned and carefully-made design decisions. But more about that later. I also spend time looking at the stickers on the rear windows on the cars around me. The fashion here in Southern California is to memorialize loved ones in white cursive adhesive letters on the rear window. I calculate the ages of the deceased, like I'm walking through a cemetery, and am always shocked and saddened when they are equal to or less than my own. Then there are the trucks. Sometimes, on the 57 freeway, there are hundreds of them, one after the other. Those drivers deserve our respect, hauling around both the useless and useful stuff that makes our economy possible, such as it is. I wonder how their backs must feel. I always let trucks go in front of me and give them lots of room. I like the way trucks are customized, with their stickers and mud-flaps. Something else that got me interested in cars was buying a car. I wanted to be systematic, so I read and researched and test drove a vast number of different kinds of cars, and I was amazed to find how limited my options were. They were all the same, give or take a few attributes. Why was that? Why were all these expensive, highly sophisticated consumer products alike? I was hoping for something special – I wanted a Datsun 280ZX, but I couldn't have one. For a number of reasons, I had to conform and plunk an unimaginably large amount of money down to buy a normal middle aged, middle class station wagon, which turned out OK. It's a Diesel, and it makes a soothing purring sound. But I digress.

COLLABORATION

In April 2010 I went to the National APA Conference to present a six and half minute Power Point presentation. Upon recovering from having exposed my thoughts to a room full of planners I set off into the evening, taking the advice of my guidebook to find somewhere atmospheric to have a drink and a great, cheap meal. Afterwards, I wound my way through the streets happily sated, wandering around an unfamiliar city. When I neared an intersection close to downtown, I saw a middle aged man in a tennis hat sitting at a card table under an umbrella. He was a fortune-teller (but not a gypsy). I didn't have anything else to do so I took a chance and sat down on one of the folding chairs under the umbrella. On the table was the expected paraphernalia: ornate tarot cards that turned out weren't actually tarot cards but some other illustrated cards that served a related purpose, a couple of candles and a binder that contained the rubric for translating the messages held by the cards into narrative. The pages in the binder were pale pages of 8.5x11 paper protected by clear plastic covers. Some other pages contained photocopied newspaper stories about the fortune teller, who at other times of the day, and at other times of his life, was a journalist and a real-estate agent. I let him do most of the talking because, of course, I wanted to get my money's worth and so didn't want to make his job too easy. I was curious to see what he would come up with based on the most minimal of information. He told me that what I really needed to do at this point was focus on finding like-minded people with which to work: Put other concerns aside and

He told me that what I really needed to do at this point was focus on finding like-minded people with which to work.



1. The Mississippi
2. The Dangers of being a Pedestrian: My hand after I fell down on the sidewalk
3. below: Dinner in New Orleans

make that my number one priority. It was perfectly good advice: succinct, and notably less expensive than other types of counseling - certainly well worth the twenty dollars. The following day, in an unrelated incident, roaming around at night after another authentic dining experience, I tripped and fell on the sidewalk and captured the interesting picture of my hand, below. It was my last evening in town and I was determined to see the Mississippi, so after the hand-incident I found my way to the other side of the barrier of urban renewal that separates the city from the river and finally saw it for the first time in the three days I was there.

WHY 2035

Marco Anderson

I once saw a presentation by a futurist named Glen Hiemstra. In that presentation, Hiemstra, proposed a mental exercise for putting oneself in the frame of mind to think about the short and long term future. Hiemstra suggested that in order to really understand the possible futures we may encounter, we should think about 50 years in the past, and identify the differences between now and then. By examining the extent of change between any two points over a fifty year time period, we are provided with a frame of reference with which to think about 50 years in the future. Something about 50 years in the past is just out of our immediate cultural memory, so we are able to disassociate from the ubiquitous presence of innovation in our daily lives. In contrast, thinking back half that span of time, 25 years in the past, provides an opportunity to capture a snapshot of the arc of change, and also imagine an interim state between now and the future, or halfway between now and fifty years in the future.

The date we have chosen for our future year horizon, 2035, is based on the vision of the future transportation infrastructure that will inform the Southern California Association of Governments (SCAG) 2012 Regional Transportation Plan. This is the master plan that each Metropolitan Planning Organization (MPO) across the country prepares every four years in order to qualify for federal funding. SCAG is the MPO for the six counties encompassing all of Southern California except for San Diego County, which has its own MPO. However this date also serves, in this context, as a halfway point between the current state of affairs, and a significantly different future state in 2060. Therefore as, Hiemstra suggests, in order to put ourselves in the frame of mind to ponder 2035 and 2060, we should

remember (or imagine, if you aren't old enough) the world, and specifically Southern California, in the years 1987, and in 1962.

In Hiemstra's example, he examined house size, and lot size in 1955 in comparison with building trends at the height of the housing boom in 2005. The significant difference between a 1st generation suburban form, versus the master planned suburban communities, and exurban McMansions of the mid-aughts, enabled him, and his audience, to completely re-imagine the urban form of 2055, with suburban retrofitting, new types of household formation including accessory housing, and semi-public shared use of common backyard spaces, as an antidote to lack of public space in Los Angeles.

In order to really understand the possible futures we may encounter, we should think about 50 years in the past, and identify the differences between now and then.

THE ONCE AND FUTURE CAR

Using this technique, we can examine some consistent features in personal vehicles, or cars. Most cars, in either 1962, 1987, or 2012 (the present) have four wheels, connected via axles and a drive train to an internal combustion engine. The driver uses a steering wheel and pedals to control the direction, and speed of the vehicle. Drivers and passengers maintain a forward facing seated position while in the vehicle. Most vehicles have three distinct spaces: the engine space, the passenger space, and a cargo space. The latter two spaces while, distinct have not necessarily been separate in the case of vans, station wagons, and more recently hatch-backs.

The essays in this book will examine the changes that could occur with vehicles and within the built environment over the next 25 and 50 years. In the context of this book, however, it is easy to see both dramatic differences, and incremental differences using the past years of 1962 and 1987, in all other aspects of vehicle design, manufacturing, usage, and pricing. While the characteristics noted above have held constant, vehicles in 1962 were largely mechanical devices (using such antiquated technology as brake cables, steering rods, spring loaded suspension), designed, engineered and produced out of metal alloys. Mandatory installation of seatbelts was still 3 years away, intermittent windshield wipers had yet to be perfected, and few vehicles were equipped with headrests to reduce “whiplash” neck injuries. Many vehicles still ran on leaded gasoline.

The cars of 1987 on the other hand can be analyzed as representing an interim state. Electronic controls, including on-board computers were more common. Emission controls, had been present in vehicles for 10 years. Interior amenities and safety features had advanced significantly. These included air conditioning, sophisticated music systems, ergonomic seats, headrests, and seatbelts. Certain classes of vehicles, which

n order to really understand the possible futures we may encounter, we should think about 50 years in the past, and identify the differences between now and then.

did not exist, or existed in limited contexts (such as SUVs, and compact cars) in 1962, were well established product types by 1987. However, more subtle changes in how cars are designed and built have made significant progress since then. Computer aided design and fabrication has allowed designers to incorporate compound curves and significant aerodynamic features. Technology has created an explosion of interior amenities, such as video display consoles, satellite navigation, more sophisticated seating controls to name a few.

More importantly how we purchase and use our vehicles has changed dramatically since both 1962 and 1987. There was a time when personal vehicles were still a luxury item purchased with cash, now they are personal necessities often entirely financed. Even in 1987 a family often shared one or two vehicles, currently there are more cars than registered drivers in some states, and it is not common for teenagers to expect a car upon a reaching driving age. Commute times have greatly increased, as have speeds on highways and roadways. Increases in size, weight, and horsepower have unfortunately absorbed advances in emissions controls. Unfortunately increases in average speeds due to increased lane widths and improved road engineering have negated advances in passenger safety so that while average crash fatalities have decreased greatly the

POSSIBLE FUTURES: SOUTHERN CALIFORNIA IN 2035

THE REGION

Some urban areas will become more densely populated, with taller buildings and more people closer together than today, creating a greater range and variety between the most urban and suburban parts of the region. This will be partly due to a 2009 law to regulate Greenhouse Gas emissions through regional land use planning, and because of anticipated market pressures. However, the region will still be a polycentric one, supporting both dense and dispersed housing, office, and commercial centers spread throughout the region.

The health of the regional economy, cost of housing, average household income, time it takes to travel by different modes of transportation and cost of transportation will be the biggest factors in shaping the region, the mobility and the built environment. The increased variety in density, its location and the connections between will influence all of the possible futures discussed below. Consequently, the answer to the question 'What will the environment for the car be like in 2035?' will always –and infuriatingly– remain "It depends": it will depend on the specific level of population, and employment density in question in particular parts of Southern California.



Southern California in 2011



Southern California in 2035

PEOPLE

DEMOGRAPHICS: Earlier times will look simple to the Southern California population of 2035. In 2011, one of every fourteen people is over 70; in 2035, it will be one of every seven. Those Boomer retirees will have their memories of driving around Southern California, but most of them will have been born somewhere else in the U.S. In contrast, the rest of Southern California’s population of 2035 will have been born and educated in California – in greater proportion than any population since California became a state. The majority of the workforce, at home on Southern California streets and sidewalks, will be the children and grandchildren of late 20th century immigrants from Latin America and Asia. As never before, their mobility will depend on the needs and priorities of people who have retired. There will be twice as many retirement-age Southern Californians in relation to working age residents as today. There will be two retirees in 2035 for every five persons of working age. The votes of retirees will decide the opportunities that are available for those who are trying to get from place to place, whether to work or to play.

This population of 2035 will spread itself widely across the Southern California landscape, as every Southern California generation has done. The mix of ages and incomes will be distributed in dense lumps of similarity, with the possibility of coming together in anonymous rides from place to place. The ease or the difficulty of getting around will contribute to whether Southern Californians will want to make the trip, and hopefully the pleasure of moving around Southern California will be more than a memory.

There are any number of radically alternative scenarios which, while credible, are not necessarily inevitable, these include, severe global depression, permanent drought in the southwest, “The Big One”, peak oil, and rapidly rising sea levels due to climate change. This book does not deal directly with any of these scenarios, however they shouldn’t be ignored.

URBAN FORM

BUILDINGS & HOUSING: Both demographic trends and rising transportation costs will impact how people live in a region currently oversupplied with large lot suburban housing. This is not to say that this type of housing won't still be the most popular, just that there will be increased demand for denser housing types throughout the region. Large lot single family homes will continue to be developed in areas with cheap land, however more dense mixed-use single and multi-family housing types will be developed in city and town centers throughout the region.

PARKING: By 2035, we will have found a better way to designate parking spaces than by painted stripes, and different types of parking needs will be addressed more efficiently. Parking design and policy have received an enormous amount of attention over the last five years. Smart technology including sensors, computers and electronic signage will improve parking efficiency, and is being deployed rapidly, although perhaps not evenly, throughout the region. Automated parking garages have already been approved for use in denser parts of the region.

Shared parking, public and private car share stations, and continued unbundling of parking from housing and employment centers will increase the options available for parking in a region where parking is already at a premium. This will also greatly increase the diversity of home and work parking solutions. For example, a small 100% electric vehicle may be clean enough to store in a garage that is actually completely integrated with your house in a dense urban neighborhood. Or driverless vehicles may be legally allowed to park themselves at an area removed from a suburban home.

URBAN FORM

In urban or urbanizing areas, regional parking policies based on requiring a developer to provide the current number parking spots will be phased out by 2020. In addition transit service and multi-mobility access will be robust enough to justify variable parking rates, meaning rates that change during the course of a day to meet demand, and assure a constant 85% vacancy in business districts. Fully automated cars will park themselves in either automated or standard parking structures. In either type of structure, the cars will be more efficiently stored, allowing lower ceilings and more cars per level - a boon to developers. The level of deployment of driverless cars will affect parking congestion. By 2035, cars will be fully capable of staying in circulation while their owners or passengers are at their destination. One possibility is that autonomous, shared vehicles will only need to be stored somewhere to recharge. The rest of the time they could remain in almost constant circulation. This could have dramatic effects on parking requirements as a car you use may be driving around picking up other passengers while you are at work.

TRANSIT STOPS AND HUBS: Hubs will need to accommodate a greater variety of modes of transportation, and provide a more viable link between long and short journeys, and between transit and pedestrians. For example, Bus Rapid Transit (BRT) stops currently pose a seemingly intractable challenge for integration into streets, due to the overlapping transit services, and weaving in and out of the peak hour parking lane. These issues will be taken on and addressed in a more satisfactory way. Efficiency of transit will continue to improve with the availability of accurate real-time information for passengers. Within the urbanized areas, Metro

URBAN FORM

Rail Metrolink, and urban streetcar hubs and their environs will continue to grow, attracting development and retail amenities. In more dispersed areas of the region transit stops as we know them will be fewer, replaced by on demand service.

JITNEYS: Jitneys or small vans and buses will provide first and last mile connectivity. They can offer a very agile and cost effective way to work residential neighborhoods and ferry individuals from home to transit station/hub and then again from transit stop to work-place. As energy costs spiral, taxi operators might realize that running a small electric or gasoline powered vehicle like an Neighborhood Electric Vehicle for first and last mile operations, makes sense. Perhaps enlightened cities will make it easier for individual entrepreneurs to buy and operate their own vehicles. Currently, there are web based services operating in San Francisco which provide specialized insurance coverage which allow members to share their vehicles with other members. It is only a short step to use these services to crowd-source billing, operation, and licensing functions for individual owner/operators.

How these services integrate with the urban form will depend on how jitney service is finally deployed. Smart shuttle services provided by employers may develop into a privatized network, or an entrepreneurially minded transit operator may develop a hybrid public private model. On the other hand jitney service may come from taxi and shuttle companies perfecting a ride-sharing pricing scheme that is easy to understand and acceptable to passengers. Along with these scenarios is one in which jitneys start as unlicensed operations in poorer areas of the region, and eventually establish themselves as legitimate operators. This will be easier in a less risk-averse society. Eventually,

There are significant issues with jitney service in the developing world, which would have to be solved by technology or policy. By serving the most popular routes jitney service further erodes per passenger return for public transit service. In addition, competition between jitney providers can lead to unlicensed drivers entering the business, and competition can create its own congestion. Varying levels of quality among providers can be seen as inequitable if factors such as safety and cleanliness are affected. Finally, the taxi industry, and transit unions in Southern California may remain powerful enough forces to continue to derail any change in the status quo.

URBAN FORM

a proper balance between risk, personal responsibility and benefits has to re-emerge. If jitney service does become available we will have fewer definitive bus stops, and fewer bus shelters since jitneys will pick people up on demand along their routes as they currently do in many global cities.

SERVICE STATIONS AND REFUELING:

Gasoline powered vehicles will remain in the majority so service stations will remain functionally similar to today, however they will offer a larger variety of fuel types. Spacing and availability of stations will greatly depend on the range of the vehicle fleet. The absolute number of refueling stations may go down slightly as electric vehicles become more common. These will be recharged at stations dispersed throughout the region in buildings of different uses such as homes, parking garages adjacent to places of work or shopping centers. Cities have expressed caution about developing charging areas as they did in the '90's before electric vehicles were properly accepted by manufacturers and the market and so the next time around, the electric car will have to rely more heavily on private sector recharging stations. Commercial vehicle refueling will become more differentiated from consumer refueling because, for example, commercial electric vehicles will have higher rated charging equipment, and will be available with hydrogen fuel cells before consumer vehicles.

VARIETY OF CARS: A substantial number of older cars lacking the benefit of sensor-enabled safety features will share the road with vehicles that are self-driving (autonomous). There will be a much wider range of types of vehicles on the roads, and drivers with a greater variety of skill-levels and attentiveness to the task of driving. There is a lot of effort being made to design, produce and promote smaller vehicles, but the trend in consumer choice has been in exactly the opposite direction, with market demand continuing to be strong for larger cars. If current trends continue, these will have significantly improved engine technology and safety. The efficiency of hybrid engine technology and lighter, more sophisticated construction techniques could continue to be applied to making larger faster cars, as they have been over the past 20 years. However, other kinds of new technology such as automation could either enable current trends or create new ones. It is also hard to predict the effect of inevitable demographic changes on the car market. One strong possibility is that we may concurrently see two opposing trends: one towards a proliferation of smaller more urban friendly cars, and another for the continued prevalence of large cars, with the two sizes of cars will be sharing the road, the small cars outnumbered by the large.

AUTONOMOUS VEHICLES: Over half the fleet of vehicles in 2035 will be fully autonomous, with regulations and market acceptance having supported the ubiquity of autonomous vehicles on highways, arterials and residential streets.

On-demand mobility means we will use different types of vehicles for different trips, so cars will not be privately owned, but shared, and generic. Cars will have fewer empty passenger seats due to car sharing and alternative ownership. At the same time, suburban families will maintain multiple cars such as larger cars for family outings and smaller cars for daily commutes.

There is no consensus on when, or through what phases of acceptance by regulators, self-driving vehicles will be allowed to operate on local streets. However, the technology probably will perform better at lower speeds where the algorithm is relying more on sensors, and slowing the vehicle, than on the highways where the algorithms are calculating complex location in space, speed, and relation to other vehicle variables. Political regulation will depend on whether the public is convinced that self-driving vehicles remove the human error, or infringe on our driving liberties.

CAR DESIGN: As the overall vehicular system becomes more autonomous, the vehicle interior environment will become more like a small living room and allow for increased customization for closer integration with each individual user's lifestyle. Some predict a shift in car-designers' focus away from the sculptural dynamics and styling that have traditionally been important to vehicle design.

For example, Apple's simple and understated product designs, such as for the iPhone, may give a hint of future vehicle exterior design: a simple exterior form and anonymous styling. Fleets of cars will travel together at space of a few feet in autonomous formation, facilitating the user's ability to communicate, socialize, multi-task, work, watch movies or play games all during their daily commute. Current research into improvements in the design of vehicle egress for handicapped people will result in better design of egress for cars in general. The way we enter and exit vehicles will be less standardized, in keeping with the increased variety of types of vehicles.

AUTO INDUSTRY: Insurgent, disruptive start up vehicle companies will lead in innovative vehicle architectures. A minimum number of vehicles will still need to be sold in 2035 in order to see a vehicle "pencil" for a manufacturer. So car companies will continue to subsidize an array of vehicles through a small, select group of best-selling models. However because of efficiency gains in manufacturing processes, materials and engineering, manufacturers will be able to produce a larger variety of cars and be more responsive to changes in markets.

Car companies become more like computer companies, in that the production of vehicles

The overall design of vehicles – the vehicle architecture - will remain remarkably similar. Vehicle exterior surfaces will be impregnated with phosphorus like materials to store solar energy from daylight and would passively glow in the dark, contributing ambient illumination to the environmental in high-density urban areas, reducing the energy draw from the grid. And, to further facilitate the requirements for constant social networking, we will see the integration of molded organic LED materials into the exterior panel construction of vehicles. These would display real time communication, dialog and expression, changeable and animated color and graphic motifs, allowing a layer of individuality and personalization of the anonymous exterior design. This would augment the autonomous driving experience.

is driven by distributed component designers and manufacturers responding to certain specifications and assembly processes. Marketing information comes from multiple sources and costs are more widely distributed. The major manufacturers provide branding, distribution, major assembly, and some R&D funding.

Significant changes in the government's approach to the regulation of vehicles will occur that will allow for more dynamic architectures. A regulatory framework built around risk assessment, and performance measures will regulate communication standards for on-board and off-board telemetry. By 2035 safety will be so improved that relaxed vehicle architectures will follow separate safety guidelines, based on systems redundancy instead of increasingly more forceful collisions.

BUSES AND TRUCKS: We will see a wider variety of sizes and types of buses and trucks, and they commonly will have assisted driving systems. Buses will range from long-distance Bus Rapid Transit to local shuttles and a great number of small, less regulated private vans and jitneys. Like today, drivers of buses and trucks will have more rigorous training than drivers of cars. Buses will look more like streetcars, and streetcars will make a comeback in areas with enough density.

The bus and truck industry does not adapt quickly to change, including integrating new technology. In fact, the general form of the cargo trucks has not changed in 50 years. Currently, smaller buses are designed to fit on large truck beds, leading to raised platforms and uncomfortable cabins. Moreover, the resulting cargo and emergency vehicles

Significant increases in the cost of energy will make long-distance transportation of finished goods economically unsustainable inducing a large-scale move to local manufacturing that will change the face of trucking. Long distance trucking will reduce, short haul, regional and urban distribution will increase. We will see even more small delivery trucks and vans.

dictate road standards. A major contributor to the current lack of evolution in truck and bus design has been the slow specifications-based purchasing processes required of public agencies. But if the purchasing processes change, it will allow for more responsive design on the part of truck and bus manufacturers. An emerging market for privatized, shared public transportation could encourage variety and experimentation in truck and bus design and manufacturing which in turn would influence public sector purchasing decisions. Increased variety in density may also challenge current conventions and leading to a more diverse truck fleet as it has in Europe and Asia.

SCHOOLBUSES: School buses will be safer, and they could be a site for learning instead of just transportation. In keeping with the logic of the autonomous vehicle, the interior of the school bus could be much more like a class room. But the future of the school bus will depend on the future of education. For example, in a scenario where schooling is a blend of on-line learning at home with only a day or two a week in a physical school building, it is likely that school buses will no longer exist as schools reduce daily transportation functions. But in a scenario where transportation is provided, or on occasions like field-trips when travel is part of education, the buses can serve as classrooms on wheels.

SMALL CROSSOVER VEHICLES AND MOTORCYCLES: There will be a proliferation of vehicles that are somewhere between a Segway and golf cart, a Segway and a motorcycle or a motorcycle and a car. Some will have two or three wheels, some four. They will have a variety of ranges and speeds, and require different kinds of fuel: for example electric motorcycles will be common. We

VEHICLES

will need to face the challenge of designing roadways to accommodate these vehicles. Similarly, we will need to craft licensing policy and rules for them alongside other vehicles that are much larger and faster. A long-term negotiation to establish public and private cooperation will be the only way to optimize the use of these vehicles and allow them to find a market.

For example, Polaris is a progressive company, which has recently acquired Global Electric Motorcars (GEM). Since 1998, GEM has been manufacturing one of the more common and better looking neighborhood electric vehicles (NEV) to be seen on American streets. It was designed by Art Center graduate Dan Sturges. Sturges actually co-founded the original company before it was acquired by a Fargo, N.D. businessman who then sold it on to DaimlerChrysler. Under Chrysler's ownership very little was done to improve or update the product, and more importantly, there seemed to be no visible effort to promote the idea of NEV's as an effective and economical means of local, personal mobility. Polaris might see GEM as an opportunity to be innovative in this dormant but ready-to-be-exploited market. It is well-positioned to create the next generation of NEV's with more sophisticated safety engineering – although without being a proper car. But it will never sell if regulations don't change to allow a maximum speed of 35 mph. The future of a broad range of vehicles in-between the standard four-passenger car, and the bicycle will depend on the future of negotiations between regulatory agencies and the automotive industry.

VEHICLES

TRAINS AND BUS RAPID TRANSIT

VEHICLES: The proliferation of types of rail vehicles will continue, and there will more than likely be select deployments of streetcars in small areas such as Downtown Los Angeles and downtown Santa Ana, as well as alternative rail vehicles like the Anaheim Monorail. More Southern Californians will have passing acquaintance with modern rail vehicles, as Metrolink continues to update its rolling stock, and offers work space amenities such as wireless communication, and charging stations for digital devices. As noted above, busses will be designed with more ease-of-use, and look more like rail-based transit. Bus Rapid Transit systems will continue to be a feasible alternative to rail based systems for low density areas of the region which cannot justify the investment in rail transit.

California High Speed Rail is very much still on the path of a 20 year plan for providing inter-city passenger rail service. However, fiscal, and governance issues can still delay or stop the project.

Regional rail service will improve, however much of the current right of way for rail is still surrounded by long-term industrial uses, and will get in the way of regional rail stations becoming the nuclei of viable transit oriented districts. This will vary greatly depending on the use and placement of freight rail. Corridors with freight rail operations will still have noise and pollution effects, higher risks, and wider unavailable rights-of-way.

ROADWAYS

HIGHWAYS: Within Southern California of 2035 the freeways and highways will have the same footprint (or Right-of-Way: ROW). There will be an extremely wide variation in the quality of the surfaces of the highways throughout the region. Many current High Occupancy Vehicle facilities and flyovers will be converted into High Occupancy Toll lanes. HOV and HOT lanes are now being built as continuous access facilities and not physically separated lanes. There will be no segregation of self-driving vehicles on freeways. To segregate them is impractical and a waste of time and money. The technologies that will allow autonomous vehicles to work will allow them to mix invisibly with legacy vehicles.

There are significant investments in toll transponder infrastructure, so we may see a HOT lane becoming a fully automated lane piloting area. Highway-running autonomous vehicles promise the greatest return on investment in congestion reduction and easier interim implementation.. However automation is actually more effective at lower speeds, therefore local driving in automated mode will make more sense.

ARTERIAL ROADWAYS: The most complex urban and transportation design challenge will play out on moderate and high density corridors in suburban communities . These will need to accommodate the widest range of modes of transportation, and the widest range in the fleet: heavy/light, fast/slow, large/small, autonomous/non-autonomous vehicles and serve regional and local needs in addition to accommodating pedestrians. Across the region there will be an even greater disparity in the quality of the road surface based on economic strength of local roadway jurisdiction.

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ROADWAYS

In urbanized areas the footprint, or ROW, will remain static, and in many cases there will be a critical mass of political will to reclaim street space for traffic calming, public space and sidewalks. Suburban areas will continue to see new arterial construction and better maintenance of existing roads in wealthier communities. Deployment of signal prioritization and smart signals that communicate actively with cars will favor suburban areas.

Segregation for bicycle facilities will increase, as will the sophistication of signals on bicycle infrastructure. Complete Streets approaches that integrate pedestrian, bicycle and vehicular travel will be implemented in varying degrees depending on density, and local resources.

ROADWAY CONTROLS & LANE MARKINGS:

There is a great deal of research being carried out these days on technologically enabled roadway controls such as cameras, sensors, and active controls that allow infrastructure to communicate with vehicles. In an opposing trend, there are planning and design case-studies that favor fewer controls: for example, marking-free streetscapes in high-density low-speed environments. Again the ubiquity of self-driving vehicles and their operation in low and medium speed environments will be a major determining factor on what kinds of requirements will be placed on roadway controls and markings.

The implementation of the currently popular strategy for achieving traffic calming with roundabouts will depend on the size of the intersections, and the speed of traffic, with these treatments being more likely as neighborhood amenities. Use of traffic circles in suburban and exurban arterial settings will again depend on the extent of self-driving

Traffic controls will be developed by the vehicle manufacturers, meaning: they will be deployed on the vehicles themselves rather than on the infrastructure. It will be the vehicles, and not the infrastructure - using cloud computing, GPS type systems and car2car communications - that will create systems redundancy resulting in public safety, thus creating self-contained virtual roadway controls that don't depend on expenditure by public agencies. This will allow much more rapid development and ensure that the technologies are continually updated and with no opportunity for certain cities or regions to be deprived of better traffic management because of political stasis. The technologies that allow autonomous vehicles to work - at any speed - will not demand much, if any additions to the infrastructure such as roadway controls.

ROADWAYS

vehicles. Traffic circles have fewer conflict points, and work without vehicles having to completely stop.

CULTURAL ATTITUDES: “The Right to Drive” In Southern California the notion that driving is a right will still be a reality of public policy for at least the next 15 years or more. However, the right to drive conveniently ignores the fact that the mobility challenged: young people, old people and sick people do not have that right. By 2035 the leading edge of the boomers will be entering their reduced mobility years, and will hopefully be reaping the planned transit investments they voted for through county level half-cent sales tax measures, in five of the six southern California counties. In other words, workable subregional transit systems will be serving a non-trivial portion of all types of daily trips for all age groups in some parts of our region.

More importantly, there will be a wider spectrum of available mobility options, and vehicle ownership options. This will remove the economic mandate of driving, as the only credible method of access to economic activity. So by 2035 the right to drive (my car, by the way) will no longer be synonymous with the need to only drive my car. Autonomous vehicles will allow a more diverse range of people get in a vehicle and safely drive whenever and wherever they want, so the right to drive could become the right to mobility. In fact the market power of the baby boomers, and their now caretaker children, will provide the market incentives to automobile manufacturers.

ROADWAYS

COMMUTING PATTERNS: Commuting habits will be less routine resulting in more traffic spread out through the day instead of during rush-hour. And the lack of routine means more difficulty in offering efficient transit services. In another trend, the increased concentration of population density means people will travel shorter distances, so there will be more demand for mobility, and public transit, within that closer range.

Telecommuting and remote working will be much more common. However, the implication on traffic is uncertain. Will more remote work result in more local trips, and in more overall travel during the working week, or reduced overall travel? A very large proportion of the population, especially the economically disadvantaged, will not have the option to telecommute because of the nature of the work they do.

LICENSING, DRIVING SKILLS, AND ENFORCEMENT: Current new driver licensing, and vehicle miles traveled have been decreasing for the last 5 years. This is in part reaction to graduated licensing, but also the increasing appeal of virtual connectivity and more interest in digital devices than automobiles by people in their late teens and early 20's.

The coexistence of autonomous vehicles and non-autonomous vehicles on the same roads, and drivers needing to be proficient in autonomous and non-autonomous modes will require a greater variety of driving abilities. The diversity of types of driving modes means that drivers will, ironically, have to be more skilled – creating the need for new levels of drivers' licenses, stricter enforcement of traffic rules and higher costs for licenses. Some on-board communication technology

Local trips will be made in small, electric vehicles. In the ideal urban community of 2035, no-one should be more than walking distance from any facility required on a daily basis – schools, shops, clinics, entertainment and a local satellite business hub.

ROADWAYS

will be used to immediately assess fines, and encourage surrendering driving control through dis-incentives.

LEASING/RENTING/BORROWING: Across the region ownership patterns will grow much more varied. There will be more on-demand mobility options in denser areas, and more technology-enabled mobility: for example, using phones to facilitate on-demand car sharing, electric charging rates that vary with current demand, flexible insurance policies that cover co-ownership or renting your own vehicle. On the other hand, there will be a large segment of lower income vehicle owners, still buying cars with cash, and engaging in informal car sharing. Future vehicle ownership is an extremely unpredictable factor. More efficient vehicle pricing, leasing arrangements and usage could lead to fewer vehicles per capita, or it could lead to many families owning multiple vehicles for different purposes such as short trips, commutes, weekend errands. In either case, people will have better access to a variety of vehicles. Currently, there are web based services operating in San Francisco which provide specialized insurance coverage which allow members to share their vehicles with other members. (Getaround.com, relayrides.com, spride.com.) They may choose to own one or more cars or they may choose to participate in a total mobility package that gives them access to what they want/need when they need. They may own the vehicle that they use nearly all of the time for commuting and then lease other kinds of vehicles for occasions when the requirements for storage are different, such as weekend trips.

However, car ownership has also been a cultural touchstone for nearly a century, and globally is still on the rise. A car also remains

ROADWAYS

the second largest purchase many people make in their lives. While this highlights the economic reasoning behind change, it also demonstrates a deep social attachment. There is near consensus on these changes, as many of these things are in place. However there are many different thoughts on the pace of this change. An oft-cited figure is that it would take 4 semi-continuous years of sustained gas prices to trigger a majority of Americans to a tipping point of more systematically rational and effective vehicle choices.

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FUNDING

FUNDING OF THE DESIGN, CONSTRUCTION AND MAINTENANCE OF TRANSPORTATION INFRASTRUCTURE:

In September 2011, there is no clear picture of the long-term future funding mechanism of the American transportation infrastructure segment. This topic is probably the murkiest it has ever been in the last 50 years. The SCAG regional council vigorously began a discussion about allowing a local agency, county or city to raise the gasoline tax with a simple 51% majority instead of the 2/3rds majority required for all other taxes, and fees. The agency has to meet the condition that the funds be spent only on reducing congestion. The federal transportation bill is entering a period of debate over its 6th extension in the wake of a near shut-down of the federal government.

There is near unanimous consensus among transportation experts of all ideological and professional stripes that the current method of infrastructure funding is inadequate. Gasoline Tax collection and distribution was developed in the 1930s and is completely inadequate for the future system. As the new standards that require 35 miles per gallon fleet-wide gas mileage by 2020 are phased in, the SCAG region will see a decrease of?? \$12B in funding over the 20 year time period. In September 2011, there is no clear picture of the long-term future funding mechanism of the American transportation infrastructure segment. This topic is probably the murkiest it has ever been in the last 50 years. The SCAG regional council vigorously began a discussion about allowing a local agency, county or city to raise the gasoline tax with a simple 51% majority instead of the 2/3rds majority required for all other taxes, and fees. The agency has to meet the condition that the funds be spent only on reducing congestion. The federal transportation bill

Telecommunications and computing companies have a stake in road-pricing, since they will have to provide part of the infrastructure for implementing and maintaining it, so they will be powerful proponents of it. However they have yet to significantly enter into the policy debate. Energy providers are currently too concerned with meeting demand for energy that they have not been as actively involved in infrastructure funding development.

FUNDING

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FUEL TYPES

FUEL TYPES & ENGINES: The Internal Combustion Engine will remain by far the most common. There will be more variety of fuel types than we have today, and more individual vehicles will have the capacity to use different types of fuels. Petroleum based fuels will be further reformulated, perhaps with an increased Ethanol (cellulosic) content will account for about 60% of the market. Many of these cars will be gasoline/electric or diesel/electric hybrids. Some will be capable of being plugged in, but non plug in hybrids, like the Prius will still be very common. Zero emissions battery-electric vehicles will account for 5% to 10% of the fleet. There will be increased use of Compressed Natural Gas, made more popular because of the possibility for home-based refueling for natural gas. Hydrogen vehicles will also be a factor, although in the minority.

In 2035, nearly all cars – indeed nearly all road vehicles will have electric traction motors. The question is what will be the energy storage mix of the fleet in 2035? A significant proportion of new vehicles will have some form of internal or external combustion engine requiring liquid energy storage. These series hybrids engines will generate electricity to supply the electric traction motors. This allows for more efficient use of the liquid fuel whether it is gasoline, diesel, bio-mix, etc. because of combustion engine optimization and elimination of the inefficient mechanical transmission used today. It also allows significant range.

Some vehicles, with shorter journey usage will have battery storage of electricity or perhaps hydrogen fuel-cells. Which of these two exist will depend on which of the two technologies wins out in the race for economic production, ecological cleanliness and energy density. This will likely be battery storage on most vehicles, and hydrogen fuel cells will be seen more on large vehicles – buses, trucks – where the high cost of the technology is a smaller fraction of the overall vehicle cost and the storage of hydrogen tanks is less of an issue.

CROSSING THE STREET IN 2025:

THE CROSSING THE STREET IN 2025

PROJECT was proposed by Bill Trimble, a senior planner for the City of Pasadena. Its purpose is to fictionalize many of the questions that planners, designers, and policy analysts ask when they consider the future of personal mobility, including the rate of change in vehicles, transportation infrastructure, and technology. For example, at what speed will people and things move, and who will be liable for the risk when, say, vehicles and pedestrians meet?

In order to get in the right frame of mind, we thought about what specific intersections looked like 10, 20, or 30 years ago. We thought of the types of vehicles you would have seen on the road, and the types and of pedestrians you would be standing with on the sidewalk.

What was the infrastructure like? Were there crosswalks? Pedestrian signs? Curb cut-outs? Then we thought about current trends in demographics, design, and technology, and imagined the same intersection 15 years in the future. The ten or so participants randomly chose the degree of density and economic context of the future intersection. What emerged were sharp distinctions between the anticipated futures of economically disadvantaged areas and wealthier communities. Generally speaking, infrastructural improvements were seen to favor areas of less density, especially wealthier suburbs, while the infrastructure of denser, urban areas was expected deteriorate. The following is based on a compilation of the narratives developed by The Car Future Group.

ORANGE COUNTY IN 2025

As they approach the intersection the youngest girl races ahead and the lights at the edge of the sidewalk blink signifying there is traffic in the intersection. The crosswalks are clearly marked and the pavement is smooth and new. The slightly blue tint in the pavement reflects the non-petroleum-based low-emission asphalt. You can't see the pedestrian sensors under the pavement but they can communicate with the newer automated vehicles to let the cars know that the light is going to be red or that a pedestrian is crossing. The new synchronization systems sense the on-coming traffic, and resynchronize within a few minutes after it passes. The flow of traffic is amazing. The speed of the autonomous cars conforms to the electronically posted speed limit, which varies with time of day, traffic patterns, and weather conditions, and they travel for miles without ever stopping at a light. This area of Orange County is one of the few non-freeway locations where vehicles may be operated autonomously because of the dense network of intersections with cameras, traffic signals and detectors. Implementation of this system a couple of years ago was assisted through hard won state and national grant funding





The turn lane has a green thermoplastic coating to signify that it doubles as a bike lane. The right-most lane also has the coating, and dedicated bicycle lights. There are a wide mix of cars, bicycles and other vehicles leaving the Business District: a few fifteen year old hybrids driven by teenagers and young college kids, and a number of brand new all electric Mercedes and Audis on their way to the freeway's autonomous toll lanes. Two and three-seater neighborhood electric vehicles whiz by soundlessly. These share the road with hybrid trucks which get a ridiculous 30 mpg and cost \$800 a year to register, but are still popular with those who have the room to park them.

Behind us is a gas station with its 8-10 different types of pumps, sorted by fuel type. On one side are the large gas, diesel, and natural gas pumps. On the other are the hydrogen, and electric charging stations. The gasoline sold these days does not even seem like gasoline any more since it contains 15% ethanol (some might call it moonshine) and many other additives to lower its carbon footprint. Some of the 240-volt medium rate electric chargers can take several hours for a complete recharge, but more and more are converting to 480 volt fast-chargers that can take an EV or PHEV battery from near dead to 80% charged in about 15 minutes. It appears that the bugs have been worked out of these systems since the rash of accidental electrocutions in the high-humidity

south a few years ago. This station, like most, has E85 pumps now and CNG and high pressure (10,000 psi) hydrogen too.

Finally the light for the cars turns red. The bicycle light stays green for another 10 seconds to allow the bikes to clear the intersection, and one lone straggler crosses on an electric Uno, the music from his speakers accompanied by the whirr from the hub motor. As soon as the bicycle light for the other direction turns green, the automated BRT bus starts to cross. Ten seconds later, the car lights finally turn green. The LED strips embedded in the pavement of the pedestrian crosswalk start blinking, and the speakers overhead start their sing-song beeping. Two senior citizens whirr up behind us on their personal mobility chairs. The scooters sense that they are not in a dedicated mobility lane, and so have a low bell sound alerting us that they are behind us.

The group of vehicles stopped at the intersection includes both automated vehicles tied into the centralized traffic control system as well as several legacy vehicles driven the old-fashioned way. While we're crossing, one driver approaches the intersection. I can see this vehicle has no automated controls, since it isn't slowed down enough to stop. The driver, on a call with his automated stock broker, runs the light, nearly hitting the group. The driver's phone buzzes with an automatic citation. While the driver looks at the citation, his phone buzzes again as he has been notified by his insurance

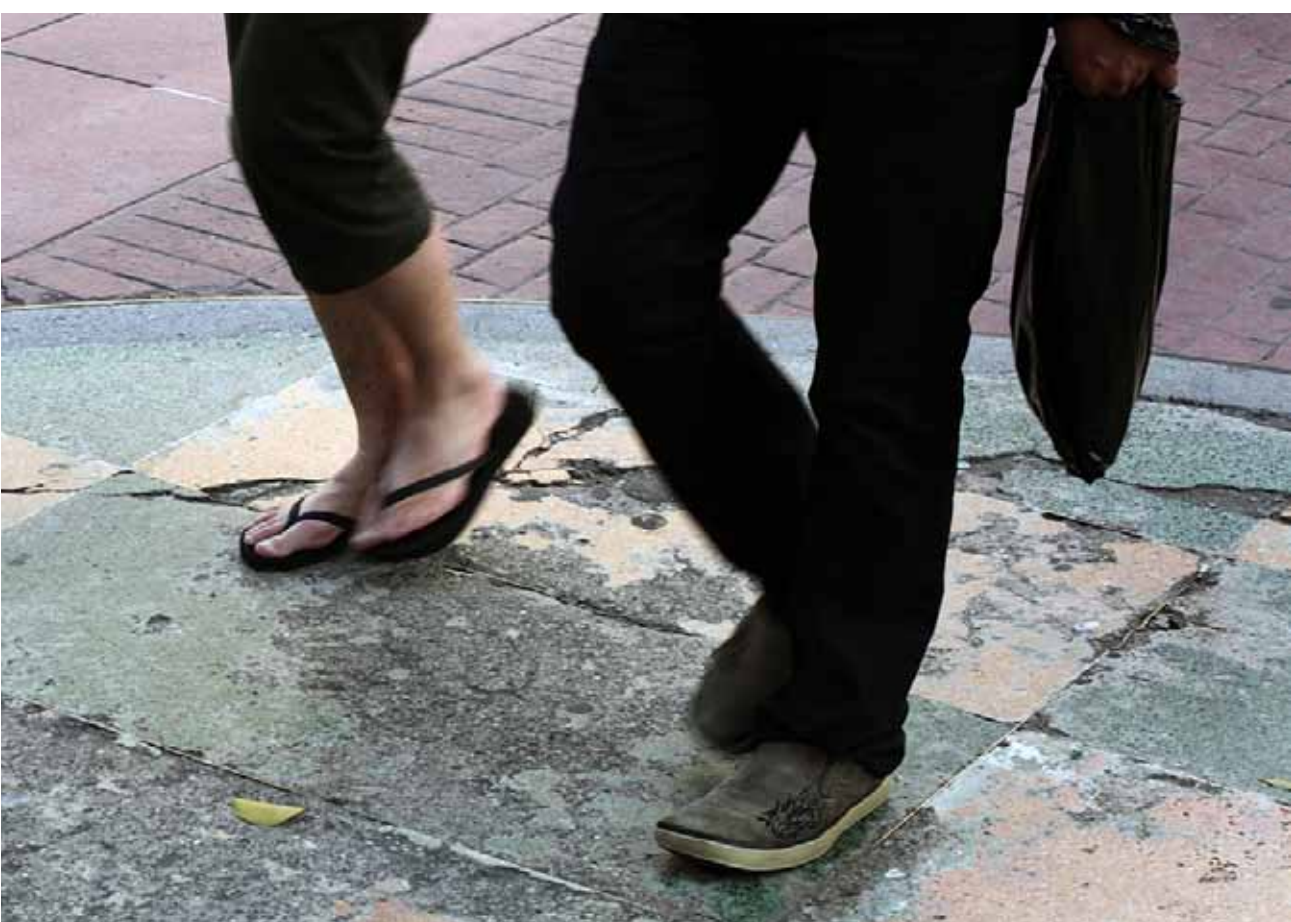
company of an immediate rate increase. It might be time for him to invest in a new 2026 Toyota with automatic control systems since this is the third ticket he has gotten in the last 2 years for similar situations.

SOUTH LOS ANGELES IN 2025

I am a 25 year old clerical worker, at Broadway and Vernon Avenue just south of downtown Los Angeles. I am trying to reach my ultimate destination in the huge job center in West Los Angeles that has far eclipsed all of the employment opportunities of the old and very outmoded downtown area.

I will catch a northbound bus along Broadway, and then catch the extended Metro Purple subway line to Beverly Hills, catch another Wilshire bus, and then a jitney that circulates southward. Most people in my area have abandoned active use of their cars. The price of gasoline has increased steadily over the past decade and \$10 per gallon is the norm. Travel is by necessity; discretionary trips are severely curtailed. Extraordinarily high capital costs for rail-based transit infrastructure has shifted public policy emphasis to super articulated rubber-tired vehicles to provide the most cost-effective flexible and demand responsive system. Region-wide parking taxes, and tolls on major arterials serving job centers, intended as a deterrent to passenger vehicle travel, have had the greatest effect in the most economically disadvantaged areas. It hasn't helped that the secondary street network for legacy vehicles with limited intelligence features are





discontinuous and in poor repair. Available freeway onramps for car model years for 2010 and earlier have been limited by CalTrans' aggressive "smart mobility" priority policies.

The ten foot wide sidewalk on Broadway has an uncomfortably crowded feeling. Its level of service is F minus. Fuel costs have spawned a new surge in walking, but I cannot move at a brisk purposeful pace. People and other obstructions combine to make this morning's walking trip an adventure. A large number of elderly people on the sidewalk are on scooters and several people have Honda walk-assisters on their legs. These seem almost as common as eye glasses used to be. Linked by tiny sensors hooked onto ear-lobes, they check balance and create responsive movements by mimicking leg muscle activity. The crowd shares the sidewalk with many wagons, most of them drones that follow behind their owners. The wagons are typically filled with produce or other items to swap. It once seemed inconceivable that we could adapt to fewer cars and less money this way, but life goes on. For example, the new fad is to worry about every ounce of weight that might be, pulled, pushed or carried. Because of the cost, people think twice about moving themselves or any baggage from one place to another. And in advertising, light is the new green.

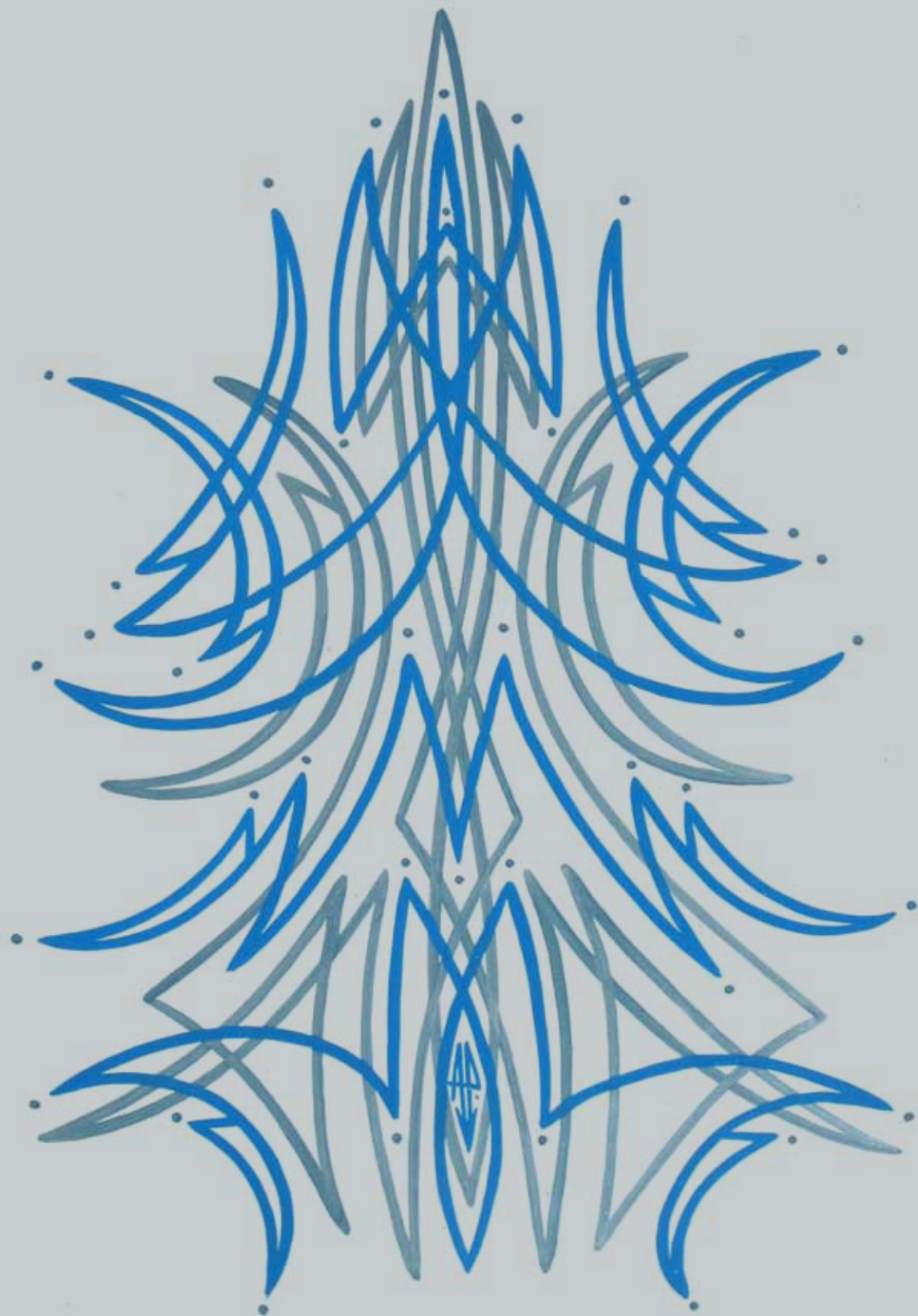
I weave through the bags, wagons and people to reach the corner, but I cannot cross because the long line of articulated

buses has stacked up and backed up. Only the old cameras and light detection systems are in place in this area, so unruly queues of super articulated buses are the norm. Two extend almost the entire distance of a short city block. There is no way to cut in between these monster vehicles. I have to retreat from the cross walk and corner. I look for any sort of gap. It is a risk darting across Broadway. Since vehicle use is down, J-walking enforcement by the police has escalated into a primary public revenue source.

The curb and street are in sorry shape. Lots of potholes. In this part of the city, the little lighter cars, for those lucky enough to have one, just cannot weather the pounding. I decide to make my move. I dart in and out from among the various shapes and sizes of buses and jitneys and converted privateered mini vans. Any newer vehicles are entirely covered by advertising, the ads a standard part of any lease agreement. I am also facing platoons of refitted year 2010 vintage SUVs with outboard suspension systems with huge springs. This primitive horde of vehicles does not seem to show much respect for pedestrians or any type of traffic control rules: Sort of a technological inferiority complex. Lots of cyclists here too, but the unmaintained pavement makes that mode very precarious and unpredictable. You just never know what a cyclist is going to do, or is able to do.

Several of us see our bus. We make a break for it and I try

not to fall prey to a pot hole. I have lots of torn clothing as a memento of prior crossing efforts. When I thrust my pass in front of the bus door sensor a voice responds, "Admit One". I grab the overhead hand-rail and my day begins.







THE CAR IN 2035:

Introduction to CARS section Obis di ulliquia dolorporum dolupta spellabo. Am alitatus, quo et exere exped minctas et autati dessum ut volori sa nonem aut aut et minto cum ari intia volore volenisimus doluptat volluptatur? Officabo. Aliae. Magnias sincidit, commod quam volupta ssimossi nonsequam eius asim qui seque volorum quam fugiat ea ad mos inveles tiossus expeliqui ad que consecus.

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AUTONOMOUS VEHICLES

Geoff Wardle

THIS BOOK IS ALL ABOUT THE FUTURE OF THE CAR but if you live in a metropolis like Los Angeles or San Francisco you must be wondering: How can there be a future for the car?

On the one hand, as noted elsewhere in this book, we believe that for the foreseeable future, California is one of the American states that will not see any huge investments in new transportation infrastructures – there isn't the political will to do so and even if there was, there is certainly not enough money to do so. (The one exception might be a limited hi-speed rail network connecting San Francisco to Southern California but this will perhaps compete more with regional air traffic than it does with road traffic.) This means that we are stuck with the infrastructure we already have – no more roads of significance will be built and anyway, experts in traffic management agree that building more roads does nothing to relieve congestion; it just moves the problem to another neighborhood.

On the other hand, apparently, most of us still prefer to get into our personal cocoon everyday to drive to work than to use public transportation options. Despite significant improvements in bus, subway and commuter rail services in our major Californian metropolises, the door-to-door convenience of using our cars outweighs the mind-numbing, blood-pressure-raising, daily combat of competing against our peers as we inch forward on our urban highways and freeways.

There is however, a knight in shining armor on the horizon that might ride to our rescue: the autonomous vehicle.

For many decades, visions of future transportation have depicted bubble-topped cars

that waft along elevated highways while blasé looking families inside lounge around reading newspapers and playing games. For at least two or three decades quite a few research groups around the world have experimented with various ways of allowing road vehicles to navigate themselves.

In the 1990's, a section of a dedicated part-time HOV lane on a freeway near San Diego was upgraded so prototype autonomous cars could be demonstrated driving by themselves. These self-driving cars were limited in their abilities, relying greatly on expensive enhancements to the roadway itself, but it was a starting point.

These experiments relied upon various combinations of communication with the

The door-to-door convenience of using our cars outweighs the mind-numbing, blood-pressure-raising, daily combat of competing against our peers as we inch forward on our urban highways and freeways.

infrastructure and centralized command systems. The autonomy of the cars relied on embedded technology in the infrastructure. In other words, major investments would be needed to modify the existing infrastructure and to build a universal communication network. With no major investment apparent on the radar and the specter of figuring out who needs to sit around the table to agree upon a universal operating platform for the communication network, autonomous vehicles still look like an implausible concept.

But wait! There is another way of looking at this problem. What if we did not need to modify the existing infrastructure and did not need a universal communications system? What if we just design the vehicles to figure everything out? Then there is no onus upon governments and taxpayers to have to invest in the infrastructural changes. It will be up to the vehicle manufacturers and their supply network to figure out the solutions, which could easily be on open platform systems. Consequently, we do not get stuck with a platform that becomes quickly obsolete.

Between 1987 and 1995 the largest research and development project to date to advance autonomous cars was called the EUREKA Prometheus Project (PROgramme for a European Traffic of Highest Efficiency and Unprecedented Safety). This European project involved universities and car manufacturers from across Europe. A famous participant in this project was Dr. Ernst Dickmanns, of Bundeswehr Universität München. In collaboration with Daimler Benz he succeeded in developing twin robot cars that in 1994, drove autonomously for 1,000 kms at up to 80 mph on normal Paris freeways. In 1995, he then created an S Class Mercedes-Benz that drove by itself at up to 110 mph on a 1,000 mile trip from München to Copenhagen and back.

In the USA, DARPA has challenged the research and academic communities to design vehicles that can find their own way from point A to point B. Google has also been very much in the news recently as it claims to have successfully driven a fleet of vehicles around on public highways without direct human control.

The secret is in enabling the vehicles to recognize their geographic location, understand where their final destination is and how to get there, judge exactly where they are on the road at any point in time, recognize stationary and moving objects

In 2009, the European Commission funded another three-year program (SARTRE) to develop autonomous vehicles on unmodified freeways. In January 2011, successful trials of two vehicles running autonomously and in tandem were completed.

How can this possibly work? Well, the secret is in enabling the vehicles to recognize their geographic location, understand where their final destination is and how to get there, judge exactly where they are on the road at any point in time, recognize stationary and moving objects (trees, barriers, cyclists, parked vehicles, other moving vehicles, pedestrians, stray dogs, etc.) and compute how to navigate around and through this dynamic environment.

To do this, vehicles will need to be able to talk to each other to share real-time information about the changing environment. Effectively, all vehicles within a given proximity will describe to each other their immediate environment so that together a continually updated picture of the local environment is created. From this virtual,

Illustration by Jiha Hwang



real-time environment map, complete with old mattresses, stray dogs and road-work gangs noted, they can then collectively compute the information to allow each individual vehicle to make decisions about its forward trajectory. As each vehicle proceeds, information about the environment it is entering will be shared by preceding and oncoming vehicles – just like columns of foraging ants relaying information about where the food lies ahead. With suitable levels of systems redundancy – as is familiar in the aerospace industry – autonomous road vehicles can be part of a robust system where erroneous contact with another vehicle or object can be a thing of the past.

Any systems or subsystems failure in an airplane can be catastrophic. Therefore, multiple, parallel sub-systems are engineered into an airplane to back up the principal sub-system. In a car for instance, it is a requirement to have a dual braking system.

This means that if any part of the hydraulic braking system suddenly fails due to damage or corrosion, there will be at least a partial secondary system that will allow the vehicle to be brought to a halt safely. On an aircraft there will be at least two back up systems for every function, so even a secondary back-up can fail. This approach to complementing controls systems with duplicates, triplicates or even quadruplicates is referred to as systems redundancy. The number of normally redundant systems that are engineered into a vehicle or machine is dependent upon the calculated risk and consequences of failure. The systems that will allow vehicles to be autonomous are already numerous, which helps reduce the likelihood of failure in the first place. Deliberately engineering in some extra redundant systems can lower the chance of failure to an acceptable level.

We already have many of the technologies well developed and many people are working

furiously on the remaining pieces of the jigsaw puzzle. Indeed, some of the technologies are already part of vehicle features in production and on sale now.

We have GPS systems, which are accurate to within a few feet, for geographic location.

We have dynamic driving control systems that can make decisions about braking or accelerating a car far faster than a driver can compute and command.

We have proximity sensors that alert vehicles and drivers of other vehicles in blind spots or when we are backing up too close to a car behind. These features are described as “accident avoidance systems”.

We have adaptive cruise control, which automatically applies the brakes when the vehicle on cruise mode gets too close to the car in front. We even have cars that can accomplish what many drivers can't, they can parallel park themselves!

What still needs some development is in sensing and monitoring equipment, which will allow a vehicle or group of vehicles to “read” their immediate environment. This will include algorithms to translate visual input to determine the difference between a streetlamp, a parked vehicle, a child running into the road or refrigerator bouncing off the back of a pick-up truck. Several large companies, including automotive companies have been working furiously for some time to develop visual perception technologies.

Also needed are advances in cloud computing – on their way – and computing power, because those algorithms will be big ones! Computing power still obeys Moore's Law somewhat. Recent breakthroughs in British and Japanese universities are set to boost the power of microprocessors quite radically over the next decade, maybe even beating Moore's Law. (footnote)

But hold on! What about taking my freedom away? I want to be in control of my car. Well, maybe we don't have as much control over our current cars as we think. For years many

Maybe we don't have as much control over our current cars as we think

cars, particularly very powerful cars have sub-systems embedded in their central processing units that discretely override the driver's input commands, if the car determines that it is approaching an unstable condition. Instant, rapid application of the brakes on individual wheels or a smooth reduction in throttle opening will occur without the errant driver even realizing. These Electronic Stability Controls are becoming ever more prevalent and the National Highway Traffic Safety Administration's (NHTSA) rule #126 requires ESC to be installed in all passenger cars and light trucks including vans and SUVs for the 2012 model year and beyond.

Gradual extensions of such sub-systems can easily be extended to steering and throttle pedal inputs to avoid hitting another vehicle or exceeding a speed-limit by a dangerous margin. The technologies to do this already exist. Several cars available in the US today feature lane departure warning or even lane departure intervention. These systems warn the driver if they drift out of the lane when the turn indicator is not engaged. Some actually gently nudge the car back into the lane. If you meant to change lanes, but neglected to turn on the turn indicator (none of us would ever do that, would we?), the driver can override the “gentle nudge” and complete the lane change. Other currently available cars have lane change warnings that use radar or cameras to warn if another vehicle is alongside when you turn on the turn indicator for a lane change.

For years, cars have been programmable to set an alarm if a certain speed is exceeded. Currently, Ford offers their “My Key” program that allows parents to program a car that their teen will be driving to limit maximum speed and maximum sound system volume.

The car senses which key (the parent's or the teen's) and sets the preprogrammed limits.

Also in Europe there are already city buses, which steer themselves along certain parts of the route, guided by a video camera and computer that tracks a white line painted along the road. A relatively simple version of what will be needed for the future but it works and passengers apparently don't start screaming when the bus driver takes his or her hands off the steering wheel.

OK, so I can imagine a future world when all cars drive themselves but how do we get from today where there are virtually no autonomous vehicles to a future of only autonomous road vehicles? The intermediate technologies described above are the secret to the changeover. As more and more of these discrete sub-systems become embedded in our cars, in the name of safety or accident avoidance features – just as anti-lock-brakes were introduced 30 years ago – people will become more and more accustomed to the car allowing for errors of driver judgment.

A recent AAA Foundation for Traffic Safety/ Automobile Club of Southern California survey (footnote – year and other info) (Steve??) of Southern California owners of cars equipped with some of the previously mentioned systems (adaptive cruise control, backing aids, adaptive HID headlights, and voice activated navigation) found that the majority would want the system on their next car; became accustomed to the system quickly and found themselves relying on the technology. In fact several respondents had collisions when backing up a different

Gradually, we would reach a tipping point where we would just let the car make all the major decisions.

car that was not equipped with a backing aid because they were used to the system providing warnings in their car. Most people who tried it felt that the technology made their car safer.

Once these systems become robust and trusted by drivers one can imagine that driving without much attention at all would no longer be a disaster. Gradually, we would reach a tipping point where we would just let the car make all the major decisions. At that point, it is probable that most drivers would be quite happy to relinquish total control of the car as they began to appreciate the reduction in stress it yielded. The other realization would be that commuter-driving time could be used for something far more productive like sleeping, reading, or communicating. Having crossed this “tipping point”, things would really start to happen quickly and the truly significant advantages of totally autonomous road vehicles would manifest themselves.

And what are these? We are likely to be stuck with the infrastructure that we already have. Therefore, we need to use that infrastructure much, much more efficiently than we have done thus far. Caltrans, the Californian State agency responsible for transportation infrastructure, believes that we have more than enough roads, highways and freeways for now and the future if only we could stream all the vehicles much more efficiently along the thoroughfares. This means smoothing the traffic flows and moving the vehicles much closer to each other. Take away the erratic human driver, prone to inattention and error of judgment and, worse still, slow reaction times, suddenly the dream of more efficient traffic flow seems realizable. Vehicles that are guided by electrons rather than neurons can travel together in very close proximity because reaction times become effectively instantaneous and always alert.

By 2035, new cars equipped to be totally autonomous and with a level of systems redundancy can be assumed to be so unlikely to crash into another autonomous vehicle that they can be built significantly lighter. This is because they can be devoid of the

The prospect of smooth, high-density streams of renewably energy efficient vehicles, precisely matching the requirements of each individual journey suggests a personal mobility solution that is safer, more energy efficient, more ecologically responsible and certainly more convenient than any transit system.

"Today, the only use for a horse is for sports."
Jim Hall, 2953
Analytics a
Birmingham, Mich.,
automotive market
analysis firm



massive over-engineering that is required today to protect inattentive drivers from the consequences of their lapses. No heavy safety structures, no air bags, no side curtains, no massive bumpers, no side intrusion structures, no telescoping steering columns – indeed no steering columns at all!

A significant issue though is how many legacy cars will be mixing with the autonomous vehicles in 2035? It can be argued that no amount of electronic wizardry can completely protect one from the drunken fool in the legacy non-autonomous Escalade. So in 2035, will autonomous cars still have to be built for collisions with the cars of today? This will depend upon when the “tipping point” occurs. This will be less of a technical issue and much more of a political, economic and social issue. How aggressive will government policy be to fiscally encourage drivers to switch to autonomous vehicles and what incentives will the vehicle providers offer to make people make the switch? Will there be any legacy vehicles left by 2035? It can also be argued that an autonomous vehicle, able to keep out of the way of other autonomous vehicles moving in a dynamic, unpredictable environment will still be able to make an excellent job of trying to miss the errant, human controlled Escalade, being able to calculate instantly the optimal escape route.

Ultimately, cloud computing amongst scores of vehicles will create cooperative flows of

traffic through the infrastructure rather than competitive surges and resultant shock-waves. Indeed, on surface streets, one can anticipate that traffic signals and pedestrian crossings will become redundant. Vehicles will never have to stop until they have to pick up or drop off their occupants. They will perfectly choreograph their way around other vehicles or pedestrians, regardless of the direction of travel.

If you want to see a wonderful model of this constant choreographed traffic flow around randomly moving interruptions – albeit in slow motion – please visit Bangalore or any other major Indian City. Because of decades of skills honed on motorcycles in crowded, narrow streets, the modern Indian car, bus and truck drivers have already developed these choreographed traffic skills. Nobody ever stops – for anything; no anger, no rudeness, no problem if someone drives the wrong way down a street or an errant marketer pushes his barrow of vegetables across the street without looking. The traffic just moves around the perturbation.

So the software algorithms that need to be developed (probably in Bangalore!) will emulate the Indian driver – the resulting electron networks will just be significantly faster than

If you want to see a wonderful model of this constant choreographed traffic flow around randomly moving interruptions – albeit in slow motion – please visit Bangalore or any other major Indian City.

even the finely honed Indian software developer’s neural networks.

Suddenly the future of the car looks much rosier. Indeed, the prospect of smooth, high-density streams of renewably energy efficient vehicles, precisely matching the requirements of each individual journey suggests a personal mobility solution that is safer, more energy efficient, more ecologically responsible and certainly more convenient than any transit system.

Finally, with cars being able to drive themselves, ride on demand and car-sharing schemes can take on whole new dimension, offering the possibility of greatly reducing the number of vehicles that need to exist. Once a journey has been completed a car can go back into immediate circulation to look after someone else’s needs.

Of course, this bright future will depend upon the car industry getting its act together and realizing that it can turn itself from being the industry everyone loves to hate to become the knight in shining armor. Come on Detroit!

THE RIGHT TOOL FOR THE JOB

Geoff Wardle

IF I NEEDED TO DRIVE A SPIKE INTO A RAILROAD TIE,

I would look to my tool-set and select the 20-pound sledgehammer. If instead I needed to nail the framing together for the house that I am building, I would probably settle for a 22 oz. claw hammer. When my house is finished and I decide to hang a few pictures, I will choose a small pin-hammer to pin the picture hooks to the dry wall, so that I do not damage the wall surface, or my thumb! So why, when we drive to work by ourselves or rush down to the local store for a quart of milk, do we so often choose a five seat automobile or even a 7 seat SUV? Are we using the right tool for the job?

LET'S LOOK AT OUR OWN MOBILITY TOOLS ANOTHER WAY.

I weigh 150 pounds. A typical, mid-sized, 5-seat automobile weighs around 3,000 pounds. That means that for every gallon of gas that I buy to move myself around, I buy another 20 gallons to move the car around. If, on the other hand, I choose a large SUV that weighs 6,000 lbs, I am paying for 40 gallons of gas to move the vehicle in addition to every single gallon I buy to move myself. Does this make sense?

It has only made sense in as much as that until recently, we have lived in a culture where the price of gasoline was a modest part of most people's weekly outgoings. We have also assumed that gasoline and other oil-derived fuels are infinite resources. Of course, now we know differently. As significantly large populations around the world find their local economies taking off, their

appetite for mobility, their thirst for fuels and their strategies for making sure that they are assured their rightful share of oil is significantly changing the supply and demand equation of the black gold. Inevitably, like all commodities in an ostensibly free-market, global economy, the cost of gas, diesel and other oil-based materials is going to rise; and rise; and rise.

Many oil industry scientists agree that we have arrived at a point in time called "Peak Oil". Peak oil means that we are now using our known oil reserves around the world, faster than we are discovering new reserves. The new reserves are much more difficult to access as well. In the time frame that concerns us here, global oil consumption might double, and the corresponding price rises will not simply reflect the doubling of demand. The escalating cost of recovering the oil along with increasing scarcity will tend to create an exponentially rising price for gasoline and diesel fuel. Because of the huge rise in the global demand for vehicles, we cannot assume that nuclear power, hydrogen, bio-fuels, battery storage devices

Why, when we drive to work by ourselves or rush down to the local store for a quart of milk, do we so often choose a five seat automobile or even a 7 seat SUV?

or any other replacement energy source will be able to mature or scale fast enough to allow us to relax. Fuels that are predominantly oil-based are likely to remain our main vehicle energy source for the foreseeable future. It is therefore in all of our interests to start getting into the habit of eking out each gallon of gasoline or diesel as best we can, rather than squandering it as we have done, unwittingly perhaps, for the last hundred years. The bottom line? For the next two or three decades, whatever propulsion system we choose for our vehicles, the cost of energy for moving those vehicles is going to be a very significant part of our weekly expenditure. There will likely be times when the availability of gasoline and diesel becomes unreliable, because perturbations in the market place will no longer be buffered by plentiful reserves.

The answer? We will become very, very strategic about when we use vehicles for transport and what sort of vehicle we use for a specific journey. A mild preview of the future can be seen in Europe and the mature Asian economies where deliberately high taxes on gasoline and diesel fuels have popularized smaller, more energy efficient cars. Europeans like the convenience of cars like anyone else. They like fast cars too. However, they forfeit size, weight and inefficiency to maintain their addiction. At the time of writing this, gasoline prices in the US are climbing again towards the \$4 per gallon levels that started to see people adjust their automotive buying habits a few years ago. As prices start to break new records, \$8 per gallon, \$10 per gallon (typical current European cost today), \$12 per gallon and even higher, adjustment will no longer suffice. We will start to look differently at the whole notion of owning and using cars or multiples of cars.

Today, when we choose to purchase a vehicle, we tend to assess all the uses we might possibly want the vehicle to perform, even the uses we might never actually put the vehicle to. For instance we might, for our annual vacation, go camping. So we decide to buy a 4-wheel drive, semi-off-road capable, 5-seat SUV with a powerful, 5-liter multi-cylinder engine, to make sure we have

enough power to scale the mountain tracks. We also feel comfortable that we could, if we needed, tow a U-Haul trailer or make a trip to IKEA to pick up those kitchen cabinets we might buy. Oh, and of course, if "The Big One" does happen, we can be the first to get out of town!

Of course, what the vehicle will primarily be used for is to drop the kids off to school and then to take us those 30 miles across Los Angeles to work – and then back again – alone.

So let's look at another option. At \$8 per gallon, why don't we buy a small, 4-seat car with a 1.8 liter engine that will carry the kids to school and perhaps return 35 mpg on the commute to and from work instead of the 15mpg that the SUV would achieve? When we go to IKEA for those kitchen cabinets, we can get IKEA to deliver them. If we do go camping for the summer, we'll look to rent an SUV or figure out a way of hitching a small camping trailer to the car. It will probably manage to negotiate the mountain roads in reality; just won't be so much fun. Europeans seem to enjoy camping in the Alps just the same, even if they drive a small Fiat with a huge roof-rack!

At \$12 per gallon, 35 mpg sounds pretty poor. Maybe, we should be thinking 70 or 80 mpg? What sort of vehicle would achieve that? Well, how about a small vehicle with one main driving seat and a seat behind that two children or some groceries could squeeze into. The vehicle would be fairly streamlined for aerodynamic efficiency, no wider than it needed to be to give its occupants some side intrusion protection and rather light. Propelled by a small gasoline or diesel engine it would still be able to keep up with freeway traffic and would actually be quite fun to drive as well. With increasing numbers of vehicles being fitted with collision avoidance technologies, mixing with other, larger vehicles would seem less risky. Beyond \$12 per gallon we will be looking at even more radical solutions to small vehicles and quite choosy about when we actually decide to use a vehicle for personal transportation. Perhaps we should own more than one

Vehicle manufacturers are going to look more and more closely at the car-sharing enterprises and realize that instead of relying only on selling increasing quantities of vehicles to make its profits, will need to develop a different relationship with their customers. That relationship might involve providing access to a variety of vehicles on some kind of leasing arrangement. This will make it easier for us to choose the right tool for the job.

vehicle to provide optimal transportation solutions.

Many economic pundits predict that more of us are going to be less affluent than before, so for most of us, owning multiple vehicles for different occasions is not going to be a reality. As you might read elsewhere in this book, many experts are predicting that the trend for parts of Southern California will be for denser urban living conditions. So, not only will we not be able to afford to own several vehicles, we will have no space to store them when we are not using them. Put all these factors together and we can start to see that for the majority of us Southern Californians, we are going to be more discerning about when we decide to drive; we are going to be much more discerning about what we drive; our criteria for choosing our personal vehicle will be very different from today and for many, parking vehicles will be far more challenged by available space, which in turn will mean rising parking costs.

So, of course using small vehicles for our main driving is all well and good. But we will still have friends and family, right? We might still all want to share a vehicle to go off for

the weekend or a camping vacation. So how can we get access to different vehicles when we do need them and yet always have at our disposal the means of mobility that meets our economic parameters?

For the past decade, there has been increasing interest around the nation's cities in car-sharing schemes. Instead of owning a vehicle, one can subscribe to an organization that will provide a vehicle as and when one is needed – even offering different types of vehicles. So far, these car-sharing enterprises have appealed to a relatively small segment of the urban population; a segment that does not use a car daily, does not have any remorse about not owning a shiny car and calculates that the cost of owning a car in a large city is unacceptable.

Meanwhile, a struggling car industry is not going to stand by and watch its business dissolve. It has to reinvent itself; come up with a different business model. Vehicle manufacturers are going to look more and more closely at the car-sharing enterprises and realize that instead of relying only on selling increasing quantities of vehicles to make its profits, will need to develop a

However this works out, we will likely see a greater variety of vehicles on the road in future than we do now.

different relationship with their customers. That relationship might involve providing access to a variety of vehicles on some kind of leasing arrangement. This will make it easier for us to choose the right tool for the job. (colleen – highlight or excerpt)

Leasing cars has been an important part of the vehicle makers' business for many years. Why limit leasing to a single vehicle – why not to a package of vehicles? Perhaps, for a monthly fee, I lease my main vehicle, which could be a one-plus-one commuter car, which would be the vehicle that I drive for 80% of the time. For the remaining 20% of the time, my monthly lease fee gives me so many credits, which cover the use of other vehicles that would be more suited to specific journeys. Obviously, the more I am prepared or able to pay per month will depend upon the number of credits I receive. Further leasing options could even look to providing me with mobility away from home on business or vacation trips. Ultimately, car manufacturers could turn into mobility lease companies, where the building of the hardware is no longer the primary revenue generating activity that it is now. It would still be a significant part of their economic activity but not the endgame. Providing total mobility programs would provide their main revenue and not limited to just their hardware. PSA Peugeot in France is showing signs of moving their business in this direction, offering its car customers options to access other forms of transportation that its subsidiary bicycle and motorcycle divisions produce.

However this works out, we will likely see a greater variety of vehicles on the road in future than we do now. It is likely too, that the new vehicle categories will fill the

obvious gaps in the toolbox that exist today: small vehicles that are optimized for the most frequent journeys that we make – the single-person commute or errand. Some of these small vehicles will be designed to give the user a long range, requiring extra energy storage, whether fuel tanks, bigger batteries or a combination of both. Other small vehicles might be designed for short, local journeys, off the freeways, so that they can save weight with smaller batteries, small motors or engines and correspondingly lighter structures.

The mix of the future fleet is going to rebalance towards more small vehicles and less large vehicles. This trend has definitely been strong in Europe over the last decade, despite rising affluence. It has been driven by common sense: ever-rising fuel prices, less and less spaces to park and more multi-car families needing to park several cars at or near the home. In urban environments, the same pressures will drive the same changes here. This does not mean that fewer journeys will be made that require large vehicles. It just means that the fewer large vehicles in the fleet are going to work harder for their living by being used by multiple users. It also does not mean that we are going to be inundated with nasty little econoboxes that make our journeys miserable. There is every reason to believe that in fact such optimized vehicles will actually be far more exhilarating and personal than the typical car we drag around with us today. Surely an aerobatic plane looks far more enticing than a military transport plane; a sailing dinghy more fun than a coastal freighter.

Next time you climb into your 5-seat automobile or SUV imagine this: every time you decided to eat, 20 or 40 of your friends arrived and asked to be fed too! How would you feel about that?

Of course, the most efficient means of transportation, they say, is a bicycle. No accident then that a typical bicycle weighs 20 pounds, which is less than one-seventh my weight. That's more like it!

IF A CAR WAS AN IPOD

Stuart Macey

EVERYBODY SEAMS TO BE WAITING FOR A SILVER BULLET SOLUTION to the future of transportation. It's important that we get used to the fact that it going to take several of diverse products that t together to solve the complete puzzle. Much like today.

So with these three factors in mind any future solution that hopes to solve the primary issues of pollution and conjection should be seen to be versatile, safe and very cool. It will also need to meet the majority of our "real" every day needs the iCar.



The Hummer H1, Smart Car and mountain bike, transportation solutions for the 90's

Having said that their are only a few key factors that inuence people's decisions to satisfy their transportation needs. The primary driver is freedom. This an essential element in everyones life. But freedom means different things to dierent people. For some it means a 5000 lb SUV that can go any where in all weather , over any terrain carrying 7 people. To others, freedom means not owning a car, free of the cost of ownership and the need to nd a place to park. The rest of us are somewhere in between.

Two additional factors that steer a purchase are image and safety. Its fair to say that the worlds population are more image and safety concious now than ever. These forces will only continue to grow as corporations push harder and harder to convince us that we need to buy thier products. A sad fact of life, whether we want to admit it or not is that we're brainwashed. The media like to call us informed consumers but I think that term is very attering.

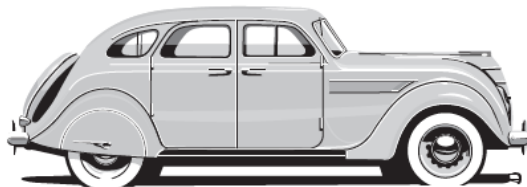
Freedom means different things to different people. For some it means a 5000 lb SUV that can go any where in all weather, over any terrain carrying 7 people. To others, freedom means not owning a car.



The 1958 BMC Mini, born out of the Suez oil crisis took a while to catch on but has influenced hundreds of millions of cars.

So if Steve Jobs applied his gifts to revolutionize the car industry what would we be driving in 2020. What Would Jobs Do? It would certainly be cool and most people would aspire to own one. It would also be very clever and above all revolutionary, something that would change our perspective for ever, much like the Mini did in 1958

Of course designing computers or personal devices is far simpler than cars. The technology industry simply look to the future and forget the baggage from the past. Not so with cars. The infrastructure alone is a major constraint on design ,not to mention legislation, climate and terrain. Add that to the fact that a car is usually the second largest purchase in most peoples life, it takes a lot of confidence to buy one. If the public perception of the car is off by a few degrees, your project will be left without any revenue to pay back the massive investment and there are plenty of examples to prove this.



The 1934 Chrysler Airflow was too radical at the time and almost bankrupted Chrysler. Other companies copied the architecture and were successful one people had warmed to the proportions

So if Steve Jobs applied his gifts to revolutionize the car industry what would we be driving in 2020. What Would Jobs Do?

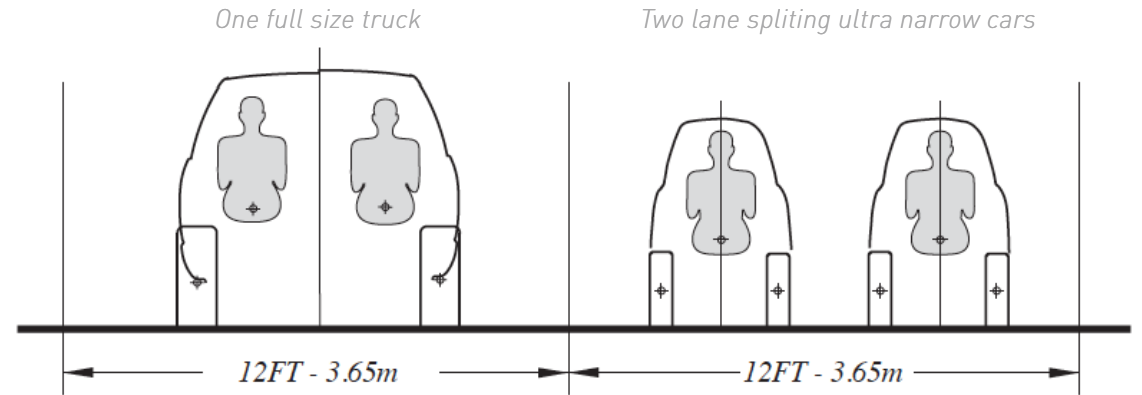
If you look at an iPhone versus a lap top, there are obvious differences but most people can do the majority of their daily tasks on their phone and only need a larger devise when they need to perform specific tasks. The iPhone is designed to fit comfortably in your hand and pocket but provides everything you need for 80% of the time when your away from home or work. No one wants to carry a lap top everywhere.



The iPhone is designed to fit in your pocket giving you the freedom to take it anywhere. The laptop fits on your lap and in a bag. It's portable but inconvenient in many situations. We need a cars that fit everywhere.

If we use the same basic phylosophy and look at statistics, we can quickly focus in on a single seater car, as research has shown that 80% of all journeys are driven with only one occupant. The biggest challenge is getting the masses to buy into driving such a small car. Most people would only consider it if they owned more than one vehicle or had access to cars and trucks that would allow them to live the other 20% of their lives. Percieved safety would also be a barrier, but this could be oset by creating "narrow car" lanes on the

ONE LANE – TWO CARS



freeways. The autosport industry has demonstrated that drivers can survive a very high speed crash in a single seater if the structure is designed correctly. The iPhone is designed to fit in your pocket giving you the freedom to take it anywhere. The laptop fits on your lap and in a bag. It's portable but inconvenient in many situations. We need a cars that fit everywhere.

So folowing the iPhone thinking, an iCar would eiently wrap its self around an occupant friendly spacial envelope and also slot nicely into the evironment with minimal impact.

Most manufactures have looked at downsizing vehicles but few have looked at slicing them in half down the centerline, yet it's a vehicle,s width that causes most problems.

Making them shorter, like the Smart Car doesn't really solve anything. Narrow cars could instanly double the capacity of every road in every city on the planet. It would also solve cronic parking problems that exsits in most metropolitan areas. Anyone who has ridden a motor cycle will be familiar with the imense sense of freedom that one feels, especially when cutting through trac., or parking in a slot between two cars. Unfortunately for most people this is overshadowed by the potential dangers.

Slicing a car in half is not without it's problems and their have been several attempts to accomplish this, most incorporating a complex mechanism that allows the body to lean as if it were on two wheels. One vehicle that takes a dierent approach is the Tango, an ultra narrow vehicle with a width similar to a large motorcycle.



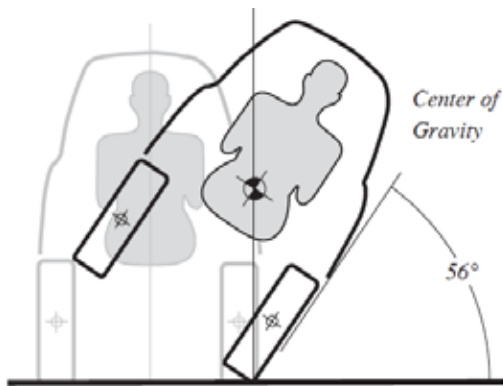
HONDA GOLDWING 2 Seater MotorCycle

Length..... 2615
Width..... 955
Height..... 1495
Wheel Base.... 1690



TANGO 2 Seater Tandem Hatchback

Length..... 2565
Width..... 990
Height..... 1525
Wheel Base... 1830

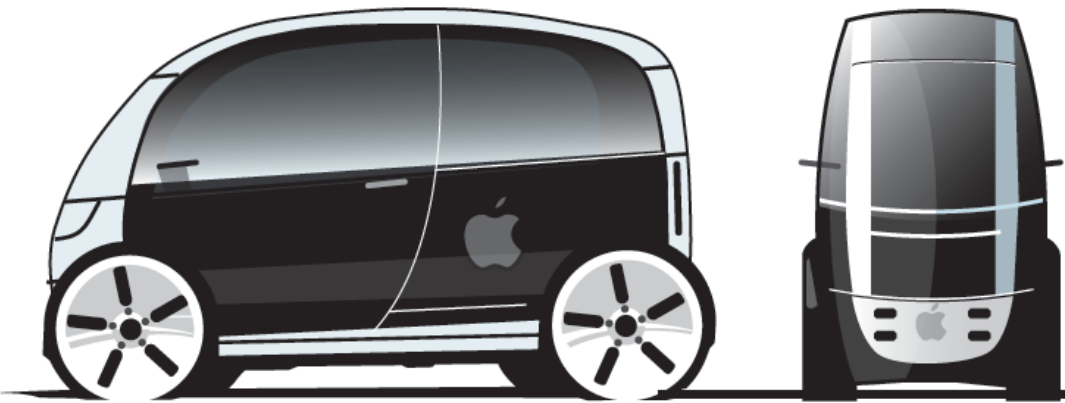


The Tango has the same rollover threshold as a Porsche 911

The architecture of this car is very clever. It basically uses the weight of the batteries, lower body structure and chassis system to prevent it tipping over. It looks infeasible, but it has the same high roll over threshold as a Porsche 911 of 56°, despite its relatively high seating position. The fact that it also accelerates to 60mph in under 4.0 seconds and is capable of over 150 mph is a by-product of its size and electric powertrain.

Passing the “laugh test” can be one of the greatest hurdles for a small car and without being too critical, the Tango needs a little help in this area, but this is just a very interesting design exercise something that Steve Jobs would relish.

So I think if Apple were to make the iCar this is the type of architecture they would choose.



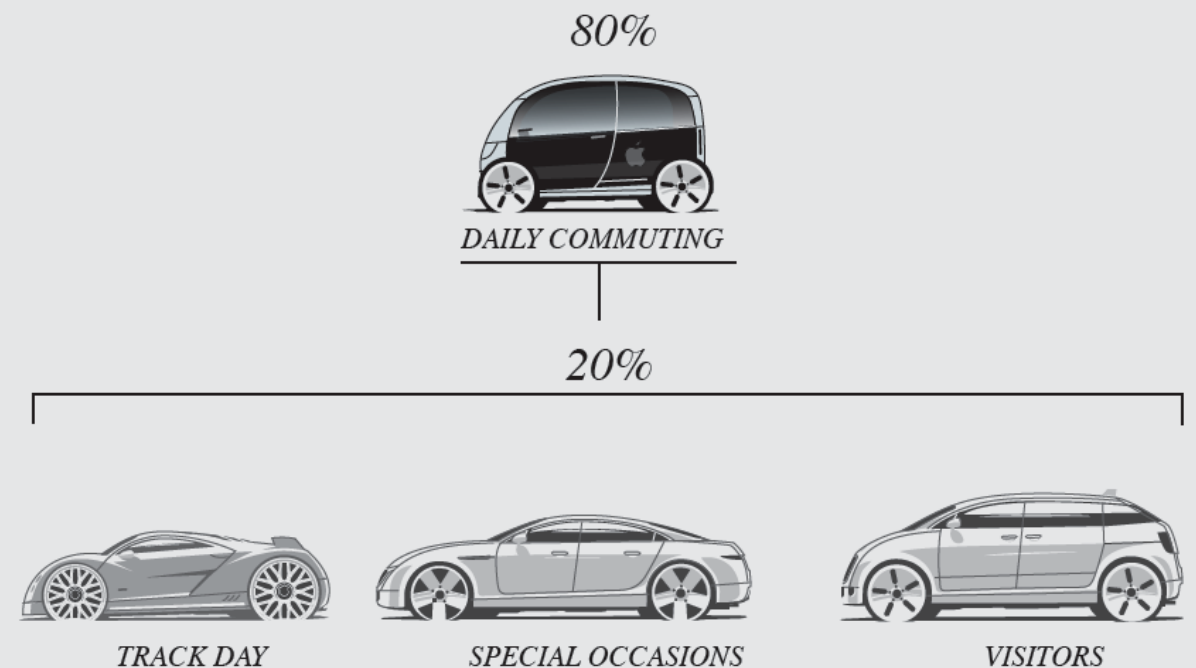
The greatest design challenge for small cars is passing the laugh test

It basically uses the weight of the batteries, lower body structure and chassis system to prevent it tipping over.

It could change the car industry in the same way that the iPod changed the music business. For sure its not “the” solution but definitely a solution, which if it captured the imagination of the masses, will have a dramatic influence on the transportation landscape. Nothing else could come close.

For the iCar to gain acceptance, the customer will need to know that if they want a vehicle to support their lifestyle outside of their daily commute, it will be available. As part of the lease plan, several different types of cars and trucks could be accessible when required. A perfect scenario. Exactly what you need when you need it.

EXACTLY WHAT YOU NEED WHEN YOU NEED IT.



FUELS AND REFUELING

Steven D. Mazor

CALIFORNIA MOTORISTS, like those in the rest of the US, are spoiled. We can go to almost any intersection and buy fuel. Even at \$4 per gallon, this fuel is inexpensive, has a high energy density, and is easy and convenient to dispense. Of course, we are talking about gasoline and for a few motorists, diesel; both are produced from petroleum.

We are constantly told that we need to stop using petroleum-based fuels and switch to alternatives, but why? There are multiple good reasons for this including air quality, global climate change, energy security and the economy. The air is much cleaner today than it was 30 to 40 years ago, mostly due to improvements in passenger vehicle technologies, including fuels. However, achieving true clean air and especially maintaining it despite growth in population, and growth in miles of travel, requires further emission reductions from all sources including passenger vehicles. And transportation is the largest single man-made source of greenhouse gasses (CO₂), and passenger vehicles accounted for 26% of it in 2006. When carbon-based fuels such as gasoline, diesel, natural gas, propane, ethanol, etc. are burned, the exhaust is essentially H₂O and CO₂; so to reduce CO₂ you need to burn less of these fuels either by using low- or non-carbon alternatives or by increasing the efficiency of the vehicle. We also need to insure a reliable supply of affordable energy that is not subject to the events that occur outside our own sphere of influence. This gives an incentive to develop fuels that can be produced locally such as Compressed Natural Gas, ethanol (cellulosic), bio-diesel, electricity, and hydrogen. Using a diverse set of fuels lessens our sensitivity to upheavals such as unrest in the Middle-East, refinery problems in the Mid-West, or storms in the Gulf. And finally, from the consumer's point

We are constantly told that we need to stop using petroleum-based fuels and switch to alternatives, but why?

of view, the main driver for alternative fuels is the economy. People need to be able to afford to go when and where they need and want to go. As fuel prices go up, people will adapt, often in surprising ways, but independent mobility must be maintained.

So taken to account these factors, what will the future hold for us in 2035? What fuels will we be using in our cars and how will we get them?

In 2035 Petroleum-based fuels such as gasoline and diesel will likely still be the major player, accounting for about 60% of the market for passenger vehicles. (colleen -highlight) However, we may not recognize these fuels. California gasoline has been reformulated at least six times since the 1970s and we can expect further refinements, perhaps including an increase in ethanol content from 10% to 15% or more. We would expect diesel to change too, including further reductions in sulfur and increased blending with bio-diesel. It is possible but doubtful that petroleum-based diesel fuel could be banned outright since diesel exhaust has been determined to be a carcinogen.

There will be significant growth in the use

of electricity to power passenger vehicles. Plug-in hybrids (PHEVs) will be common since the California Air Resources Board is introducing a new category for their Zero Emission Vehicle program called Transitional Zero Emission Vehicle (TZEV) that will require significant numbers to be sold (explain). It is likely that some PHEVs will not use gasoline or diesel at all. There have been several demonstrations of vehicles using CNG-powered gas turbines as generators to maintain the charge in a battery pack, similar to the Chevrolet Volt. Zero-emission battery-electric vehicles will make up 5% to 10% of the fleet and the current non-plug-in hybrids, like the Prius, will be extremely common.

(A GRAPHIC WITH THE PROBABLE BREAK-DOWN OF FUEL TYPES IN USE IN 2035? PIE GRAPH?)

Charging for Electric Vehicles (EVs) and Plug-In Hybrids (PHEV's) will be accomplished in a variety of ways. The most common will be home recharging with discounts for charging at night. This may even be automatic. Park your EV/PHEV and at the time the utility company deems "off-peak" and your charger will connect itself, mechanically or inductively, (one would suspect that simple switching would be far more effective, albeit less dramatic, than the vehicle waiting until the anointed time and then physically connecting itself – EN) and recharge the car. Apartment dwellers will have the ability to home-charge with credit card-activated pole-mounted chargers located in the parking lot. Public charging stations offering 240 volt charging will be common and 480 volt fast-charge stations that can recharge from 20% to 80% in a few minutes will be placed at strategic locations. AAA will have trucks with fast-chargers on board to rescue motorists with dead batteries and reduce "range-anxiety".

Since the US and Canada have abundant reserves of natural gas and it burns cleaner than petroleum-based fuels, we expect growth in natural gas-fueled passenger vehicles, despite the fact that today, the Honda Civic GX is the only OEM natural gas-fueled car available.

There will be growth in the current network of Compressed Natural Gas -dedicated refueling stations, but we anticipate Compressed Natural Gas dispensers will appear at traditional fueling stations too. However, home-based refueling is possible and likely in homes pre-plumbed with natural gas. Systems like Honda's current "PHIL" that slowly compresses the low-pressure natural gas feeding your home providing an overnight fill, will be more broadly available. Since the range of Compressed Natural Gas vehicles is greater than Electric Vehicles, it is possible that home-fueled Compressed Natural Gas vehicles will almost never be fueled elsewhere than at home.

We also expect growth in the use of ethanol, both through an increase from 10% to 15% (I like this essay very much overall, but the headwinds against ethanol grow daily, as it almost certainly raises grain and food prices and therefore increases hunger in the food-importing world – EN) in the amount blended into gasoline, and in the growth of the use of E85, which is 85% (E85 cannot really use pipelines, as ethanol is hydroscopic ((attracted to water, including groundwater)), and so is highly unlikely implemented in any volume as it must be trucked everywhere and has a terrible carbon footprint as a result) ethanol blended with gasoline. We don't expect to see 100% ethanol used for performance and safety reasons. Starting a car fueled with 100% ethanol on a cold morning is problematic, but more importantly it burns with an invisible flame, which can be hazardous for emergency responders in the event of a fire. Adding 15% gasoline provides that dramatic orange flame and billowing black smoke familiar to any of us who have watched an action movie. A major advantage of ethanol versus other alternatives is that it can be dispensed as a liquid with similar equipment to that used for gasoline.



Many see hydrogen as a panacea, and they may be partly correct, but many difficulties remain. The appeal of hydrogen is that when used to power a fuel cell, the only exhaust is pure water and thus hydrogen fuel cell-powered cars are the only other currently known zero-emission-vehicles besides Electric Vehicles. Hydrogen used in an internal combustion engine can qualify as a Transitional Zero Emission Vehicle, similar to many plug-in hybrids.

Hydrogen is the most abundant element in the universe (as far as we know so far), but at least here on Earth, it does not exist in pure form in any usable quantity. Instead, it

There will be growth in the current network of Compressed Natural Gas -dedicated refueling stations, but we anticipate Compressed Natural Gas dispensers will appear at traditional fueling stations too.

is chemically bound with other compounds, most notable as the "H" in H₂O or simply water. Thus it takes energy to separate hydrogen from whatever it is bound with. Today, most hydrogen is produced by splitting natural gas, but this leaves a residual of CO₂, the most-common greenhouse gas. But somewhere down the road, we see hydrogen as an energy carrier in a 100%-renewable energy system. How this could this work? Electricity from solar, wind, or other renewable sources could be used to electrolyze hydrogen (one wonders why, if such green juice were readily available, it wouldn't just be used as the primary vehicle energy instead of wasting much of it creating hydrogen to then use to power vehicles? – EN) from water, instead of natural gas, leaving only pure oxygen as a residual. The oxygen can be released into the atmosphere, since when the hydrogen is burned, as in a combustion engine, or used to power a fuel cell, it is combined with exactly the same amount of oxygen producing the same amount of water as you started with. The water goes back into the environment and you restart the cycle. Below, is a picture of a prototype facility located on the campus of California State University Los Angeles that uses a combination of solar- and wind-generated electricity to produce hydrogen from water, then compresses it to 10,000 psi and dispenses it into vehicles. This facility would also have two EV charging stations.

There are also many other methods - some more promising than others - under development to produce hydrogen from water.

These include the use of high temperatures, enzymes, or catalysts.

WHAT WILL THE REFUELING NETWORK BE LIKE?

We anticipate a wider variety of refueling scenarios than are common today. Home refueling will be routinely available for Electric Vehicles and Compressed Natural Gas vehicles. Urban areas will have mega-stations with the complete gamut of refueling capabilities including gasoline, diesel, Compressed Natural Gas, E85, hydrogen, and 480-volt EV fast charging. Other areas will have stand-alone fuel-specific facilities. Automated systems on vehicles will always be able to locate the closest facility with the correct fuel and will even likely know the wait time for access to a charger or fuel dispenser. AAA will provide emergency refueling service similar to their current practice of providing 1 or 2 gallons of gasoline to stranded motorists, except all fuel types will be included. Fleets of vehicles, including government, private and public car-sharing fleets, could have centralized automatic refueling systems specific to the vehicles and technology in their fleet.

The bottom line is that there will be a wider variety of fuel types available and many more ways of refueling our vehicles. During the time frame from 2035 and beyond, the market-place, which is always heavily influenced by regulators, will determine which fuels will grow and which will fade away. Our long term bet is on 100%-renewable hydrogen, but only time will tell for sure.

Home refueling will be routinely available for Electric Vehicles and Compressed Natural Gas vehicles. Urban areas will have mega-stations with the complete gamut of refueling capabilities

FEWER, CHEAPER, LIGHTER THE EVOLUTION: OF VEHICLE MANUFACTURING

Eric Noble

CONTEMPORARY CAR MANUFACTURE is mostly a money-losing operation. This fact alone could ultimately suffice as motivation for the adoption of new vehicle construction techniques. However, tightening safety standards, dramatically increasing fuel efficiency mandates, and consumers' undying desire for ever better products are all leading to improved methods of engineering and building cars. These forces will inevitably have distinctly positive effects on the design and sustainability of future automobiles.

While our primary focus here is the forward evolution of vehicle construction options, it is instructive to frame the current manufacturing business model before moving on to how it can be improved.

Since the 1932 Ford, most cars and light trucks have been made by bending sheet metal into particular shapes (stampings), and then combining (welding) those stampings like puzzle pieces into a whole, encompassing floor, apertures and the paintable exterior surface we see. In the beginning, such body shells sat atop separate frames, but for the last 50 years, most passenger cars have had the frame integrated into the sheet metal body. This form of construction is known variously as body-frame-integral (BFI), monocoque, or unibody and is the dominant car manufacturing process used today worldwide.

Unibody construction requires astounding levels of capital and tooling investments. A typical unibody consists of 300 stamped sheet metal parts, each requiring three to five, two-piece die sets. Even with a carryover floor and some parts sharing, a typical car's new sheet metal requires 400 new dies, not including doors, hood and trunk lid. Die costs often exceed \$150M per program. The stamped components from those dies must then be fixtured (held) and welded together, requiring another \$80-85M in body fabrication tooling. Contemporary stamping presses (push the dies together to shape the sheet metal parts) cost around \$65M each, and the remaining plant equipment to assemble the stamped parts into bodies is another \$600M. This brings the typical unibody construction investment, including tooling and equipment,

It's proper to review the poor business model for current car making, before moving on to how it can be improved.

to over \$800M - and the resultant output is still just bare steel.

The next step in traditional car body building is liquid paint (something nearly all other major industries have discarded in favor of powder) sprayed onto the sheet metal structure. Car factory paint shops are therefore still complex, highly sensitive operations requiring an investment of more than \$250M incremental to the cost of the plant.

Together, automobile unibody stamping, assembly and painting operation expenditures often exceed \$1B, a staggering sunk cost for carmakers and their investors. The magnitude and, indeed, servicing of this investment effectively constrains automotive initiatives to existing factories and construction techniques. As a result, carmakers' new models, however innovative in concept or even powertrain, are condemned from the outset to a flawed business model, essentially unchanged from that of their predecessors. To the extent startup carmakers (and governments underwriting them) also assume conventional vehicle construction, this methodology serves as a barrier to entry in the industry.

The problem today lies in allocating the monumental cost of using these old unibody construction methods. In the past, carmakers counted on such costs being amortized across tremendously high sales volumes per model; investment, as a percentage of total revenue was miniscule. The industry's postwar heyday saw single models of Chevy, Ford and Plymouth selling a million units per year, their makers able to amortize very

large fixed investments in very short periods, even a matter of months. As a result, designs and bodystyles could be updated annually, the tooling cost already recuperated. Today's diverse, competitive marketplace has resulted in an explosion of the number of vehicle models. As a result, high per-vehicle annual volumes are gone, though the production building blocks and methodologies built around them linger on.

The average sales per model in most developed-world vehicle markets has consistently fallen for decades, and with it the profitability of carmakers. In the U.S., average sales per model fell below 60K/yr around the recent turn of the century, and are still dropping – far below the threshold of profitability for unibody construction. The reasons for this decline in annual model volumes can be summarized as more carmakers, making more models, chasing the same number of buyers. Thinning margins from diminishing model volumes have led auto companies, on the expense side, to a nearly manic focus on cost cutting and, on the revenue side, to live in messianic hope of the next “big hit” that will save the day by rapidly paying off its own tooling and then subsidizing the rest of the unprofitable model lineup. When that happens too seldom, they go bankrupt or get subsidized, or both.

While the sort of economic natural selection taught in business schools could rationally be expected to cull the car company herd, nations view automakers as key employers and very seldom allow them to fail. America, Japan, Korea, Europe, Brazil, Russia and China have all rushed to the aid of captive (and prospective!) carmakers on a regular basis and in a myriad of creative ways. Whether such subsidization can – or should -- continue in the face of broader economic issues is increasingly uncertain.

Meanwhile, automakers desperately seek lower costs, consumers fresher designs, and regulators greater efficiency and safety than unibody construction can reliably offer. This leaves all parties potential beneficiaries of moving beyond stamped steel construction.

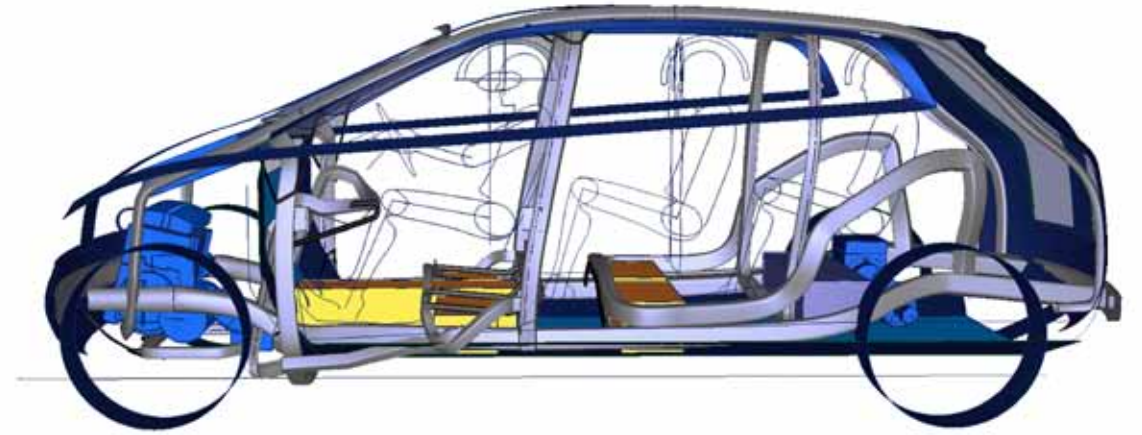
At some point, the confluence of these pressures will force this change to occur.

What, then, will future vehicles be made of? The obvious answer is that material choice will be based upon particular requirements in the vehicle, instead of on servicing the sunk costs of old equipment and methodologies. As the value of capital (and mass) reduction rises, lower density materials will selectively replace steel for the body system, facilitated by advancing methods of producing and forming these materials. How then, will future cars “hold up the paint?”

First, lower density, low cost composite materials (think “fiberglass” not carbon fiber) will replace steel in the car body's “secondary” areas: floor, dash panel, rear package shelf, etc. These “unseen” areas of the vehicle are obvious, initial candidates for composites precisely because such parts are not appearance-critical, and want to be as large as possible – something composites do well.

Next in line for conversion to composites is the vehicle's exterior body. It is hard to overstate the historical difficulty in molding “appearance” panels using composites. Cars' visible surfaces must be very smooth (Class 'A') and defect free. Traditional composite molding processes, such as hand lay-up (think ski boats), resin transfer molding (RTM), structural reaction injection molding (SRIM), etc., have yielded inconsistent surface results and low production throughput, and will, therefore, not be part of the new regime for vehicle construction. Conventional sheet molding compound (SMC), as used on Chevrolet's Corvette, is certainly more rapid, but has historically demonstrated surface degradation in paint ovens, necessitating repeated re-work, and also requires rather high forming pressures. Better methods for replacing stamped steel with composites are required.

A uniquely promising process for creating composite panels fit for automotive exterior use appears as an enhancement of an industrial molding process for fiberglass. In this process, a thickening system makes the



7-seat, hybrid, family vehicle with hydroformed steel space frame. Note very low parts count, excellent load paths, full safety protection, and use of inexpensive, overlapping joints for steel tubes. Composite outer and inner body panels would be attached.

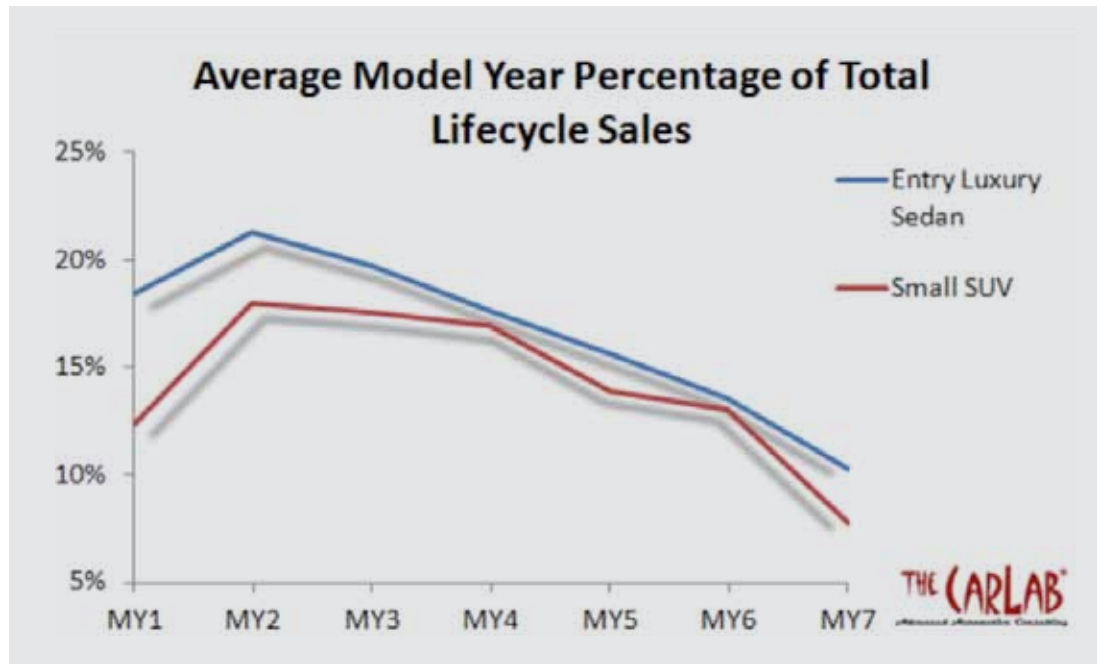
compound used “handleable”, and enables it to mold at very low-pressures, allowing forming tools to be cheaply fabricated rather than machined from expensive billet (as sheet steel stamping dies are), very substantially reducing tool and equipment cost. This process is capable today of producing large, secondary vehicle structure panels to replace sheet metal, and is under development for automotive Class ‘A’ exterior surface requirements. A US company, National Composites, did ground-breaking commercialization work in this material and process, and progress today continues globally.

As composites march toward their takeover of the vehicle body system, great progress in replacing wet paint is also being made. Specific to composites, in-mold paint is being explored, and post-mold powder painting techniques are being rapidly developed. It is likely that the paint booth will be obsolesced at some point not long after the stamping presses are.

If the car body will move to composites, what will the underlying structure be? Here, some observers wrongly assume the answer is also non-metallic. Most vehicle skeletons (the inner frame), however, will remain metal for the foreseeable future, because only metals have the unique combination of stiffness, ductility (crash energy absorption), and relatively low cost required. This metallic, primary structure (rocker/sill, rails,

pillars, etc.) must be composed of hollow members to achieve weight efficiency. As crash performance standards increase (which they will until the dominance of autonomous vehicles begins to eliminate crashes altogether), these frame members will transition to higher strength, tubular (not stamped unibody) steels, with some judicious application of aluminum. Essentially, these are tubular metal space frames akin to those often seen as “roll cages” in race cars, but in volume production using fewer, larger tubes and modern forming processes more easily adapted to increasing safety and crash standards. Such hydroformed (exactly shaped from inside with pressurized fluid), tubular steel frames are already replacing inner, sheet metal stampings in portions of current production vehicles. Total skeletons will come next, and be cloaked in composite skin. (Illustration 1)

So, just how much could so-called “loose panel” composite construction, draped over a steel skeleton, alter the business case for making cars? Preliminary cost studies indicate savings of 25-35% piece cost and 70-80% investment reduction for a composite/steel skeleton assembly, compared with conventional stamped steel unibody. Further, these studies assume a perfectly realistic volume of only 60K/yr for composite/steel while allowing 250K/yr for steel unibody (a best-case scenario for traditional car



Rapidly changing consumer tastes and external environments give models in most vehicle segments a peak-and-die lifecycle.

factories). Once implemented, the new method will clearly outstrip the old one economically.

Beyond the obvious benefit of potentially lower prices, the consumer benefit of dramatically lower vehicle production costs is simple - more change more often. Studies of vehicle acquirer behavior consistently show styling and content tastes change much more frequently than carmakers can debut new models. Proof here lies in the simple fact that fresh new models sell much better than aging ones (Chart 1).

Automakers are today severely handicapped in meeting evolving market demands because they're stuck slogging through what is typically half a decade of production in efforts to pay off each model's hundreds of millions of dollars' unibody investment. Space frame/composite body cars promise to cut that required lifecycle by more than half.

If consumers of unibody vehicles too seldom enjoy new generations of vehicles, so too do engineers and designers. The new fuel systems, better safety, improved efficiency and

fresh aesthetics that car companies painfully need all must wait for the cadence of a full model change. If such model changes can happen at twice the rate, so too can progress in these important areas.

The benefits of moving away from stamped steel construction, however, go far beyond shorter vehicle lifecycles. Weight, the enemy of both performance and fuel efficiency, is dramatically lowered by moving to composite panels and steel space frame assembly. Calculations have shown that a typical, 7-seat family vehicle can, conservatively, shed more than 10% of its mass by moving to such construction. In the face of what has been, and will likely remain, the creeping obesity of cars (Chart 2), this is a serious weight reduction, and one with very positive implications on sustainability. Counting on consumers to wake up and realize the cars they demand are far larger than they need is fantasy; meeting people where they are, with big, affordable vehicles that are simply lighter is pragmatic. And possible.

In all facets of society, technology has enabled "better, faster, cheaper" products

across a wide range of uses. Meanwhile, the car industry has been consumed trying to force fit the ancient, stamped steel, "1M/yr Impala" operating model to the new reality of 50K/yr per model - a 95% reduction. The business and operating models do not scale to that degree, meaning 10K/yr Nissan Leafs, Chevrolet Volts and other potentially revolutionary vehicles will continue to be financially hamstrung (or moribund) by unibody construction.

Newer, reduced scale processes, utilizing contemporary composite molding technology and the recognized advantages of metal space frames, are capable of transforming the auto industry. Ironically, the speed of this transformation will be tempered by carmakers' (and governments') ongoing obligation to serve capital investments in the old machinery and equipment.

IS AN ENVIRONMENTALLY NEUTRAL CAR POSSIBLE?

John Thackara

Posted 11.15.10 on Design Observer



THE FUTURE OF THE CAR HAS BEEN ELECTRIC

for what? Five years now? Ten? The answer is 110 years, for it was back in 1899 that La Jamais Contente (The Never Satisfied) became the first vehicle to go over 100 km/h (62 mph) at Achères, near Paris.

Since then, as we produced hundreds of millions non-electric cars — and despoiled the biosphere in the process — all manner of non-petrol cars, including electric ones, have come and gone. Tesla in the the US and Norway's Think are just the latest in a long line of newcomers.

They, too, will fail to break the grip of the gas guzzler for one reason: they do not challenge the production system and business model of an incumbent global industry that is so mature that it can only make incremental changes as new pressures arise. Electric cars such as Tesla fall into this category: they are an incremental improvement, not a replacement for an ecocidal global industry.

This writer has long been sceptical that small private vehicles would have an important role to play in a sustainable mobility mix.

The company's founder, Hugo Spowers, explained that every aspect of the company's operation is based on whole system design.

But Riversimple has made me pause for thought.

At a presentation in Leicester, UK, in October 2010, where a deal has been struck with the City Council for 30 vehicles to be piloted there in 2012, we were told that the formal purpose of this new start-up is "to build and operate cars for independent use whilst systematically pursuing elimination of the



environmental damage caused by personal transport.”

Not reduce but * eliminate* environmental damage? How could that be possible?

The company’s founder, Hugo Spowers, explained that every aspect of the company’s operation — not just its vehicle technology — is based on whole system design. It has evolved from a linear resource-consuming model, in which natural capital resources are not replenished, to a cyclical system in which waste streams provide all material inputs, and all loops are closed.

The car itself has five novel features: a composite body, four electric motors, no gearbox or transmission, regenerative braking, and power provided by hydrogen fuel cells. Its Network Electric Platform has been so designed that if there are breakthroughs in other power sources, these can easily be incorporated later on. The vehicle is decoupled from a single power platform or refueling infrastructure.

The way the system has been designed, it is in everyone’s interest to keep cars on the road as long as possible.

But Riversimple’s technology is just the start. It’s cars will not be sold outright. Customers will buy mobility as a service rather than a car as a product. There will be no maximum or minimum mileage allowance and critically, it is a fully bundled service covering all costs such as road tax, vehicle maintenance, insurance and fuel, with no surprises to the customer.

The way the system has been designed, it is in everyone’s interest to keep cars on the road as long as possible. Riversimple will be the first car manufacturer for whom success will not mean persuading you to buy a new one every three years.

Customers will interact with Riversimple and its user community through a personalized digital interface accessed from the car, on their computer or via their mobile phone. They will be able to manage their account, request maintenance, ask questions, locate the nearest refueling station and so on.

To ensure that energy and resource efficiency remain at the heart of everything the company does, lower environmental impact is financially rewarded.

A sale of a service model is therefore pushed upstream into the supply chain. The supplier of the hydrogen fuel cell, for example, is likely to remain its owner. Manufacturer and supplier thereby have a shared interest in the longevity and reliability of the vehicle, and of the system as a whole.

Riversimple’s production model, too, is distributed. Its carbon composite bodies allow profitable manufacturing with plants producing 3-5,000 units each year. This regional distribution of production will enable the delivery of improved service for regional markets at reduced cost. (The company is in early stage discussions with other regions across the world to roll out this strategy through joint venture partnerships for local manufacturing facilities.)

The next consideration is service. An urban car is effectively tethered to its home city, so the critical scale for establishing a commercial market is that of a city, rather than a nation. Riversimple’s service infrastructure, too, is cellular — city by city.

The surprises continue. Everything in RiverSimple is open source. The company is adopting an open intellectual property model, based on that used in open source software. The design of this and future vehicles will be shared, thereby allowing anyone to collaborate in the design and build of the cars under an open source license.

Riversimple, as one producer among many, believes this will be a fast route to replacing the internal combustion engine.

The aim is to maximize design input from passionate experts at low cost. It is therefore also licensing its technology to the

open-source foundation 40 Fires. Riversimple wants people to contribute to the design in the same way computer programmers help build Unix.

The company is owned by six “custodial bodies.” Among these is Environment — on an equal footing with investors and commercial partners. Checks and balances are built into the system through the appointment of a Stewards body, who are responsible for auditing and monitoring the governance.

The structure and responsibilities of conventional corporations create a confrontational dynamic with most stakeholders. Therefore shared ownership is another key feature of the Riversimple system. Its ownership model is inspired by long-standing and successful businesses such as VISA International, John Lewis Partnership and Mondragon. All stakeholders have a formal role in the organization, to all parties’ benefit.

Is RiverSimple another design-studio concept? Hardly: The family of Ernst Piëch, part of the dynasty who founded Porsche, is the current major investor.

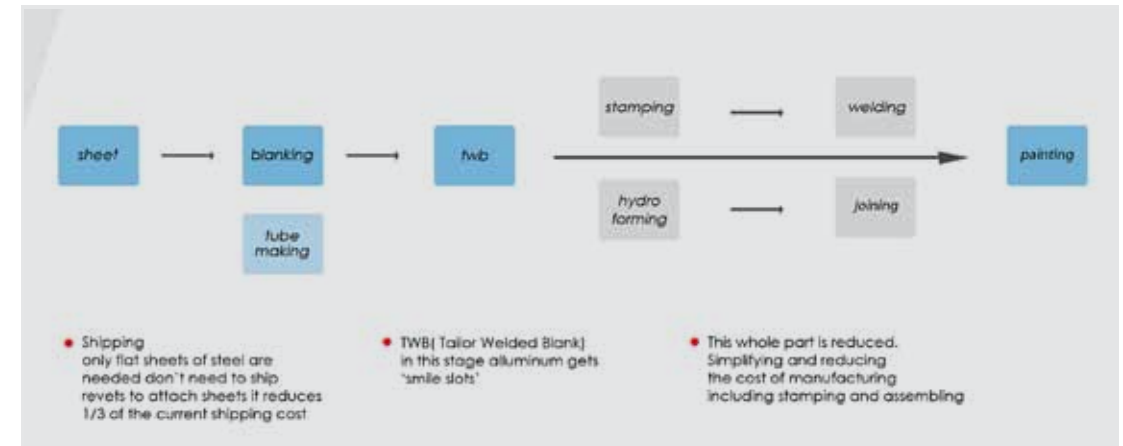
Oh, you wanted to see the car? Here it is:



ORIGAMI MODEL T

Sang-eun Lee

INDUSTRIAL ORIGAMI MANUFACTURING PROCESS



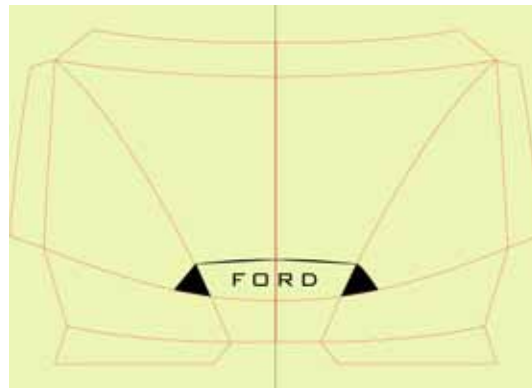
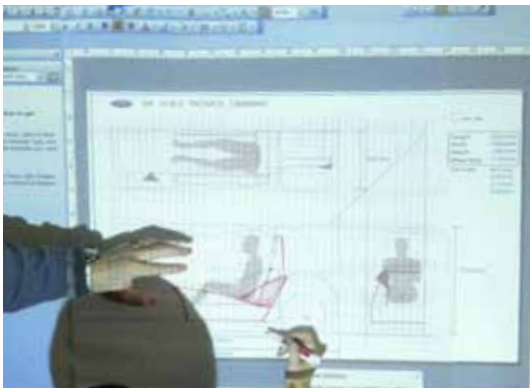
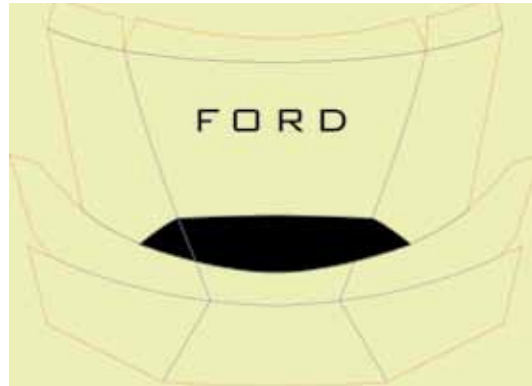
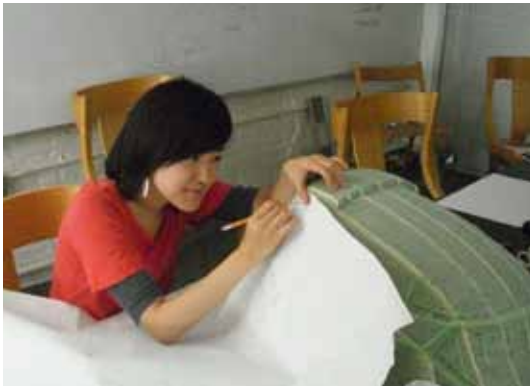
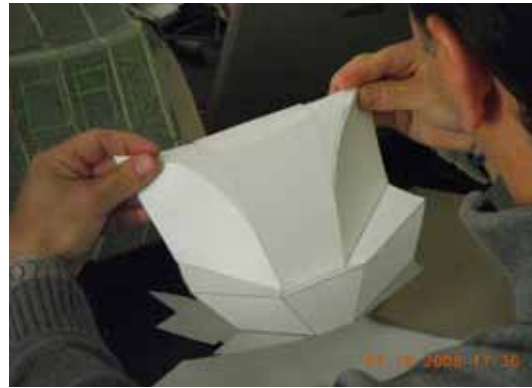
2008 WAS THE YEAR THAT FORD HAD 100TH YEARS ANNIVERSARY OF MODEL T

which was built in 1908 for the first time. Hence, Ford sponsored us a project for designing a car under \$7000 by having an innovative manufacturing process, in order to appeal mass population as if Model T did 100 years ago.

At the beginning of the course, I came up with the idea of ORIGAMI theory which can create a volume by folding a sheet of paper that is very cost-efficient and environmentally friendly. I started to research about ORIGAMI inspired products and I found Industrial Origami company, which is a company builds products by folding metal sheets. I contacted them and started working together to make an Origami Model T.

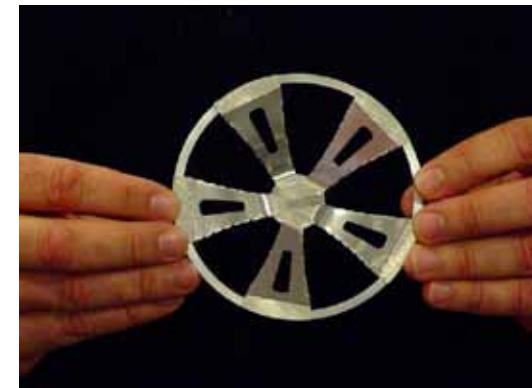
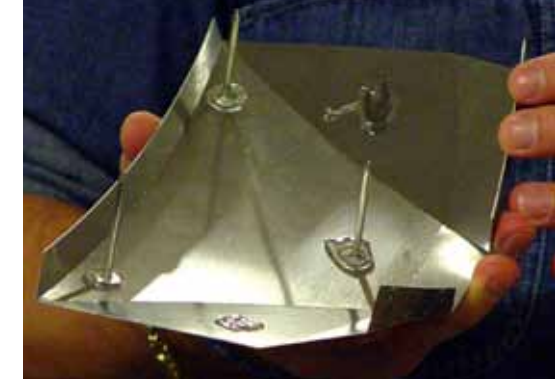
We worked out very successfully through the course and the final model was selected as one of 6 finalists for this Ford sponsored project.





1. Patch papers on the mock-up to see how the surface would fold
2. Tailor paper to the foam mock-up
3. Design a chassis that suits the origami car body

4. Study paper folding on the front face design
5. Keep refining front-face and side folding to match the corner lines
6. Front-face and rear-end illustrator templates. These templates make the origami steel car possible.



7. Completed paper mock-up
8. Very first stainless steel side panel
9. Origami folded wheel

10. The completed 5 panels are attached to each side
11. Attached each panel to the foam mockup with glue
12. Made 2 small holes on the corner of each piece and stitched the pieces with wires to complete stainless steel origami car body!

A person wearing a blue long-sleeved shirt is working on a car engine. They are using a wrench to tighten a bolt on a metal component. The scene is dimly lit, with a bright light source on the left creating a strong highlight on the person's shirt and the engine parts. The background is dark and out of focus, showing more of the engine bay.

PROBLEM SOLVING



WE MODIFY MITSUBISHIS FOR A TYPE OF RACE CALLED TIME ATTACK.

It started in Japan and is one of the most popular forms of motorsport in the world. It's not a wheel-to-wheel race; it's who can drive the fastest lap while maintaining traction. There are a number of things we are trying to balance, and it's really about experimenting, seeing what works and going back and adjusting in order to maximize horsepower, minimize weight and maintain safety. We work on shaving weight: we want to make the car as light as possible, and we're also balancing the weight corner to corner so we move around the shocks and we weigh each corner. The most important thing is getting the weight even from front to back, and second most important, from side to side. The bigger the tires the better, but they have to be appropriate to the car. The width of the car also has to stay within a certain dimension. We also move the ECU – the electronic engine control unit – because it has to stay cool and high enough in the car that it is never submerged in water. The electronic control unit is the key to giving you more horsepower so we add piggybacks to the ECU in order to override the manufacturer's parameters. If you can reflash the existing

It's really about experimenting, seeing what works and going back and adjusting in order to maximize horsepower, minimize weight and maintain safety.

ECU you can have everything you desire, and there are a couple of ways to do this: One is to remove the ECU completely and entirely replace it with another engine management system. In a racecar, that lets you do more, but it's more complicated to do and not as bulletproof as adding onto a commercially made control unit. Two of our cars have a new custom made engine management system, and the other one has a piggybacked system. We also add a computerized accelerator – a launch control.

TUNING

We also modify a lot of different cars that are not necessarily for racing, but just because people want more horsepower from their cars and improved performance. As for the future, performance will always be a big deal. We talk to a lot of young people in the 20-30 age group, and as always, there are those guys who want to drive fast cars. It's an expression of manhood and machismo, and you can look backwards to the 50's and the hotrod craze on up from there to the street racers. And you can see from the past that there's an age group that is always going to be compelled to buy the cheapest cars available and somehow transform them into something well beyond where they started. Some of the examples of the cars we have out here, they're 150 horsepower cars, and most of these guys are not satisfied until they're double that horsepower, and that would've been true in the 60's, the 70's, 80's and so on. Everybody's expectation is to take a \$13,000 car – kind of bottom of the rung, from any manufacturer – and somehow make that into a giant-killer. But we also have guys that are 40 or 50 who'll buy a car for practical reasons, but they're not pleased with the pep and the pickup. They ask what we can do to improve the performance aspect of the car. They're not interested in the looks of the car as much as getting more from the engine, and because of that, they spend money on it.

Some manufacturers design and build their cars to be tuned more than others. Mitsubishi, for example, has a racing heritage. They have a halo product that they rest all of their laurels on: an Evo. Then they build a whole line of cars underneath that at varying price levels. You have an Evo up here, then you have a Rally Art: still turbo charged but with less performance. Then they have their 2.4 liter Lancer GTS which is at another

point all the way down five or six rungs of the ladder but they're all the same body and that's great for us because guys who can only afford the bottom tier are still aspiring for it to perform better. The halo car is a big deal in those lines. Not like with say, Nissan. They have a lot of great cars but they're all kind of random. There's not much rhyme or reason to it. For example they have a 370Z. It has its own body; it's own everything. Then they have an Altima which is over here, then they have a GTR, which is an incredible super-car – it's way over there. They have SUV's; they have a Cube: Talk about just randomly filling niches, and that's worked for Nissan, but you can't take a Cube and make that into a 370Z.

ECU's

The biggest trend I've seen is that ECU's and computers are more and more difficult to change. They're limiting what you can get away with. Even over the last four or five years there's been some significant changes in the operating language: There was OBD1, and OBD 2 and CanBus and all of these things. The industry changes the operating languages all together. They have some kind of an agreement where within a year or two they'll elect to change to the next language and those standards make it more and more difficult. It's the State of California forces a standards committee, SAE, to do it. That's causing some difficulty in being able to extract the most power. But there's always a computer geek lurking in the wings. They don't even have to be in the industry. It's just a little bit of time before that system's hacked into. First it's hacked into enough to be able to read it and see all of the parameters, and shortly thereafter somebody's able to write to it. There's a lot of brilliant people around – they could be working for Boeing or anyone but they're intent on helping their little

community of say, Subaru guys, who want to manipulate things. Every iteration that comes out, someone manages to overcome it. We find them on forums. They all raise their hand and they want to become a folk hero in that community.

TRANSMISSIONS

Another thing that's been problematic is the transmission changes of the last few years, going to CVT's (continuously variable transmission) and things like that. Transmission has become a limiting factor because they are designed to take just enough of the power that the manufacturer has assigned to the engine. And so that's become a problem for us, and it's become a problem for a lot of people. We can make the car twice as powerful in a manual version of the car, but if it has a CVT, it does not allow for that extra torque to be utilized. It'll start by throwing warnings at you and if you choose to ignore those warnings or bypass them with electronic gadgets you put in there, then they will eat up the chain or the belt and so the transmission's done. Most of the enthusiasts are like: "why did they come out with this transmission?". In Mitsubishi's, eight out of ten have a CVT while only 20% are manual. They always offer a manual version because they know the pure enthusiasts will gravitate towards that. Their way of looking at it is the CVT will sell to the masses and the enthusiasts will get the few manuals. Although with the newer manual, there is an added plus for us because there aren't enough in the right packages for people, so people come to us for modifications. And there again is another big trend. We know the advantages of the CVT: the mileage, the smoothness when it shifts. It appeals a broad audience. But all the operating environments are going to some variation of automatic transmission. Even a Ferrari, for God's sake, doesn't have a clutch pedal anymore. So you go from that to a Fiesta, which they call a six speed automatic, but it's just basically supposed to shift itself. Ten years ago the manual was cheaper. They're still pretending you should pay a premium for an automatic, but in reality, a manual is rarer and is the higher

On the other hand the new transmissions are allowing the big improvements in gas mileage to take place.

performance version. But on the other hand the new transmissions are allowing the big improvements in gas mileage to take place. There are some mandates now for 35.5 miles per gallon in a fleet by 2016, and 35.5 is a lot.

AUTOMATED DRIVING

Cars mean a lot more to enthusiasts than people think and when you say technology is helping you control it, that's fine. You can assist me with breaking and steering, and I will accept it. But if you're taking my free choice away, I don't want it. Say for example a racecar comes with ABS and it doesn't respond in the most efficient way possible, we pull the fuse out. But we keep the fuse with us because if we have a race and it's raining, and we think the ABS will help us go faster, we put the fuse back in. Same thing with traction control or anything else. First thing we do is turn off traction control because with these kinds of cars, traction control will cut in such a way that way too much time lapses in between. But if I was in a rain race, I would put up with that because the speed would actually be enhanced. Take away free choice, there's where enthusiasts are done; we're out. They're going to be driving old stuff if they can, or they're going to find ways to turn all that stuff off. I would assume that as automation technology emerges, there's going to be premium charge for that stuff, as in "The Mercedes knew the truck stopped" -good for them, but for the enthusiast, any chance to undo that or remove that will be taken advantage of. There's a lot of satisfaction to driving a vehicle that has some performance to it. Just the exhaust note alone is something that motivates people. We spend time on some of

that stuff. We even listen to the exhaust notes on this road out here that's wide open. It does have an impact. There's still a horsepower war. If you're going to take away my ability to drive, why entice me with 500 horsepower?

One of the most technologically advanced cars in the area of ECU's is the Nissan GTR. Nissan had originally put something in there where you could not get all the performance out of the car until the GPS told them you were at the track. By people complaining, they made Nissan repeal that. They felt like they were told I bought an \$80,000 highest performance and you guys have Big Brother-ed me into using it in sanctioned place via GPS. People still see cars as a source of freedom and when you start taking that away, put my money in public transportation. I will continue to tinker on my own car. With the manufacturers, there's the warranty side, but the PR and marketing side of the company's know that people want the ability to personalize their cars. A lot of the time I get cars for free it's because I get an email saying hey, if you can build a turbo kit for this car, I'll buy it, but otherwise I won't. And then when I answer, I don't blind-copy the car company -I copy them! I go: here. They use the email with their upper managers to demonstrate what's going on. And we're doing research for them, informally.

There's the Big Brother factor, where they can track you wherever you are. For instance if you have OnStar, it calls a satellite every five minutes.

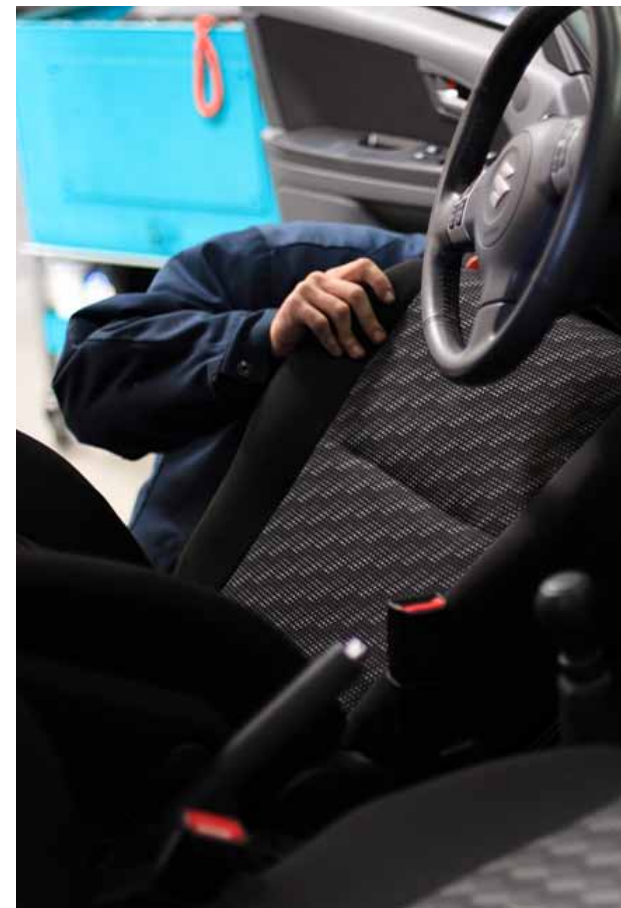
STEVE MAZOR: *The way they plan to market automated controls is that there'll be diamond lanes for cars them. Until you're on a freeway, you're driving your car. Once you're on the freeway you can drive in bumper to bumper traffic, or be in a platoon of cars and head to San Diego, be in the diamond lane at 90 miles and hour and read your paper five feet from the car ahead of you and get there in a couple of hours. So you can have the best of both worlds. When you decide to drive that car, you have the choice.*

And that sounds good when I don't want to pay attention to driving. But not all drivers are good drivers, and not everyone knows where they're going, so it's going to be very hard to account for all those things. Until someone figures out all of those things, it's going to be difficult.

TRACK EVENTS

Another phenomenon that's grown a lot is there's a lot more track events. Even the young guys are starting to accept that racing around on public roads is not a good idea, so on any given day there are a lot of track events at local venues where you can go out and run your car in a controlled environment. If I have a 500 horsepower car, I can't drive it to work and utilize it. But with a set of tires for the track, that one car can go out once a week or month. There are more and more of these organizations popping up. But this is growing. A while back there was one called Speed Trail USA, and you could go 150 miles an hour safely. And that might work for someone with a 500 horsepower car. Then there's the Big Brother factor, where they can track you wherever you are. With OnStar, it calls a satellite every five minutes.

STEVE MAZOR: *We're just going to market with a type of telematic device for people who want pay-by-mile insurance, but if they get into a collision, the Auto Club - who they trust - is keeping track of them, so people are flocking to it*



Will is starting work on a Suzuki SX-4 that was shipped from New Jersey to Road/Race Motorsports in California. The owner is paying \$20,000 for having his winter car tuned to become the fastest and most efficient it can be while staying street legal and in compliance of New Jersey's inspections. Road/Race will strip down the inside completely so it just has racecar seats in the front. They will turbo charge the engine and double its horsepower with an engine modification kit they designed specifically for this type of car. The car will be ready to be shipped back to the owner in eight weeks.





This phase of the work is about addressing all the car's systems for safety and performance. Road/Race is installing larger breaks, a roll-bar and increasing chassis rigidity. The car was originally produced with barely 100 horsepower at the wheels but the horsepower of the two-liter engine is doubled by customizing their base turbo charger kit further for this project. Steel floor plates create a smooth surface at the bottom of the car so the driver can position his feet. The last step is using aircraft fastener clips to attach new custom fiberglass body panels, bumpers, side-skirts and a rear diffuser.





Services:



PARK

24-Hour secure bicycle parking for members
Free parking during staffed hours available for non-members



FIX

Tools available for members at no charge.
Non-members pay per hour
Professional mechanic services during regular business hours



PARTS & ACCESSORIES

Lights, locks, tubes, tires and all rider's basic needs
Members receive a 10% discount



FREE AIR



INFORMATION

At our station, we offer bicycle transport and route information



SHOWERS/CHANGING ROOM

Private restroom and showers for members



LOCKERS

Private, day use lockers available



DIRTY BICYCLE REPAIRS
call 562-436-BIKE (413) or visit our website
or stop in during business hours

Bikestation Long Beach
223 E 1st Street





THE STREET IN 2035:

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OPERATORS

by Bill Trimble



WE ALL EXPECT TO ENJOY VEHICLES IN 2035 that are no more than a sketch today. We should also expect that those newly imagined vehicles will share—their riders and occupants will share—space with vehicles that even today seem old. Some people will keep their own old cars, or other people's old cars, when those cars are the cars they can afford or that make a statement. Old cars, operable only with the sentience of their human drivers, will be moving along next to the most advanced vehicles of 2035, vehicles that are sentient themselves and responsive to a sentient infrastructure.

The public space of vehicles, the space of our mobility system, is space we all share. Streets and sidewalks, highways, and transit lines are the public realm we use to get around, at least on the ground. How will we share that space in 2035?

Mobility has changed, of course. It will keep changing. Trolleys and automobiles and bicycles and trucks all came with the promise of easier mobility. Walking was too

slow, the horse too much trouble, at least for most. The streets of downtown Los Angeles in 1900 accommodated every existing option, whether horse-drawn or engine-powered or "active." Vehicles moved at speeds a pedestrian, at least a pedestrian running, could match. Even trucks and trolleys moved slowly enough for someone to jump on. Cyclists moved faster than the walkers, but not so much faster in the crowded street. The average travel speed may have increased to eight miles per hour in 1900, from four miles in 1850, but even in 1900 a pedestrian could keep up by running occasionally. Deaths occurred, but few vehicles moved at speeds that were inherently life-threatening to a pedestrian.

The public space of mobility in 2035 will be as mixed as a Los Angeles street of 1900.

People watched others in the public space in 1900, they do today, and they will in 2035, even when those others are in other vehicles. The way people “move,” their mobility, is a gesture revealing what is going on for them. How they walk, how they drive an automobile or ride a bicycle, how they take a seat on a bus or train—the “gestures” of moving, the many decisions about what people do with themselves on their way somewhere, reveals what they think of those who share their space.

The gestures may be exuberant, aggressive, timid, competitive, fearful, gracious, angry, distracted, patient. Patient? Some gestures reveal more patience than others. Speed matters. The public space of mobility today must accommodate disabled pedestrians at one mile per hour and motor vehicles capable of sixty miles per hour in four seconds. Encounters can be deadly. Can travelers with so many different priorities share the same public space in 2035?

The mix of people in this public space will change by 2035. The chances of riding or walking next to someone who is past seventy years of age will double by 2035. The chances of encountering people older than eighty will nearly triple. The generation that will dominate the public space of mobility and the workplace as well, the generation between 35 and 55 years of age in 2035, will be the first generation to grow up digital and connected. (Colleen-emphasis)

Patience with the journey may feel different in 2035, if “connectedness” continues to accelerate. Will travellers in the street shift the here-and-now of physical public space to the margins of attention, with instantaneous

Patience may feel different in 2035 if digital connectedness continues to accelerate.

connections to everywhere else becoming the focus? The many generations of 2035 will not be traveling at the same speed, not moving with equal patience.

Travellers in 1900 depended on their own human sentience or, perhaps, on the sentience of a slow-moving animal, to get them where they were going, safely. Vehicle sentience today protects some drivers from collisions. And it guides vehicles that are capable of autonomy, needing a human only as a passenger.

Technological sentience, and the other technologies that must accompany it, may be directed to at least three different roles, each representing a view of what can be expected of the human being in the vehicle, the severity of the risks, and whether the technology can be adopted universally. First, the technology may be used to inform the operator (i.e., provide “situational awareness”), so operation can be more responsive to the situation. Alternatively, it can be used to require proper behavior or to block dangerous behavior, whether with an operator or without. Thirdly, technology can be used to encourage safe behavior by conveying incentives and penalties to the operator, so decisions are more likely to benefit the public.

Every operator misses important information. The driving situation is more complex than the driver recognizes. Blind spots, changes down the road, the mental state or physical condition of the driver of the next vehicle—missing information limits the operator’s awareness and ability to respond. If the operator is attentive, additional information can make the difference between safety and collision. A commitment to technology that informs the operator, that enhances an operator’s own sentience, places the responsibility on the operator, with considerable optimism.

Some are not so optimistic about the operators, or at least about all of the operators, so choose another approach. There are operators today, whether inattentive or willful or inexperienced, with little regard for information that others consider crucial: traffic

The chances of riding or walking next to a person who is over seventy years of age will double by 2035.



The public space of mobility will need to accommodate disabled walkers at one mile per hour and motor vehicles capable of accelerating to sixty miles per hour in four seconds.

signals, the break lights of the next car, street signage, signals indicating trains are coming, speedometers showing excessive speed. If operators cannot be expected to adhere to safe practices, technology may be used to replace them, blocking the possibility of unsafe behavior. Of course, all technology can be hacked. And not all operators will want to operate vehicles that limit their control.

Incentives and penalties make a difference. They are most powerful when they are linked quickly and clearly to a specific action. (Can this be one sentence-kr)? Immediate notification is more powerful than notification days later. Memories offer excuses. No, not all operators will always choose to operate responsibly. But information about an action can quickly result in delivery of a penalty or offer of an incentive, even before the end of the trip—strong encouragement to operate safely. This third option for sentient technology does not control behavior; it gives behavior a push.

The public space of mobility in 2035 will be as mixed as a Los Angeles street of 1900. And more. The range of possible speeds and the distribution of physical capabilities will require full attention and active sentience, if the space is to operate safely. In the public space of mobility, how will technology change the role of human attention and sentience?

HOW TO STOP DESIGNING THE TRANSPORTATION SYSTEM OF TOMORROW FOR THE CARS OF YESTERDAY

by Christopher Gray

THERE ARE SIGNIFICANT CHANGES in the field of vehicle design and technology that will introduce a high level of differentiation in automobiles at a scale and form not seen previously in the history of transportation planning and engineering since the introduction of the automobile in the early 20th Century. The main challenge will be how the transportation planning and engineering field adapts to these changes. If the current business-as-usual practices are continued, it is likely that the adoption of new vehicle design and technologies could be limited or slowed because of current practices. However, there are opportunities for changes to occur now which will ensure that these innovations in vehicles are not precluded or limited in the future and we can see their full benefits realized.

Any new paradigms for traffic planning and engineering would evolve from current practices. As transportation planners and engineers, one of our main tasks is designing transportation systems. This design process would remain a long-term and extensive one that incorporates the use of historical trend data, future projections, standardized design requirements, and modeling tools. The three major elements of transportation system development are travel demand modeling, traffic operations analysis and roadway engineering. All of these could be carried out in a way that is more responsive to changes in vehicles.

Travel demand modeling applies demographic projections and data on the transportation system to determine the future roadway needs of a City, County, or larger region. It involves comparing the future projected volumes for a roadway against its capacity in order to identify which roadways need to be widened or extended

(or made narrower. I know this happens but is it ever the direct result of travel demand modeling?-kr). Travel demand modeling is often done far in advance of any transportation improvement project, with lead times of 5-10 years being not uncommon.

Once travel demand forecasts are complete, detailed traffic operations analysis can commence. This analysis considers the roadway characteristics and the travel demand to determine the exact roadway configuration. For example, the traffic operations analysis will determine the length and width of freeway on-ramps and off-ramps or the presence of a traffic signal. This process often occurs subsequent to travel demand modeling and may proceed construction by 3-5 years, or more.

The final step in the process, roadway engineering, employs the data produced by traffic operations analysis to produce construction drawings for any proposed improvements. In many instances, the persons preparing the construction drawings employ standardized design criteria established by reference manuals which ensure a high level of standardization in geographically separate locations. As such, roadways in New York are designed very much like roadways in Texas or California. This process often occurs immediately prior to construction activities with less lead time as compared to the other steps.

Currently, regardless of the location and the scale of analysis, all of these studies assume that the vehicles that the traffic system will accommodate are the same types of vehicles that we have today. However, we are looking at unprecedented changes in vehicles in terms of, first, fuel and power systems, which will have a significant effect on the

All of these studies assume that the vehicles that the traffic system will accommodate are the same types of vehicles that we have today. However, we are looking at unprecedented changes in vehicles in terms of, first, fuel and power systems, which will have a significant effect on the vehicle's performance.

vehicle's performance. Secondly, differences in vehicle size, weight, construction methods, and shape will create a wider variety of vehicles than currently exist today, and thirdly, implementation of vehicle automation systems will create differentiation in vehicle types from what is on the market today. These developments could provide significant benefits in terms of reduced emissions, high roadway speed/capacity through automated control systems, and greater personal mobility choices. However, there are a number of factors inherent in our current transportation planning/engineering paradigm which would likely result in limiting their adoption and making the most of their benefits.

For example, in today's planning and engineering practices, one of the only levels of differentiation between vehicles occurs between light duty vehicles (passenger automobiles and light trucks) and heavier vehicles including buses, delivery trucks, semi-trucks, and other similar vehicles.

The Federal Highway Administration (FHWA) currently has a standard classification system with 13 vehicle types. This system has one category for passenger cars, another category for light trucks (which are defined as pick-up trucks, vans and other similar vehicles), a separate bus category, and nine separate categories for various types of trucks ranging from delivery trucks to multi-axle semi-trailers. This differentiation occurs for two main reasons: First, the emissions profile of these light vehicles and heavy vehicles are very different. Trucks produce much higher levels of emissions on a per mile basis than passenger cars and detailed emissions modeling requires information regarding the mix of vehicles to produce the most refined level of analysis. Second, larger vehicles generally require more space to turn from one roadway to another. To standardize the analysis process, transportation engineers have developed templates for various types of vehicles to verify whether a particularly sized vehicle is able to turn at a corner.

Despite the thirteen categories, the classifications are too reductive in practice and they pervade the entire set of activities related to transportation planning and engineering. For example, travel demand models which are used in the planning for future transportation facilities often track only two categories: light and heavy vehicles. Standardized roadway design manuals devote a significant portion of their length on how best to accommodate larger vehicles. Even the thickness of roadway pavement is determined by flawed estimates of how many large vehicles will be driving on the roadway over its life span. Categories aside, trucks become the limit-case or lowest common denominator, in some cases resulting in overdesign and increased expenses.

A second level of differentiation important to transportation planners today occurs between highway lanes: Those which are toll facilities, requiring payment to travel on, or High-Occupancy Vehicle Lanes (HOV), which are restricted to vehicles with one driver and at least one passenger. A combined facility, known as a High-Occupancy Toll Lane (HOT), allows both HOV vehicles and single-occupant autos to travel on the facility. Nearly all other roadway are classified as mixed-flow roadways. The interstate highway system is a mixed-flow roadway except for selected portions which have HOV lanes.

Currently, there is no physical difference between a vehicle assumed to be travelling on an HOV lane, a toll vehicle, and mixed-flow vehicles. The main differentiation between the lanes is access. For example, HOV lanes are often physically separated from adjacent mixed-flow freeway lanes. Toll roadways are often even more restricted with limited entry and exit points, which are often then locations where toll charges are collected. One recent development is the implementation of electronically collected tolls in which drivers are issued transponders, which are linked to a bank account or a credit card. There are a limited number of toll facilities where access is limited to those vehicles which are equipped with a transponder.

The fact that all types of lanes can accommodate the same vehicles makes it easy for drivers to use freeways, HOV lanes, and toll lanes interchangeably on travel through metropolitan regions. This improves efficiency of the system. However, HOV lanes, toll facilities, and mixed-flow freeways each perform differently in terms of traffic flow and capacity, impacting the results of travel demand models and traffic operations models. Current advances in vehicle design indicate that automated vehicles will perform most efficiently in dedicated lanes where they can drive faster and closer together in a convoy. This is an assumption that should be already built into traffic demand models that segregate dedicated from mixed flow highway lanes. The introduction of autonomous vehicles to the fleet is a realistic and

imminent enough prospect now that the optimized use of autonomous vehicles needs to be included in scenarios and models for traffic demand and operations. And this would come into play especially vividly in the design and analysis of highways with differentiated lanes, skewing current results of travel demand and traffic operations models for highways that have dedicated lanes.

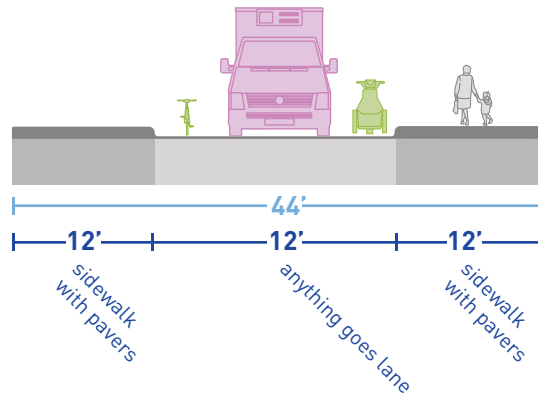
A third factor relevant to transportation planning and design is vehicle restrictions according to types of roadways and surrounding land use. For example, it is not uncommon for cities to restrict travel by large trucks on residential streets. Cities will often identify designated truck routes, which limit trucks to freeways and other major roadways. These restrictions affect the design of a roadway in that a different standard or criteria is applied during the roadway engineering process depending on whether trucks are allowed to travel on that roadway. As an example, it is common to prohibit large trucks on residential streets and allow their usage on major roadways and freeways. Outside of these restrictions, there are few others that limit which vehicles can travel on roadways. (What does this mean? Do we need more quantitative analysis of residential streets, or a different way of assessing the combination of residential and non residential throughout the system?) If we were to anticipate a wider variety of vehicle types, including those which could only cover a small range such as Neighborhood

Currently, there is no physical difference between a vehicle assumed to be travelling on an HOV lane, a toll vehicle, and mixed-flow vehicles.

2035 NEW MASTER PLANNED COMMUNITY

Resulting from changes to number of cars, shaped by global factors

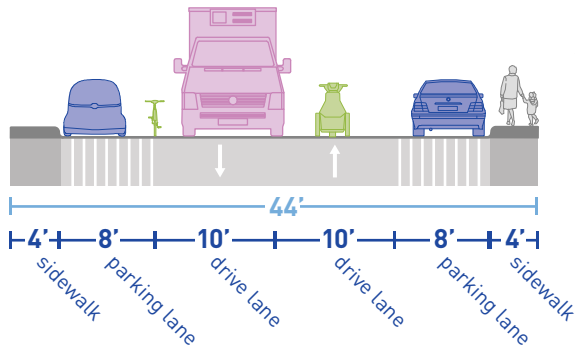
SCENARIO 1: FEWER CARS



Assumption: 1 car per house.
Parking requirement: one car, in driveway.

VMT taxes, tolled roads, scarcity of land, scarcity of fuel, lower standard of living, car sharing, pay as you go insurance, more public transit, increased density, shorter trips, less need to travel for middle class, smaller roads in new developments, wider, colored/textured sidewalks. Parking is not needed as much.

SCENARIO 2: MORE CARS



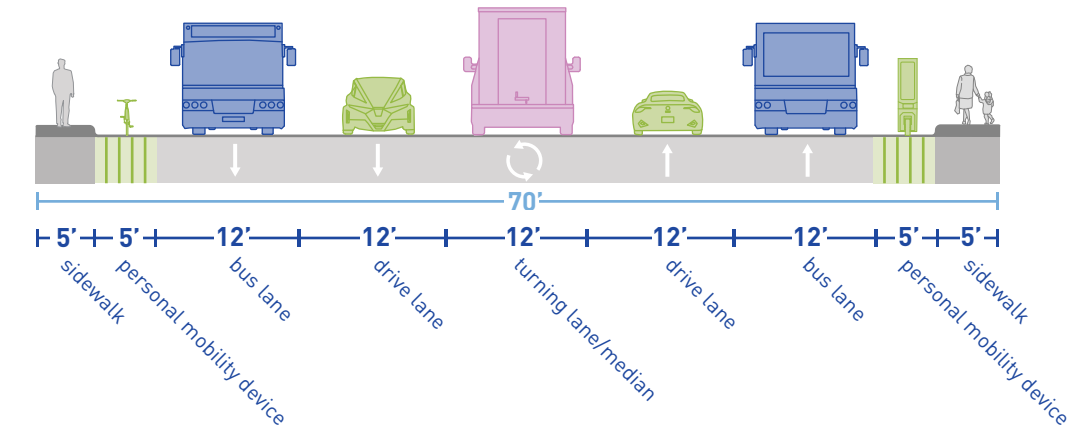
Assumption: 5/6 cars per house.
Parking requirement: one car, in driveway.

More than one family living in some houses, Need for more vehicles because of "right tool for the job", economic resurgence, less expensive cars, Personal Mobility Devices, cars from India and China, advances in how cars are manufactured/marketed, new cheaper fuel types, cars park on street, sidewalks sacrificed to parking.

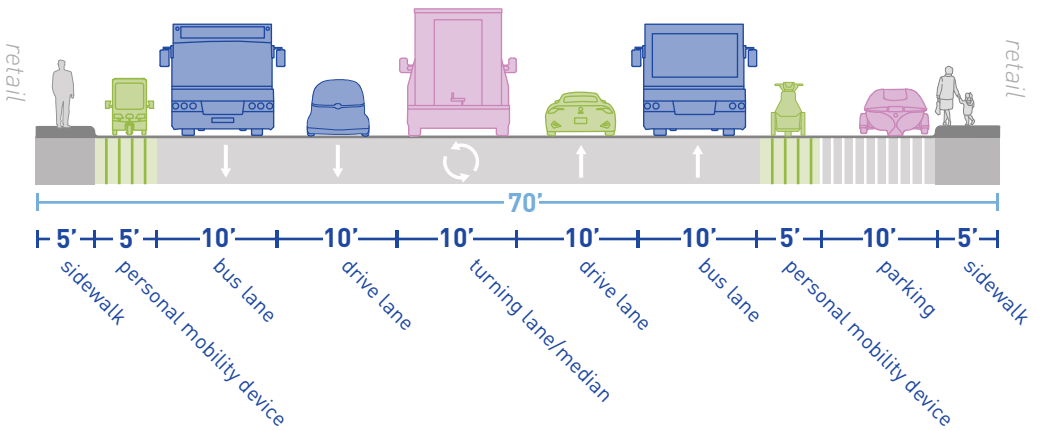
Assumption for both: New master planned community, middle class.
Parking requirement: one car, in driveway.

2035 SUBURBAN ARTERIALS

SCENARIO 1: NOTHING TO SLOW YOU DOWN. NO PARKING NEEDED.



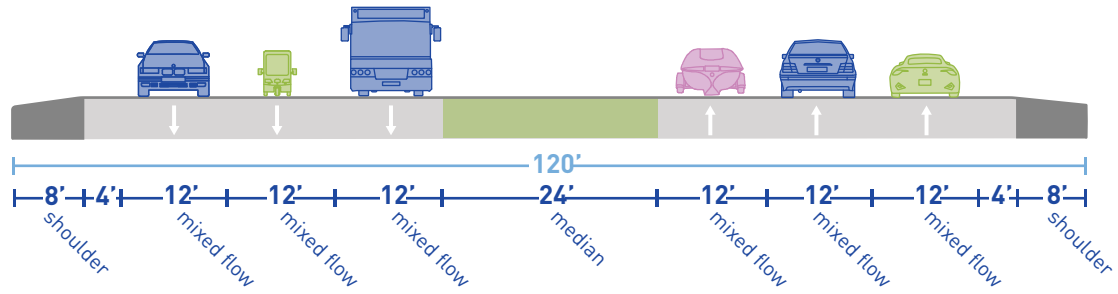
SCENARIO 2: RETAIL ON BOTH SIDES OF STREET PARKING NEEDED



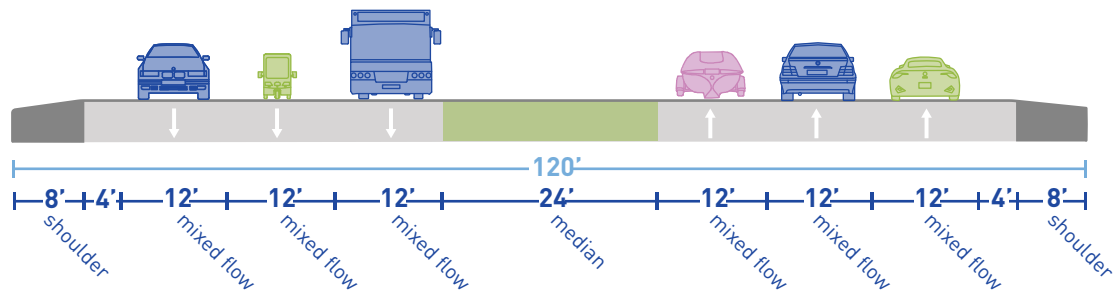
Assumptions: Smaller delivery trucks, vehicles will need to mix, access for delivery trucks will be regulated. Both options allow buses and bikes to comeingle

2035 FREEWAYS

SCENARIO 1: BUSINESS AS USUAL

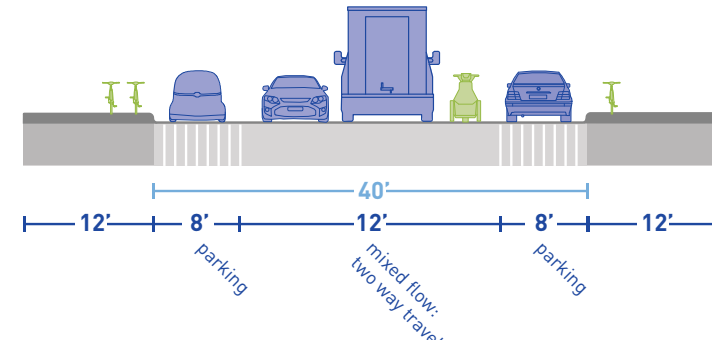


SCENARIO 2: DEDICATED LANES FOR AUTOMATED VEHICLES



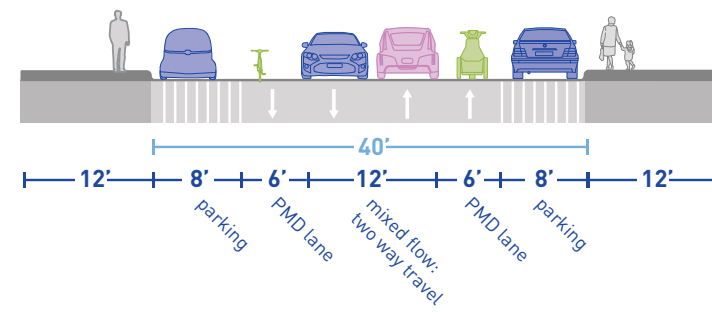
2035 RESIDENTIAL

SCENARIO 1: SIDEWALKS HAVE A MIX OF BIKE/PED.



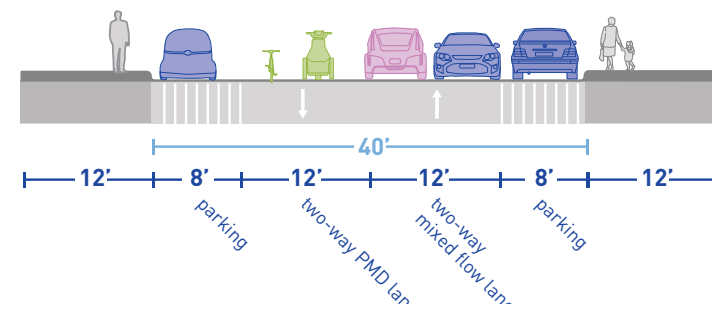
Same as existing roadway, but no lane parkings except parking lanes.

SCENARIO 2: PRIORITIZES LANES FOR HIGHLY REGULATED PERSONAL MOBILITY



Only 1 lane for automobiles in #2 and #3.

SCENARIO 3: BI-DIRECTIONAL LANES FOR PMD'S AND CARS.





Good - at LA Live & Staples

120' Bus Lane & Streetcar

30' Parking

10' Bike Path



Better - at LA Live & Staples

120' Streetcar & Bus Lane

24' Multipurpose Median

100' Park Lane



Best - at LA Live & Staples

120' Streetcar & Bus Lane

30' Multipurpose Median with Pedestrian Formwork

100' Park Lane

Renderings courtesy of Gehl Architects and Melendrez Design Partners

This mismatch between the current planning paradigm and emerging vehicle trends is particularly problematic.

Electric Vehicles, or if, for example, a car was half the width as is currently typical, or if there were advances in truck design that would make them typically smaller or otherwise improve their performance, we would have to rethink the scenarios by which these vehicles could be used and partner with policymakers and designers to forecast hypothetical restrictions and design our transportation systems accordingly.

This mismatch between the current planning paradigm and emerging vehicle trends is particularly problematic since it will likely limit or slow down the adoption of new vehicles and reduce certain aspects of their effectiveness.

The technology which is likely to be impacted the most is automated control systems. This negative impact can be anticipated based on how passenger cars are treated in current transportation planning, operational analysis, and roadway engineering. As we have seen, all passenger cars are essentially thought of as the same. However, automated vehicle control systems would perform differently from other passenger cars. These vehicles can travel much faster and at a much closer following distance than regular passenger cars. As such, a roadway could provide a much higher capacity for cars with automated control systems than a traditional roadway. However, none of the current HOV lanes or toll roads are being planned or studied to accommodate these types of vehicles. As these vehicles are deployed, it may be possible to retrofit a limited amount

of HOV or toll lanes to accommodate them. However, this retrofit would be limited because most of the roadway network in the form of regular surface streets and most of the highways (freeways) do not currently have lane differentiation. Therefore, it will be possible to dedicate lanes to automated vehicles in only a small subset of the overall transportation system that currently have physically distinct access-restricted lanes. (Is it that hard to change a lane to a dedicated lane?)

A similar lack of attention on the part of transportation planners and engineers to specificity in the size and configuration of passenger cars has could result in lost opportunities for the public. The future will likely see the introduction of smaller vehicles, many of which are likely to be powered by alternative fueled sources. Many of these smaller vehicles could potentially require dedicated facilities or may be difficult to operate within the larger transportation system if asked to comingle with buses, large trucks, and other larger vehicles. This lack of dedicated facilities could make it difficult for communities to allow their usage. Two recent examples can be drawn from the introduction of Neighborhood Electric Vehicles (NEV's) and Segways. NEV's have been widely implemented within select communities. However, current regulations in the State of California limit the roadways on which they can drive and have lead several communities to incur the expense of creating a separate roadway networks for their usage. While these vehicles are perfectly capable of driving on most roadways, their usage is excessively limited. As such, the adoption of NEV's has been severely constrained to select locations. The second instance relates to Segways, which are small personal mobility devices. When first introduced, Segways were promoted as having the potential to revolutionize the transportation system. The difficulty is that Segways do not fit into the current transportation paradigm in that they are too slow to comingle with cars on most roadways and create conflicts with pedestrians on sidewalks. Currently, there is discussion over how best

to accommodate Segways within the existing transportation system. As an example, the City of Boston initiated efforts to ban or limit the use of Segways citing conflicts with pedestrians in 2010.

There are several ways in which the transportation planning and engineering field can embrace new vehicle technologies. In many instances, these changes to vehicles are likely to occur without active participation from transportation professionals, but awareness of potential innovations in vehicle design should shift their focus to implementing changes now which will encourage, and not preclude, these future vehicle technologies.

First, given the long-lead time for transportation improvements, current planning studies - particularly traffic modeling exercises for regional areas - should be taking into account informed research on potential changes in vehicle technologies. These discussions and awareness early in the design process would engender new flexibility and adaptability in transportation planning and engineering paradigms, and lead to substantive improvements in the roadway systems of the future.

Second, any current roadway engineering efforts for limited access facilities such as HOV lanes or toll lanes should consider a potential future conversion to automated vehicle operation. It is likely that these facilities could be easily converted for the most efficient deployment of automated vehicles than any other roadway facilities.

Lastly, current engineering standards and design documents should consider and disclose how changes in vehicle technology could be accommodated within our existing roadways. Continually revisiting and revising these standards in light of ongoing innovation in vehicle design will ensure that the vehicles of tomorrow are not treated like we treat NEV's or Segways today.

Current engineering standards and design documents should consider and disclose how changes in vehicle technology could be accommodated within our existing roadways.

PARKING

Shannon S. McDonald

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Parking Lot Dance by Anita Pace, Photo by Warren Neidich.



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TRANSPORTATION INFRASTRUCTURE UTILIZATION

John Stutsman

IT IS CLEAR THAT WE ARE NEARING THE END OF the freeway era spawned by the Interstate Highway Program Act of 1956, and the notion that we can build our way out of urban area congestion. Sprawl has literally hit-the-wall in Southern California, with very little remaining developable land within the Los Angeles basin. Coupled with being at or beyond peak oil production, commuting costs are rendering far flung housing developments economically infeasible, with the Great Recession delivering the final blow.

We have come to the realization that we must achieve better utilization of our scarce existing public rights-of-way to achieve our societal transportation objectives. Some recent public mass transit projects get around this problem by not involving the roadway network, which is "built out" in dense urban areas. For example, the Metro Green Line and Expo LRT projects are largely making use of existing railroad rights-of-way, plus some street running, elevated or tunnel sections. The Westside Subway(Metro Purple Line) is all below-grade in twin-bore tunnels.

As a result of these additional modes of transit, the Westside of Los Angeles, roughly defined as the I-405 on the east, the Pacific Ocean on the west, the Santa Monica Mountains on the north and LAX on the south, will see an increase in bi-directional peak-hour person moving capacity of 30,000 at the eastern and southern borders by virtue of the Expo LRT, Metro Purple Line and Crenshaw/Green Line projects. This represents a significant travel option opportunity for the 300,000 daily commuters either leaving or entering the Westside.

This potential mode shift may well facilitate substantial transit related development,

with the net result that roadway congestion will remain at today's levels. So, what are we to do and what tools do we have to help achieve our objective of improving personal mobility? Several things have happened and/or are in the works. The City of Los Angeles has implemented an adaptive computerized traffic signal control system for the some 4,500 signals citywide. Metro is implementing congestion pricing HOT lanes on the Harbor and San Bernardino freeways, as well as a BRT project on Wilshire Boulevard from Western Avenue to Centinela Avenue at the Santa Monica Border. This BRT project, which will be a peak-hour, curb-lane operation, has potential to substantially increase person-moving capacity in this corridor, until such time as the Purple Line subway opens to the West Los Angeles Veteran's Administration Hospital.

BRT is one example of the move towards a more systematic sharing of major arterials. Planners and engineers are now placing much more emphasis on the sharing of

We have come to the realization that we must achieve better utilization of our scarce existing public rights-of-way to achieve our societal transportation objectives.



Inappropriate Pedestrian Behavior. (Image courtesy of VISSIM)

BRT is one example of the move towards a more systematic sharing of major arterials.

roadways by pedestrians, cyclists and transit users. To address this new reality, development of a multimodal intersection “level of service” metric is underway. Other relevant factors are the complete streets/road diet and traffic calming trends, which generally reduce arterial roadway capacity and shift local traffic to major arterials.

Regional travel demand models are ill-equipped to discern the localized effects of such roadway sharing by multiple users. Fortunately, microsimulation models such as VISSIM are capable of performing such analysis and are increasingly becoming more

cost-effective for addressing such problems. Driver behavior is one of the key analytics of such models. Further, one of the key output options are videos showing vehicular, pedestrian and transit movements, which have proved to be very effective in demonstrating project effects for both the public and technical staff.

The problems we face are indeed daunting as we confront the limited opportunity to increase roadway capacity and legitimate competing demands from pedestrians, cyclist and bus transit patrons. Microsimulation will help us work with this multi-modal complexity so that we can use our existing resources most efficiently.





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POLICY IN 2035:

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LOS PARRANDEROS CAR CLUB

I MET ALEX RUIZ and the Parranderos Car Club at an event on June 11th, 2011 called Cruisin' the Galaxy which took place in the parking lot of Galaxy hamburger in the warehouse district of Ontario. Approachable, enthusiastic and articulate, Alex promised to be an ideal interview subject, so I got his contact information in order to arrange to meet with him and learn more about his club, Parranderos, and about amazing labor of love - a project in full swing: a rough, unpainted Dub style mini-truck made up of a Chevrolet body with a Cadillac front end and Cadillac rear headlights. I received an email from Alex on July 15th about the Mini-Trucks for Troops Cruise Night to take place a few weeks later, at El Toro Sushi Restaurant on Mountain St. in Ontario. Looking forward to talking with him further, I arrived at the event and was shocked to find out that Alex had died a week after he had sent me the email, at the age of 34, from complications arising from diabetes. Do I need to come out and tell you that Parranderos are a great reality check.? They bring right down to earth the issues planners work with at 20,000 feet. The Club consists of two brothers, the Gurrola's, and their sister, who was Alex Ruiz' wife, and a few of their friends. The Gurrola's - Chava (Salvador), Octavio and Cecilia - are from Zacatecas, Mexico. Junior Lopez is from Tijuana, Bola Marin is from Michoacan and Tony Rosales is from Colima. Alex Ruiz was from Los Angeles, but he grew up in Michoacan. He spent 15 years in Michoacan and then moved back here for high school and college.

An amazing labor of love – a rough, unpainted Dub style mini-truck made up of a Chevrolet body with a Cadillac front end and Cadillac rear headlights.

August 13th, 2011 at Mini Trucks for Troops in the parking lot of Toro Sushi on Mountain Ave. in Ontario.

CLUB MEMBERS:

President: Salvador "Chava" Gurrola

*Vice President: Alex "El Peke" Ruiz
b. Nov 76 - d. July 23rd, 2011*

Octavio Gurrola

Antonio "Tony" Lorenzo Rosales

Jose "Bola" Marin

Roger "Junior" Lopez

Cecilia Ruiz (maiden name Gurrola)

Wendy Gurrola

Iris Graciano



THE RIDES

JUNIOR: I have a 2000 Honda Civic DX but it's down right now. The motor got messed up and I have to put another motor in it. So far the car is stock, but I put Lambo doors on it. I put on 17" rims and tires, neon lights, LED's underneath the car - on the undercarriage. I put a box in it. I have two kicker amps: one for the highs and one for the bass. I have two TV's on the head rest. I put an LED light in the hood and the trunk. It lights up the trunk. We customized the trunk where it opens up a different way. I have pedals with glow in the dark lights. I'm trying to hook it up to the best of my ability. Not only me but all the members are helping me accomplish what I'm trying to do to my vehicle.

TONY: My name is Lorenzo Rosales and I have a 1994 Chevy Suburban. Me and the president, Salvador, we do suspension; we do front air bags, we do hydraulics, we do suicide doors, we do Lamborghini doors, we do paint, we do fiberglass - we do pretty much everything. We do TV's. We do everything

from scratch. Nothing from shops, everything from the backyard: Backyard Boogie, you know.. I'm about to put on ramps, a paint job, suspension and TV's. Right now, the car's not here because we're still working on it. The suspension is air bags. With the air-ride suspension, it drops slow and smooth.

CHAVA: I have a 1995 Chevy Tahoe four door. Right now, I've put on Lambo doors, butterfly doors on the back, full suede and Coach interior upholstery with fiberglass door panels. I have 12 TV's. The new paint job is Laguna Seca blue BMW edition. I'm about to put in a new air ride suspension and my hood is custom. The gas tank has a custom cover. In the back we have a custom box for audio; neon lights and suede. We also have custom painted tail lights. They're black - sometimes the cops give you a ticket for that. They still glow red, but they're dimmer. The front end of this truck is factory, but we want to modify it in the future. My friend Tony and I have a lot of projects for my truck. Little by little, I will add all the details until it is perfect. We're trying to make it work.

TONY ABOUT ALEX'S, NOW CECILIA'S,

TRUCK: This white truck is a '96 Chevy Tahoe with full custom systems: a custom trunk, with shade doors in the back, shade doors in the front. Custom intake on the engine. Custom paint on the dash, custom steering wheels, air bag suspension, intake headers, custom hood. It has a Cadillac front end with a 2005 GMC Sierra front bumper. The truck is a Chevy but the front end is Cadillac, and the bumper is GMC. So it's three different cars mixed into one. The back has Cadillac tail lights. Whatever the front end is, the tail lights are the same. But here, the front is a Cadillac Escalade, and the back has Cadillac Fleetwood tail lights. It's a Cadillac car in the back and a Cadillac truck in the front. So we're not driving the same truck as what the dealer sells. We upgraded it and made it our own style. It has a custom built front grille. Another friend made the grille. We cut the Cadillac front grille out and stuck the new grille in and it fit perfectly. We have strobe lights inside the front lights, like a cop - they flash, neon all the way around - even under the hood. We have suspension, 20" wheels in the front, and 22" in the back. We have offset wheels, and the whole truck can lay flat on the floor. We're trying to get together to work on the truck to get it the way Alex wanted. We're going to do the paint job the way he wanted as well as some air-bushing, the interior and a couple of details. We will pitch in with his wife and brother in law and get it the way he wanted it to be.

BOLA: This is an 89 Nissan hardbody mini truck. The president and his brother did the airbag setup and they also did the speaker box. (incates the air compressors in the truck bed..) This is your valve and your tank and compressor to fill up the airbags. The truck goes up and down and side to side. This aluminum box with switches controls everything. Those are '05 stock Chevy Silverado wheels. This is a Nissan but we're putting Chevy stuff on it. The headlights will be 2008 Silverado headlights. Same with the rear headlights. I want a top of the line car, get the code and then paint it like that. I don't know yet what color it will be. It will also have remote control doors. The one on the passenger side is going to be a sliding door. It

It's three different cars mixed into one.

takes a long time and a lot of money. We have to pay bills, and this takes extra money. We can't take it to a shop. Everything is me, him and his brother. His brother does welding cutting, chopping, painting. Salvador's dad, back in the day in Mexico, would paint Pepsi trucks as a job. So he's an expert.

INTERVIEW

TONY: Parranderos was Chava's and Alex's idea, and we only started about three months ago. We all belonged to different car clubs before, but we decided we wanted our own. Chava had been with a car club that is really established, but they had a lot of drama, a lot of fighting - situations where he was uncomfortable. And they would discriminate against people with simpler cars. We wanted to start a club where we don't care if you want to start at the bottom, with whatever car or truck. We'll give you a chance. A Car Club is about family: creating a second family. So we got our closest friends together - Chava, Bola, Junior and Octavio. Most of us were born in Mexico and raised here, but Alex was born here and then he went to Mexico and came back.

Before we started this car club, we had another car club, back in the day, about five years ago. It was called Neighborhood Riders but now we're back with a different name. I started it with Chava and Alex and Octavio, in Moreno Valley. We all live in different places now, but we all used to live in Moreno Valley. Later Alex moved to Riverside, but we stuck together. Now we live spread out between Moreno Valley, Riverside and Perris, but we still meet in Riverside twice a month, at Arlington and VanBuren, in the K-Mart parking lot. At the meetings we talk about what car show or cruise night we're going to go to, and what we're going to do on our cars and trucks. Some of us got married, some of us are still single, but this club, now

that we're older, is more about family; we're more mature. Our wives help and support us. And yes, the wives are members: a part of the club. You see we're just chilling, joking around, having fun, snacking. That's what the car club is about - just being together.

For example, Junior used to race, but he doesn't anymore. Plus you can't race with these cars - you can't get very far (... they laugh..). And in this car club, we have rules. We can't be drinking, doing drugs, smoking, racing. We can't have trouble with members of other clubs. If anything happens, if something gets out of hand, the president takes care of it with the president of the other car club. If we have a problem with another person, we tell the president and he will talk to the leader of that other club and he talks to his members. We don't get crazy with anybody. We just come, cruise, chill show our cars, get ideas for how to improve our cars. That's what we do.

CECILIA: This is a picture of Alex. He was so excited about the car club. When I first met him, he loved new cars with no problems - just make the payments and drive the car. But then he met my brothers, and he started to learn to fix cars from our family. He became so excited about his cars: His new toys. He was like a kid. He sold his Monte Carlo and he bought the Chevy truck on Carigslist. The Monte Carlo was big but low, and so he felt more comfortable in an SUV because he was a big guy. He was so responsible, and would always plan so carefully to make things perfect. The rest of us have to make his dreams happen. There was a cruise night three weeks ago in Fontana in his memory. We had a lot of support from three car clubs: Sunset, Concrete Deep and Regulators. They each really helped us out so much it was amazing. California Sound helped us with the location. People were crying at the Cruise Night - Alex had so many friends. He was so outgoing and not shy at all. There were 35 cars at the Cruise Night, and we were not expecting that many cars. At his funeral, we were expecting 200 people, but there were 500 people. It was at Rose Hills, in Whittier. There were a lot of people

there from Cruise Nights.

We still don't know exactly why he died. It was probably a heart attack but we're still waiting to find out. He was diabetic and had high blood pressure. He'd been diabetic since he was thirteen, but we only found that out two years ago. He had a lot of health problems, especially with his eyes. He had had four surgeries on each eye to recover his vision, so we were always fighting back with surgeries, but they never really worked very well.

Alex was a good student, and had graduated with honors from CalState LA in East LA. As a job, he did loss prevention and security. He worked at the Big Lots warehouse in Rancho Cucamonga. He took care of the warehouse at night. He checked the cameras. He checked the trucks coming into the warehouse to make sure the merchandise was logged. The night before he died, he worked eighteen hours. Three years ago we bought our first house in Hisperia, near Victorville.

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We also bought new cars, but when the economy started going down, I lost my job and he lost his second job and we started to lose everything. So then we moved to Moreno Valley, into a small apartment. My parents also had an apartment there, and so did we, and we all had a lot of bills. So then we all moved to Riverside together, into a house. To help everybody reduce the bills. And then, just a couple of months ago, we started to talk about moving out and having kids. So... I still live with my parents. We're going to fix up Alex's truck. I told my brothers that I don't care if I spend too much money on it. I have to fix it and drive it and have it the way Alex wanted it. We're going to accomplish it all in our house, garage and backyard - none of it in a shop.

TONY: I used to go to Alex's house all the time. We were best friends. I used to look for Alex. Even if he was asleep after working the nightshift, he'd come down and we'd be chill and talk about things. He lived in Riverside, I live in Perris. A Car Club like ours is a second family. You have a family, but a Car

Club is a family that you communicate better with. They understand you. They know what you're going through and if you're struggling. Sometime your car club can help you more than your family. It's a fraternity where we understand where we came from, what we've been through and what we're going through. You help each other. And all of these things that happened to us, like about Alex, make us closer and more united. We know we need to take care of each other.

CECILIA: Alex helped me a lot. He helped me with my citizenship and he helped my parents; my brother's in process. If anyone asked him for help, he would never say no. He would say you never know when you'll need help. You never say no: He taught me that. I've changed my mind totally to where I see you need to help each other. I've had so much help from his friends - and we've all now had to help each other so much. I think totally differently now. You can't choose your family, but can choose another, second, family. We're close and we can make it work. We started this Car Club and I hope you will see

A Car Club like ours is a second family. You have a family, but a Car Club is a family that you communicate better with. They understand you.

it grow bigger and we will recruit more family and more friends. The cars will get fixed up.

TONY: We have Alex's, mine, Junior's, my wife's and his wife's car: We have a lot of projects, a lot of cars. Salvador has two cars. We have a lot to do and we have to make it work with our paychecks.

CECILIA: My dad does the paint, and mechanics, and I'm a seamstress.

CHAVA: I do the upholstery. I learned how to do it. It's a lot of work.

TONY: If we see something and we like it, we're going to try to do it.

OCTAVIO: I work in a mechanics shop. My family had a shop in Zacatecas and I'd love to have my own shop here - that's the idea. But there's a lot regulation and insurance, so it's complicated. It would be great to have a shop in the future... It would be great to call the shop Parranderos.

THE FUTURE OF THE CAR AND SUSTAINABLE NEIGHBORHOODS

Terry Hayes

THE BUILDING BLOCKS OF A CITY are its neighborhoods. The neighborhood defines the physical urban space and provides residents with a comprehensible framework within which they go about their daily routines of work, school, shopping, and leisure/entertainment. The collection of neighborhood variety in any given city, define the city's character. However, not all neighborhoods are equal. There are socioeconomic, racial and cultural differences. There are differences in home ownership, housing types, availability of amenities, housing density, etc.

The geographic location and spatial relationship between neighborhoods also plays an important role in defining the quality of life in urban neighborhoods. The distance traveled to school, work, church and the accessibility of services all figure in. Neighborhood mobility and accessibility are key factors in establishing the relative desirability of one neighborhood versus another. Most importantly, mobility and accessibility set the groundwork for the relative sustainability of a neighborhood. Are there convenient exit routes during a natural or man-made disaster (earthquake, wildfire, riots, etc.)? Can residents get to grocery stores, emergency centers, or food banks when they need to? Overall, does the neighborhood represent a convenient spatial relationship to jobs, services and community facilities?

The growth and distribution of neighborhoods in Los Angeles has been stimulated in large part by the access afforded by the private automobile. While it is true that older neighborhoods evolved around the mobility afforded by the red and yellow car transit lines that sprawled across the region, the real thrust of suburban growth was fueled by the accessibility of the private automobile and the expansion of the freeway system.

For many years the freeway and highway system expanded and flourished and the transit system was allowed to atrophy into an inefficient, infrequent and inconvenient collection of bus routes. Since the 1980s the pendulum has been swinging back, with a massive public policy emphasis on recreating the public transportation system where as the cost of expanding highways has become cost prohibitive, and politically unpopular, and there is an emergent environmentally-based view that the Los Angeles region must reverse 60+ years of transit neglect. Los Angeles County voters' support for sales tax Measure R in November 2008 confirms the popularity of this view.

Los Angeles neighborhoods are caught in the middle of the evolving tide of transportation investment policy. As we focus out 20 or so years into the future, the implicit ideal planning vision for our urban area now seems to entail nodes of high density land use developments (Transit-Oriented Development) linked by efficient and high capacity fixed guideway transit systems such as bus rapid transit, light rail and heavy rail. California State legislation on Greenhouse Gas – the

Neighborhood mobility and accessibility are key factors in establishing the relative desirability of one neighborhood versus another.



Global Warming Solutions Act of 2006 and Senate Bill 375- all seem to mirror this vision that transit and land uses conforming to transit will cure the region's environmental quality and traffic congestion issues.

It is interesting that the passenger car is strikingly omitted as a positive element of this vision. Like the dinosaurs that fuel it, the passenger car is assumed to become extinct or on the verge of extinction as a viable transportation mode, as if a region that has built up around the car will simply cast it aside in the face of economic and environmental imperatives. Our current transportation policy fiction leads us to believe that new neighborhoods will be clustered around hierarchies of centers that will be linked via all varieties of transit guideways and networks.

The expected extinction of the passenger car is greatly exaggerated. The California Air Resources Board (CARB) expects that there



Like the dinosaurs that fuel it, the passenger car is assumed to become extinct or on the verge of extinction as a viable transportation mode, as if a region that has built up around the car will simply cast it aside in the face of economic and environmental imperatives.

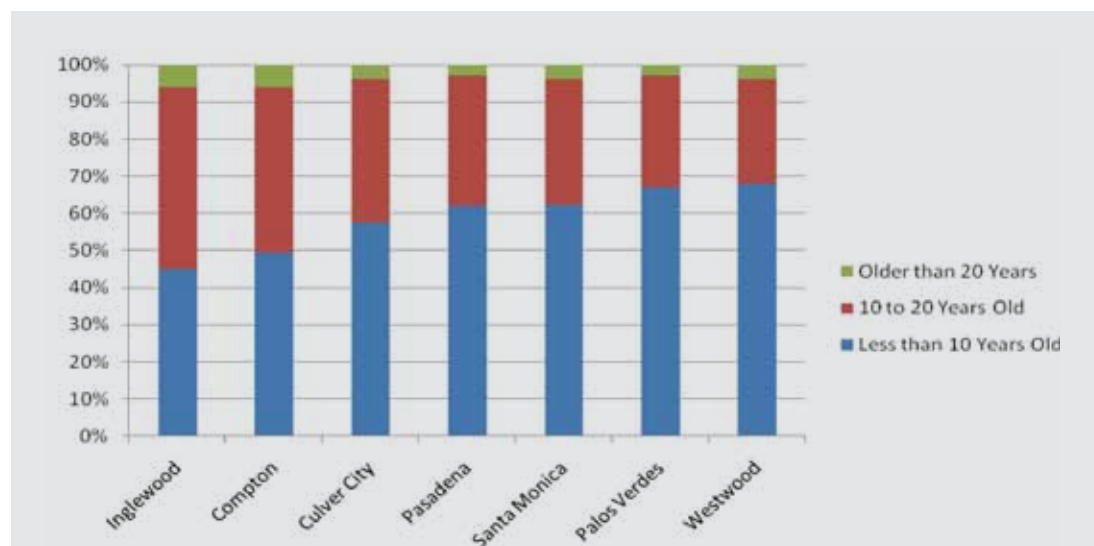
will be 6.4 million light duty cars and trucks in daily operation in Los Angeles County in the year 2035, making approximately 38 million daily trips. This would represent a 2.1 million vehicle increase from today (4.3 million light duty vehicles). The accessibility and mobility of neighborhoods will continue to be linked in large part by the car and its roadway infrastructure. A one-square-mile neighborhood on average will be served by more than 30 miles of major arterials and collector roadways. With the premium placed on mobility, it is extremely doubtful that this neighborhood space will be left dormant and unused. Without the major catastrophic effects of a peak oil shortage, transit travel demand models at best show automobile trip reduction of 1 to 2 percent. The vast majority of travel in and out of Los Angeles neighborhoods will continue to be by car. The survival or sustainability potential of all urban neighborhoods is, however, not the same. In a 1970 study, the U.S. Department of Housing and Urban Development describes the life cycle of a neighborhood, and within a given urban area, neighborhoods are in various stages of evolution from initial formation to decay and disinvestment. Similarly neighborhoods are cast along a continuum of sustainability. Siting electric car charging stations and community gardens may be an important objective for one type of neighborhood; while another neighborhood's focus may be on adequate jobs and having convenient grocery stores with fresh produce. Any particularly unforeseen event intersecting these neighborhood life-cycles could create unusual opportunities. or possibly have devastating results. Witness the effects of hurricane Katrina on the 9th Ward neighborhood in New Orleans where disinvestment compounded with scarce emergency preparedness and few elements of sustainable infrastructure led to the near-obliteration of the neighborhood.

Using census tracts as a rough surrogate for neighborhood boundaries, the year 2000 census for Los Angeles County showed a wide separation in median incomes. Fifty-one percent of the 2,054 census tracts in the County were less than the median income. These socioeconomic differences create

It's more than likely that there will be higher turnover rates of replacing older vehicles in higher income areas than in lower income areas. The end result being that those areas least able to invest in advancements in automobile technology will have the greatest access needs and have the greatest proportion of legacy vehicles on the road.

strong implications for future mobility. As incomes rise, neighborhoods with higher incomes will likely generate more discretionary trips to school, shopping, and other non-work purposes. Because of the white collar nature of many of these neighborhoods, the trips will likely be shorter due to a more even geographic balance between jobs and housing. Even the need to travel would be diminished by future advancements in telecommuting and remote access to corporate intranets and the internet. For all other neighborhoods future mobility will be more challenging. In places like South and East Los Angeles, the imbalance between jobs, housing and basic services is likely to be exacerbated. There will be longer work and discretionary trips to job centers in West Los

Exhibit 1. Comparative Age of Automobiles by Neighborhood



Angeles or in the South Bay. Similar to today, socioeconomics will figure into differences in auto retention. It's more than likely that there will be higher turnover rates of replacing older vehicles in higher income areas than in lower income areas. The end result being that those areas least able to invest in advancements in automobile technology will have the greatest access needs and have the greatest proportion of legacy vehicles on the road. In the year 2035, current vehicle models (2011 to 2015) will still be on the road, and it is highly likely that these vehicles will be concentrated in lower income areas of the county.

It is doubtful that, although expanded, the transit system will be able to adequately fill the mobility gaps for neighborhoods cast over such a wide spatial landscape. The passenger car will continue to be the backbone of the transportation system. How older vehicles with more primitive technologies will be integrated into intelligent highways or how these vehicles will be segregated from more advanced vehicles is yet to be determined.

So far, few have peered into this mobility looking glass with any clarity. Advancements in roadway and automobile technology are taken as givens that are assumed to magically wash across the region through "market acceptance". The socioeconomic differences in the city are, however, becoming more

starkly contrasted. There is no reason to believe that the divide between the haves and the have-nots will not increase.

Because the concept of "divide" is subjective, we decided to look closer at the notion of neighborhood differences in automobile choices and the model age of cars. While not setup to meet a specific statistical test, we used census data to select seven neighborhoods with contrasting socioeconomic differences, i.e., Compton, Westwood, Inglewood, Palos Verdes, Culver City, and Santa Monica. We surveyed grocery store parking lots in each of these communities as the best indicator of local automobile choice. The range of differences was not surprising. In Inglewood and Compton, the proportion of cars less than 10 years of age was 45 and 50 percent, respectively. In comparison, the proportion in Westwood and Palos Verdes was 67 and 68 percent, respectively. For the oldest vehicles (those over 20 years), the proportion in Inglewood and Compton was almost twice as high as the percent in Westwood and Palos Verdes (Exhibit 1). It is these differences that will likely be the baseline for the future. In 2035, affluent communities will have 70 percent of model year vehicles manufactured after 2025, while in less affluent areas, well over 50 percent of the vehicles will have been manufactured prior to 2025, possibly with a significant proportion manufactured before 2015. We

strongly suspect that the number of 2015 vehicles will be higher than even the existing baseline given the persistent economic woes that currently beset the region and that will undoubtedly retard new automobile sales and increase automobile retention for some time.

While vehicle age points to one difference that may carry into the future, vehicle features and accessory packages also hold clues. Perhaps what is critical in determining accessibility and mobility is determining what type and extent of automotive technology is within reach for differing neighborhood communities. For example: it was not uncommon to see in our informal survey an abundance of Chevrolets and Toyotas that were less than ten years old in the South Los Angeles region. It was equally common to see Toyotas and BMWs in the Pasadena area that were also less than ten years old. But when looking at the spectrum of models, model levels, equipment packages, and additional options – it becomes apparent that there are differences between entry level models and those that are feature-rich. Thus, even amongst "new cars", important differences in automobile feature technology will likely accentuate access differences to advance transportation infrastructure in the future.

Aside from pure economic determinants, the changing demographics of city neighborhoods also figure into the future role of the car. For decades, the car has served as symbol of economic mobility and independence. This type of symbol has not been lost on minority neighborhoods as they strive for advancement. The car is the quintessential symbol of making it into the middle class. The car represents independence and self worth that may not be realized in other aspects of minority life in America. In Chester Himes' 1947 novel, "If He Hollers Let Him Go," Bob Jones (an African American shipyard foreman) seems to find self-worth in racing his 1942 Buick against other white workers along Alameda Street on his way to work in San Pedro. Similarly, the roots to the low riders in East and South LA can be traced directly to the parity and positive recognition that can be achieved with a car in relation to the larger society. Tracy Chapman, in the

lyrics to "Fast Car" observes:

*"...You got a fast car
And we go cruising to entertain ourselves
You still ain't got a job
And I work in a market as a checkout girl
I know things will get better
You'll find work and I'll get promoted
We'll move out of the shelter
Buy a big house and live in the suburbs
You got a fast car..."*

While we, as planners and policy-makers, place great emphasis on public transit investment as a way to enhance the sustainability of the urban area, even the equitable distribution of transit service throughout the region is problematic, and the allocation of this vital mobility resource is often a function of the relative political power and savvy of neighborhoods within the region. The reality in Southern California is that transit will be, at best, a last resort backstop and safe guard against some catastrophic failure of the automobile to perform. Maybe that failure will be the scarcity of fossil fuel, or maybe the failure will be unbearable grid lock and congestion. Should public policy focus on how to ensure there is no failure and support the automobile's continued adaptation to changing circumstances? Or will market forces do the trick? The automobile and its emergent design and technology is not an end in itself. It is a means to an end. It is

Thus, even amongst "new cars", important differences in automobile feature technology will likely accentuate access differences to advance transportation infrastructure in the future.

Our challenge as policy-makers is that automobile technology has not and may not ever be equitably dispersed throughout the consumer market, given vehicle price and the wide variety of makes, models and ages of vehicles on the road.

the central support element to realizing the mobility and accessibility needed to support quality of life in neighborhoods throughout the City. Our challenge as policy-makers is that automobile technology has not and may not ever be equitably dispersed throughout the consumer market, given vehicle price and the wide variety of makes, models and ages of vehicles on the road. Likewise, the rollout of “smart streets” and “intelligent highways” has historically been spotty. Priority is typically given to the areas of greatest congestion or where transportation infrastructure systems receive the greatest political visibility. There are still portions of Los Angeles that have yet to see the City of Los Angeles Automated Traffic Surveillance and Control/Adaptive Traffic Control System at local intersections, or where the system has not been fully activated (a good example of this are intersections along Slauson Avenue, east of the Harbor Freeway, in South Los Angeles).

Undoubtedly, if the past provides us any clue, some neighborhoods will be better positioned to take advantage of automobile

technology improvements than others. With our love and attachment to the car in Southern California, as well as our dependence on it given our sprawled spatial landscape, it is naïve to assume that transit will be the great equalizer. The “haves” will have their smart cars and the “have-nots” will have buses and light rail. Not really. Transit may not reach the far corners of the city where lower income households (regardless of race) may be pushed by housing prices. Nor will transit satisfy the mobility independence that a car has historically provided to otherwise disenfranchised areas. It will be ironic that those neighborhoods that may have the longest journeys to work or to services may have the most outmoded automobile technology and transportation infrastructure. Under these circumstances, the relative sustainability of neighborhoods in the city will be greatly strained. It will be left to public transportation policy-makers to achieve some level of acceptable parity between neighborhoods from a sustainable mobility perspective. This is a much needed role in order to achieve social justice, but one simultaneously facing down both the dynamic and powerful forces of consumer automobile economics and the hard ball politics of how infrastructure improvements are allocated within the city.

NEIGHBORHOOD RESEARCH

Sean Donahue

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PRICING FOR AUTO-MOBILITY

Marco Anderson

THE COST OF AUTO-MOBILITY – meaning the cumulative yearly amount spent by an individual on the lease or purchase of a car, fuel, insurance, registration fees, parking, tolls and repairs – changes due to shifts in the pricing strategies of multiple players in the private and public sector. These pricing strategies have evolved in the past fifty years and are bound to continue to do so into the future. Certain assumptions and best guesses can lead us to see at least a hazy picture of the pricing strategies of the near future of 2035.

In Southern California today, the cost of auto-mobility is defined independent of other alternative forms of transportation. This has been because over the past 50 years any of the alternatives have been rendered irrelevant... However, significant investments in alternatives to the automobile over the past 25 years have changed that. The relevance and interplay of all modes of mobility will become more intertwined over the next fifty years in the denser areas of our region. And how we pay for those various modes will have a bearing on how attractive they will be to future users. The full picture of how we pay for mobility (auto-mobility and other modes) is much more complicated than other consumer products, because there are so many components that are all priced, and paid for in different ways. For example, in the case of auto-mobility, there are the sunk costs of purchasing a vehicle, and there are the ongoing finance costs for purchasing the vehicle, and there are the various operating costs, including insurance, maintenance, and fueling the vehicle. And finally there is the hidden cost of depreciation. There are a number of ways in which technology will influence each of these pricing mechanisms in the future. The questions are will the new pricing strategies for auto-mobility

support adequate access to mobility for a broad enough range of the population? Will it ensure a distribution of cost for mobility that is equitable, and will it make other modes of transportation viable?

In 1962, car ownership in the United States was significant, and obviously on the rise, but hardly universal. Meanwhile, in Los Angeles, the Pacific Electric Streetcar system ceased operation in 1961. However, bus ridership represented a sizeable proportion of the population, especially among low income and minority populations. Car loans were not as common as they would be in 1987, or today. It can be said that General Motors once used to be a car company that sometimes helped its customers buy cars,

In Southern California today, the cost of auto-mobility is defined independent of other alternative forms of transportation. This has been because over the past 50 years any of the alternatives have been rendered irrelevant.

THE HAT OF A BUREAUCRAT

*Gentleman's Hat (tanggeon) / Korea, Joseon dynasty (1392-1910), 20th century
Horse hair and bamboo / Pacific Asia Museum Collection / 1972.30.6*



A second and related market force that will affect pricing will be the extent of cellular phone banking, and other digital moneys

but in 2012, GM, measured by profit sectors, is a bank that manufactures and distributes cars in order to produce loans.

In 1962 drivers paid for their gas and insurance with cash. In 1987 drivers paid with checks, and in 2012 drivers generally pay with credit and debit cards. First invented in 1932, parking meters have changed from individual coin operated mechanical devices to electronic, wired, smart payment stations

that access online accounts.

Major changes in pricing strategy occur when the private sector sees an opportunity to make more profit out of a new method of payment. In the case of financing automobiles, banks and lenders are able to make more profit over time on a car loan than they can by letting the consumer drive out the door with the capital. New methods of payment are attractive to those setting prices because they make purchasing easier and more appealing to the consumer, resulting in more sales, or where the new method of payment results in lower administrative costs for the producer. For example, there was a steady progression, in the past thirty years, in the availability of, first, fuel company credit cards (Exxon, Gulf, Shell) run by hand, then general credit cards, and finally ATM cards read at the pump as methods of payment for gas. (In Southern California, ARCO stations impose a \$.45, per transaction, charge for using any other methods besides cash - A rare reminder of a time when the cost of the transaction and the cost

of the product were not bundled). How have these changes affected overall revenues or consumer prices?-kr

Technology's role in each small transaction required for individual mobility will have a cumulative effect on mobility choice at large. For example, advances in the technology of paying for private on-demand mobility has the potential to stimulate a significant increase in the number of customers for taxis and short term rental cars. One national rental car company has been looking at fitting their entire Southern California fleet with capability for hourly rental, and car sharing companies have had a long trial period. But technological barriers have made it difficult to get the vehicles in the fleet to the customers who need them quickly enough. And another challenge is: how can providers collect payment quickly enough for the customer without excessive risk to the provider? Most car sharing systems require registration and membership. Obviously renting a car out to an individual requires establishing trust between the consumer and the car sharing company, and a membership registration allows the company to establish the credit and risk worthiness of the driver. But universal on-demand mobility requires a much more stream-lined process of establishing that relationship in real-time.

One scenario for widespread car sharing sees cars with credit card swiping capabilities. This seems entirely within the realm of possibility since more stores and restaurants do not require a signature when paying by credit cards. At first this was for small transactions under a certain amount, and now increasingly higher amounts. This is due to a realization that there is nothing about a scribble on a scrap of paper that assures, either the clerk or the company that I am who I say I am when I present this card. The acceptance of this practice demonstrates that the ease of payment is worth any perceived risk to the consumer, despite the fact the prior model held that if you were asked for your signature it was harder for someone to steal your credit card and rack up charges. As consumers, our commitment to pay can be seen as part of a wide social contract

A second and related market force that will affect pricing will be the extent of cellular phone banking, and other digital moneys

between consumers and a vast number of providers under the umbrella of credit card companies. Although renting a car for an hour involves a much more substantial contract than buying a sandwich, it is easy to see how the use of a credit card as both identification and a method of payment could become much more wide-spread.

A second and related market force that will affect pricing will be the extent of cellular phone banking, and other digital moneys, over the next 25 to 50 years. This shift raises important equity concerns as payment methods become predicated on having access to technology investments. Being able to order up a driverless car, or a bicycle, for that matter, and pay for it using a smart phone is a wonderful image of 2035, but won't really help a person who doesn't have a bank account (How to help the person with no bank account or credit? What is the solution for them?-kr) And access to those technologies is subsidized, though not always as effectively as necessary - explain?. Paying taxes is being more enabled by technology every year, as well as registering, and paying for your car on the internet. Some people will still line up at the DMV to renew their registration with cash and checks, but using a phone to pay for products at the point of sale will be ubiquitous even if debit cards, credit cards, and cash will not disappear.

(So will the cost of mobility go up or down because of these changes? Will it be equitably distributed? What is the impact going to be on access to modes of mobility?-kr)

Using the internet to purchase a used car went from a fringe activity, to occurring in such large numbers as to become a viable source of research data. Autotrader established a business model that was priced right for the seller. (what is the business model? more detail? – kr) A number of providers including Edmunds.com, Kelly Blue Book, and AAA now offer car buying services on the internet. In the past 5 years Carmax has emerged as a major internet retail outlet that also provides research, and internal stock tracking. The business model was developed on the back of the new purchasing technology (explain more how it works). Multi-brand auto malls are disappearing across Southern California as dealers and car manufacturers struggle to develop a replacement that capitalizes on customer demands, and fits their distribution model as effectively as on-line purchasing.

Another major innovation currently being discussed is Pay-as-You-Drive (PAYD) insurance. The common concern with PAYD insurance is that the consumer is worried about a Big Brother effect, with insurers being able to record data about drivers' whereabouts and provide that to the state. However experience has shown that consumer concerns are trumped by significant ease of use, or savings gains. But at least for now, there is little incentive for insurance providers to push pay-as-you-drive

The pricing of fuel for our vehicle is poised to change dramatically with the rise of plug-in hybrids and electric vehicles. Utility companies are racing to develop.

insurance and its attendant collecting of personal data because the insurance companies are limited by statute from making profit off the extra data reaped from pay-as-you drive technology. Regulation in California states that the only factors that companies can consider for setting insurance rates are: 1) your zip code 2) your years driving 3) your credit rating. These factors are really proxies for other actuarial data, but are strictly regulated. The intent behind such regulation is to avoid punishing certain population groups

Energy companies' pricing strategies are poised to change dramatically with the rise of plug-in hybrids and electric vehicles. Utility companies are racing to develop pricing models which will act as tools to shape behavior so as to avoid overloading the grid, and will allow electric vehicle owners to charge their vehicles, at work, at shopping malls, and at home even if they live in multi-tenant buildings. Smart phones, smart meters, and the smart grid will all need to communicate with each other in order for this system to work.

will this make fuel, and the rest of mobility, cheaper or more expensive? How will it effect the use of the automobile?

Pricing strategies all have consequences to the fairness of cost as it is manifest across different income groups. This gets to the issue that for many years in our region, driving an automobile has become an economic necessity, and therefore can be argued to be a right. Any impediments to universal access to driving, be it roadway pricing, or more stringent licensing standards, is seen as a regressive tax on the poor, on communities of color, and to undocumented immigrants. Therefore, public policy has an important role to play in how we price mobility.

Public policy has resisted roadway pricing in Southern California, as well as pay-as-you-drive insurance in the state. However, challenges to the status quo in both of these areas have come from both the left and right. First, there is agreement on the part of both liberal and conservative transportation policy makers on the efficacy and fairness of

pricing as a policy lever. Moreover, there is agreement from all sides that the process of funding mobility is completely broken, and that future enhancement and maintenance is dependent on new sources of financing.

The distribution of tax based funding for our roadways has resulted in the strikingly uneven quality of roadway surface conditions across our region according to whether an area is affluent or not. (explain how the money for maintenance is currently distributed –kr) In essence, what we have agreed on as a society is that you get the road conditions you deserve, meaning, the road conditions that you pay for. To add insult to injury, the comfort of your journey is a function of not only where you drive – in wealthy neighborhoods with smooth roads - but how much you have paid for the suspension of your vehicle. Countless advertisements for SUV's over the past 20 years have shown them conquering the urban jungle, rolling through potholes and over speed bumps. Therefore with money, you can drive comfortably, either over smooth road surfaces and/ or with a large suspension system... What would be the most equitable way of paying for our roads, with the understanding that we want the roads to all perform to the same standard? (The answer should go here).

One complication among many is that both social equity advocates and anti-tax advocates believe that pricing existing infrastructure is unfair. Another potential source of revenue, fuel tax, is also problematic because, due to the increased fuel efficiency of vehicles, the linkage between fuel tax and system usage is largely broken. In other words, the driver of an efficient vehicle does not necessarily pay more fuel tax despite inflicting more wear on road infrastructure. On the other hand, a person with an old, inefficient car may end up, by economic necessity, having to contribute more pollution, purchase more fuel, and pay more fuel tax that he or she cannot afford. For the sake of argument, if it can be agreed that driving, at least in Southern California, is a right due to economic necessity, then the individual driver should not have to bear his own share of the cost. Rather, the cost

The pricing of fuel for our vehicle is poised to change dramatically with the rise of plug-in hybrids and electric vehicles. Utility companies are racing to develop.

should be spread as equitably as possible throughout society. But this goes against the reality presented by new technologies for metering and paying for driving. Because of the potential of smart technology to be a powerful tool for designing pricing strategy and influencing driver behavior, the opportunity to extract money from tolls and roadway pricing may simply be too compelling for policy makers desperate to find revenue for road maintenance and construction. Much of this book operates under the theory that design innovations precede market acceptance, and that policies and regulations follow from use. However in the case of pricing, the usual order of things is reshuffled: It is a rare case where new technology will likely lead to policy and market acceptance follows from there.

ROAD AND CONGESTION PRICING: TEN QUESTIONS ON THE PATH TO SUCCESS OR FAILURE

Steve Finnegan

Direct road pricing is increasingly being considered as a way to both “manage” the finite resource of road capacity at peak travel times and to generate revenues to pay for a variety of transportation projects and services. Direct road pricing proposals range from simple toll facilities (bridges and roads financed by tolls revenues) that charge a set price for all users to more complex arrangements that vary the toll – or price paid – based on any number of factors, including time and day, congestion levels, number of occupants in the vehicle, or even type of vehicle.

People view road pricing in many different ways. Some see road pricing simply as a way to raise money (a de-facto tax). Others see it as a way to inject market forces into travel decisions, thereby improving traffic flow when some motorists – in an effort to avoid tolls or peak congestion charges – choose other travel times, routes, or modes (or don’t travel at all). Still others see pricing as a way to charge more for driving in an effort to increase its relative cost compared to other modes or to cover “externalities” – the real or perceived costs of driving not currently

Still others see pricing as a way to charge more for driving in an effort to increase its relative cost compared to other modes or to cover “externalities”

paid by motorists. And others see road pricing as unfair to low-income households or a threat to personal privacy or wrong because motorists and taxpayers have already paid to build the roads.

There are legitimate points to be made across the spectrum of thought and motivation surrounding road pricing. However, despite substantial support from planners and some policy makers, road pricing remains controversial, with many skeptics.

For road pricing to be implemented on a broad scale in the United States it will have to be supported by most people and elected officials. The following ten questions are the mile markers on possible paths to road pricing. The success, or failure, of road pricing proposals rides on how these questions are answered and how the issues raised in the questions are addressed. The outcome is in the hands of policy makers.

1. WHAT ARE THE OBJECTIVES?

This is the most important question. Objectives often discussed include less congestion and better mobility, new or increased revenues, and less driving (or vehicle miles traveled).

Using road pricing to improve mobility is perhaps the most understandable motivation for road pricing. Improved mobility, less congestion, faster travel speeds, and more predictable travel times are all widely supported objectives. If increased mobility is the core objective, then policy decisions need to be made and carried out to support and deliver this outcome.

What value will motorists paying the charge receive?

Another primary motivator for road pricing proposals is revenue generation. Although this may be the most inherent and assured result of pricing, it can only be achieved if the pricing proposal is accepted and implemented and if there are enough drivers using the priced facility to generate expected revenues.

And, for some, reduced driving (and reduced personal mobility in most cases) is a motivation for road pricing. Reduced driving – in and of itself – is not likely to be accepted as a reasonable or beneficial goal if it reduces mobility, if it reduces access to employment, commercial activity, services, and recreation, or if it reduces economic and social opportunities. These negative outcomes are a risk across broad swaths of many urbanized areas where convenient alternatives are not available for many trips, travel patterns, and needs.

2. “WHAT’S IN IT FOR ME?”

This is the essential, bottom-line question for most people – what value will motorists paying the charge receive? New lanes/capacity projects, for example, the construction of the SR-91 express lanes in Orange County, have inherent value for those paying to use the lanes – the lanes would not exist without the toll revenue to pay for them. For conversion of existing lanes, the “value question” can be more challenging. Some conversions can be relatively easy, like when the grossly underutilized carpool lanes on I-15 in San Diego County were changed to High Occupancy Toll (HOT) lanes. Adding tolls to existing non-priced, general-purpose lanes is much harder for most people to accept. For any road pricing proposal to be successful there must be direct, recognizable benefits for motorists paying the charge and no adverse impacts on those who choose not to or cannot pay the price.

3. HOW WILL THE MONEY BE USED?

Despite other possible objectives – it’s always about the money. Revenues derived from tolling should be used to improve mobility and benefit users within the corridor where the charges are collected. This can include paying for the capital costs of new priced lanes or routes, operating and maintaining the priced lanes, improving and expanding priced and parallel lanes and routes, and providing effective transit services.

4. WHAT ARE THE OPPORTUNITY COSTS OF ROAD PRICING?

The amount of money paid by drivers for priced road facilities will not be spent or invested elsewhere in the economy. This is the “opportunity cost” of redirecting these resources from other uses to tolls or congestion charges. In short, “there is no free lunch.” For pricing to be successful and for society to benefit, the individual and societal value derived from imposing prices on roads (primarily in terms of better mobility) must meet or exceed the total value that could have been derived from other uses of those funds.

5. HOW AND WHAT ARE PROPONENTS COMMUNICATING?

Positive and negative impacts need to be realistic and explained up-front, honestly, and in terms policy makers and the public can understand. If the objective is to improve traffic flow by changing behavior (route, time, or mode of travel) then people need to understand the level of change that would be needed to accomplish the objectives. And that level of change needs to be realistic and still meet people’s travel needs. Real,

meaningful input needs to be obtained from current and future users – those who will be paying the charges – and incorporated into plans. Failure to do so will set pricing proposals back many years, as happened in early development of carpool lanes when the public widely rejected the first HOV lanes, which had been converted from existing lanes.

6. WHAT ARE THE EQUITY IMPACTS?

How pricing impacts people of varying incomes is an important issue that should not be quickly swept aside. Oftentimes equity concerns are addressed by overly simplistic assurances that 1) even low income people will pay for faster lanes when they really need to be someplace on time and 2) revenue from pricing will be used to pay for public transit, which is predominantly used by people with less money. We effectively have a two-tiered transportation system in most cases now – those who can afford to, and can, drive and those who can’t. Pricing should not result in a three-tiered system based on wealth or income.

7. HOW MUCH SHOULD DRIVERS PAY, AND FOR WHAT?

There are really two parts to this question. One involves the amount and uses of taxes and fees currently and previously paid by motorists. The second involves how much motorists should pay in the future, and for what purposes.

Some argue that adding tolls to existing “free” lanes is essentially double taxation because motorists have already paid taxes to build the road. The issue is clearly more complicated than that because there are multiple sources of money used for transportation and because the United States has chronically underinvested in infrastructure

How pricing impacts people of varying incomes is an important issue that should not be quickly swept aside.

for years. However, addressing this basic concern about an additional motorist charge will have to be part of any serious pricing proposal.

There are many views regarding how much money motorists should pay in the future and how those funds should be used. For pricing proposals to be successful, the amounts and uses need to be reasonable, proportionate, and politically realistic. And pricing cannot be used as a reason to allow existing transportation funds to be redirected to other, non-transportation, uses.

8. DOES PRICING MEAN WE STOP BUILDING ROADS? IF NOT, HOW WILL WE STILL BUILD ROAD CAPACITY WHERE IT IS NEEDED AND POSSIBLE?

New road capacity for private and commercial passenger vehicles and goods movement will still be needed and can be done in some places. Pricing cannot be used as an excuse or replacement for not building needed and viable highway improvements, like adding truck lanes to serve busy ports, widening two-lane rural roads to improve safety, addressing long-standing bottlenecks, and completing carpool lane networks.

9. CAN PRICING IMPROVE TRANSPORTATION PROJECT DECISION MAKING?

Some argue that pricing will result in better project selection because market forces and investment analysis will be used to select projects. How can this happen if the agencies and boards now charged with making transportation investment and policy decisions retain and continue to exercise their authority? Without more fundamental changes, transportation decisions will continue to be made by local, state, and federal elected and appointed officials, who will continue to be influenced by myriad political pressures to build or not to build various projects. Pricing will not change this dynamic by itself.

10. IS CONGESTION A TRUE “EXTERNALITY”?

Time wasted in congestion is oftentimes labeled an “externality” that needs to be internalized through pricing. However, for congestion, those imposing the costs of wasted time on others are also those paying the price (in time) of sitting in traffic. Therefore, the time value of congestion is already internalized to all users (although it is not monetized). If so, there may be no or limited external congestion time cost to be internalized, or captured, by pricing.

However, economic theory and the “tragedy of the commons” tell us that under-priced or under-controlled public resources can be over-consumed to the detriment of all. This was certainly the case when overgrazing by farm animals in the public common land of communities resulted in the over-consumption of edible resources and the ultimate starvation and death of livestock. The analogy

Time wasted in congestion is oftentimes labeled an “externality” that needs to be internalized through pricing.

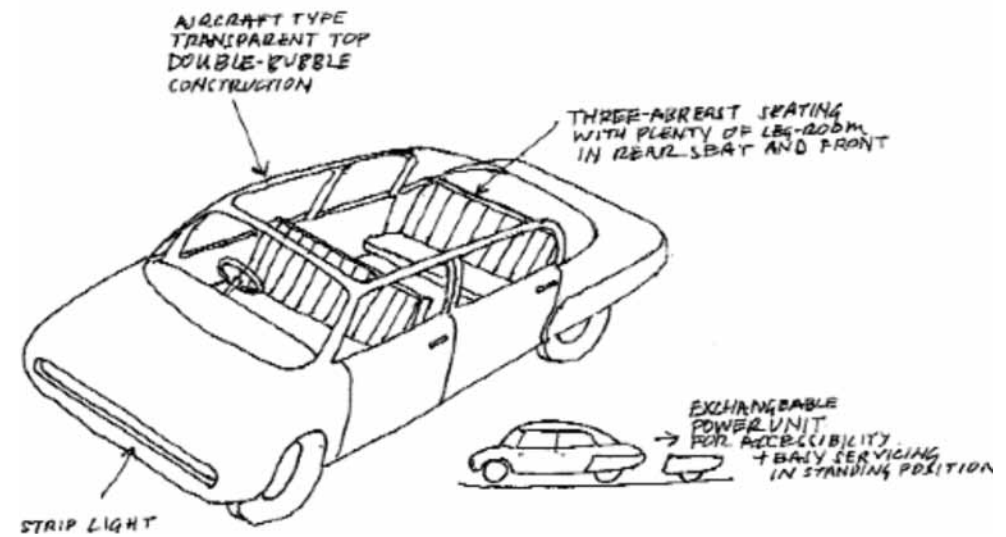
has been extended to driving, with motorists over-consuming a limited amount of road capacity (at any given time and place). But there are important differences. The “commons,” in the case of driving, is road space that may be insufficient at any point, but that is never consumed in a way that eliminates it for future users. Although congestion is harmful and frustrating, people do get to their destinations.

Moreover, society has a big toolbox, with many tools, that can be used to maintain and improve mobility over time. Tools include building and improving roads (essentially expanding the commons), providing effective transit services, facilitating non-motorized travel, and using technology to both increase system performance and – hopefully in the near future – to leap-frog many of our problems, for example through the use of automated or semi-automated vehicles – like the Google Car now traveling around – that can both substantially reduce congestion and, more importantly, dramatically improve safety.

The question now before us: Is road pricing a tool that will be employed to further mobility, and if so, in what forms will it be acceptable for most people and their representative government?

THE CAR OF THE FUTURE DRAWN FROM MEMORY AND A TRAFFIC UTOPIA THAT NEVER HAPPENED

John Chris Jones



Jonathan encouraged me to make a drawing of the 'car of the future'... this is the first time I've drawn it—what I sent to the competition in 1946 was a balsa-wood model.

A car of the future, as envisaged in 1946

Drawn from memory in 1998

OVER THE YEARS SINCE 1946 I've been watching car design to see if it has followed my prediction and by now it very nearly has (apart from the adequate leg room for passengers and the detachable power unit capable of being serviced in a comfortable posture while the car owner drives off with a newly serviced one).

Does this mean that the future forms of cars, and similar hardware, can easily be inferred from their present forms, fifty years ahead? I guess it does. And it also means, I suppose, that improvements proposed for people without economic power (in this case the back-seat passengers and the motor mechanics) are far less likely to be realised.

Looking now at this attempt of 1946 I realise that it lacks any trace of the traffic automation (in which cars and buses are replaced by automatic taxis and minibuses finding their own way through a city without congestion) that took hold of my thinking once I'd experienced some of the early computers around 1957. Nor does this 1946 vision take account

of the traffic accidents, parking problems, noise, air pollution, etc. which by now are turning many people against the car though as yet there is no good alternative. My car of the future doesn't even have seat belts and I had no conception of urban motorways, parking meters or multi-storey car parks!

*I conclude from this that, while it is easy to extrapolate existing designs and trends, it is difficult or even inherently impossible to anticipate how future people will react to misuses and side-effects. It seems to me now that determinism is a fact for as long as existing forms and attitudes can be stretched to accommodate the effects of increased numbers. But eventually, when the whole situation becomes so negative that people actually change their minds and motivations, the future becomes indeterminate and unpredictable (as perhaps it is at present). Especially when the rigid technology of wheels is supplemented by the flexible micro-technology of electronics... for 'all things become possible' if we are willing to change habits.

jcj march 1998 (slightly edited 2011)

PART 2: TRAFFIC AUTOMATION: A UTOPIA THAT NEVER HAPPENED

THE CENTRAL POINT OF THIS PROPOSAL

was to reject the present mixture of cars, buses, taxis, roads, traffic lights, traffic police, car parks, traffic meters, etc. as a hopeless failure, with its notorious 'insoluble' problems of congestion, parking and traffic accidents, not to mention pollution, etc., and the attempts to solve the problem by adding the urban highways and the multi-storey car parks which create 'the concrete jungle'. I took the first three of these problems of high-density traffic and asked myself if there were other kinds of crowded movement in which such problems do not occur. What came to mind were the movements of swarms of bees, flights of migrating birds, and the complex movements of people walking in all directions across a railway station plaza without slowing down, without colliding with each other, and without clogging the space with empty vehicles!

Why, I asked myself, are people in road vehicles so unable to travel smoothly and safely in high density when birds, insects, and people on their feet, can do so easily? The answer, I thought, is 'information'. Because the professions then responsible for city traffic (civil engineers, police, law-makers, and vehicle designers – this was in 1959) were each trying to solve the problem piecemeal by the inappropriate methods of pouring concrete, enforcing laws, and making feeble attempts to reduce the size and parkability, but not the number, of cars. The right solution, I felt sure, was to give to each driver and vehicle sufficient information and freedom of action to be able to steer clear of congestion before it became excessive, and to free everyone from parking difficulties by making each vehicle automatic enough to find its own way to the next people wanting to move, once its present occupants had got out. The automatic control of vehicles, through a magnetic tape embedded in the road, would remove

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railway station plaza
without slowing down*

the need for traffic lights and would make traffic collisions almost impossible. Car parks could be eliminated and the utilisation of vehicles could rise from, say, five per cent, as at present, to perhaps ninety per cent, as each vehicle would be moving most of the time, thus freeing-up most of the curb space for getting in and out wherever you wish and perhaps reducing the need to manufacture so many cars in the first place.

The result of this thinking was a scheme for complete traffic automation which could be introduced in easy stages over the twenty years from about 1960 to 1980 and would gradually reduce the main features of the traffic problem to nearly nil provided that the users of cars, taxis and buses could be persuaded to abandon their present vehicles for small automatic cars and minibuses which could be called to any phone or (transformed) parking meter from which the traveller indicated his or her position and destination. Each traveller would be given an expected arrival time at destination, depending on the density of traffic, and if this was excessive would have the choice of cancelling the request until a quicker journey became possible. In this way I proposed to provide each of the millions of minds, presently immobilised by information scarcity, the means to use its own intelligence, as in the

case of birds, bees, and people walking on a plaza ... this is what I call true decentralisation, or constructive anarchy. I think control from the centre is barbaric. It's useful only in emergencies.

THERE'S MORE TO THIS SCHEME

but I think I've said enough to show why I reject altogether the 'bad design' of city traffic, and indeed of industrial life as we know it, and why the kinds of solution I seek, though so beautifully fitting in theory, are so very difficult to realise. They cut against the vested interest of each of us in our specialised, paid, or sanctified roles as car owner, investor, car worker, civil engineer, policeman, lawyer, parking attendant, taxi driver, bus driver, etc., and they call for a scale of thinking, and of collective responsibility, that is far beyond what is encouraged in the culture as it is. Yes, it's courage we need, the courage to 'tackle the whole', but without imposing our preconceptions, and to live out the probably amazing consequences of doing so 'decentrally' and 'without control'. 'I made it without an idea', said Marcel Duchamp referring to 'the large glass', his central work. What I'm describing is I think art, the art of technology, unthreatening and free, the spirit of the time. Why not?

HOWEVER, ALL IS NOT HOPELESS.

Since about 1960, when the scheme became technically feasible (using the kind of electronics which was then being developed for the space program) many electronic fragments of the scheme have appeared piecemeal: the linking of traffic lights permitting tidal flow, automatic control of the distance between vehicles, electronic maps in cars to show congestion, parking places, etc. Unfortunately, these bits and pieces are being allied with ideas such as road pricing, and automatic surveillance, and central control, that show none of the equality and trust that are possible if these sub-solutions are linked together in a cybernetic and democratic anti-plan for collective intelligence, such as 'true' traffic automation allows. Again: the need to change our minds. When will it happen? And where is the selfless kind of non-directive leadership that could make it possible? I believe they're to be found in

Many electronic fragments of the scheme have appeared piecemeal: the linking of traffic lights permitting tidal flow, automatic control of the distance between vehicles, electronic maps in cars...

the work of socially-minded artists like John Cage and Joseph Beuys and in the unspoken thoughts of many.

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John Chris Jones, 'the future of breathing', in designing designing, Architecture Design and Technology Press, London 1991. pages xvii to xlv. Copyright has reverted to the author. This is an essay on 'my life with the car', and a correspondence with Edwin Schlossberg and Erwin van Handenhoven, in wide-ranging discussions of traffic automation ... and with extensive references.

John Chris Jones, the internet and everyone, ellipsis, London 2000. Copyright has reverted to the author from whom copies may be obtained by writing to jcj AT softopia.demon.co.uk (please replace AT and spaces by @). The above text and drawing is an edited and shortened version of pages 210 to 201 and 46 to 50

HISTORY & PROJECTIONS:

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FLEET TURNOVER

DESIGN

CARS

INDUSTRY REGULATORY TECHNOLOGY

ROADS

TOLL ROADS

HIGHWAYS

TRANSIT

PARKING

FEDERAL

LOCAL

PLANNING

REGULATORY

DEMOGRAPHICS

INFRASTRUCTURE

1896

Gottlieb Daimler builds the first motor truck. Daimler's truck had a four-horsepower engine and a belt drive with two forward speeds and one reverse.

1891

William Morrison of Des Moines, Iowa builds the first successful electric automobile in the United States.

1897

First known automobile operating in Los Angeles

1880

First paved road, Main Street, opens in Los Angeles

1880

Santa Fe Roalroad completes a second trans-continental rail line into Los Angeles

1880

Rail line extended between the City of Los Angeles and San Pedro

1895

Henry Huntington develops the first segment of the Los Angeles Interurban railway

1869

First bicycle appears on the streets of Los Angeles

1859

First railway in Southern California opens.

1885

First massive migration of Midwesterners into Southern California

FLEET TURNOVER

1933 - U.S. AUTO REGISTRATIONS 22,000,000

1900

Of the 4,192 cars produced in the United States, 28 percent are powered by electricity, and electric autos represent about one-third of all cars found on the roads of New York City, Boston, and Chicago.

1912

Charles Kettering invents the first practical electric automobile starter.

1912

Manually operated traffic signals first appear in Salt Lake City, Utah.

1913

Peerless introduces a centrifugal governor advertising "maintain speed whether up hill or down."

1920

U.S. AUTO REGISTRATIONS 800,000

California State legislature authorizes the painting of center lines on highways

1924

First national conference on street and highway safety recommends white on red background for stop signs

1924

"Major Street Traffic Plan", first proposed parkways across Los Angeles. Arroyo Seco Parkway proposed

1924

Peak mileage & ridership of PE streetcar system

1910 - U.S. AUTO REGISTRATIONS 500,000

1924

Los Angeles begins annexation of neighboring cities

1922

Board of County Supervisors creates LA County Regional Planning Commission

1909

Zoning first utilized in the City of Los Angeles.

1900 - U.S. AUTO REGISTRATIONS 8,000

1910 - U.S. AUTO REGISTRATIONS 500,000

1926

Model A - begins era of "planned obsolescence", renewable car purchases, design enters into manufacturing processes

1933

Buckminster Fuller's Dymaxion designed

First production SUV is introduced by Ford.*

First cloverleaf interchange built between two major roads in New Jersey

1929

Nation's first network signal timing strategies developed in downtown Los Angeles

1929

First cloverleaf interchange built between two major roads in New Jersey

1935

Oklahoma City, OK installs first parking meters, 150 in all

1926

US Highway System adopted, spurs construction of US route 99

1930

Los Angeles City ordinance 66,883 creates Bureau of Street Traffic Engineering

1930

Olmsted-Bartholomew Plan for the Los Angeles

1925

McClintock's new traffic code approved by city voters, including formalized use of painted curbs, legalized right turns on red after stopping, and pedestrian obedience of traffic signals

1935

Ramona Boulevard opens, first "airline" route permitting 50 mph speeds with no intersection conflicts

1939

Ramona Boulevard opens, first "airline" route permitting 50 mph speeds with no intersection conflicts

1940

Arroyo Seco parkway is completed. Connects with Harbor, Hollywood, and Santa Ana Parkways

1944

San Bernardino Freeway opens. Eventually I-10 will stretch coast to coast.

1947

Plans for world's first 4-level grade separated interchange made public. 101/110 Interchange finally built, five years later

1942

Union Square Garage opens in San Francisco, becomes first underground parking garage independent of a structure in the nation

1938

California state law authorizes non-stop roadways

CA increases gas tax to pay for state freeways

1947

Wartime migration for manufacturing labor

1940

Loss of racial covenant south of Stausson

1948

First left turn lane striped in Los Angeles

1947

First modern freeway signs installed on Santa Ana

1949

Fwy (I-5)

Figueroa Street Bypass reaches downtown Los Angeles. Figueroa Street becomes longest street in the City. Temple Street grade separation becomes first diamond interchange built in Southern California

FLEET TURNOVER

DESIGN

INDUSTRIAL REGULATORY TECHNOLOGY

Ford introduces safety belts and padded dash boards.

1956

1964

Ford introduces the Mustang

1963

US mandates lap seat belts in cars

1965

Unsafe at any Speed by Ralph Nader

1971

Chrysler Introduces computerized ABS (Anti-Lock Braking System) on the Imperial

Switch to Catalytic Converters

1975

Introduction of Unleaded Gas

Mercedes Benz introduces the front air bag.

1981

Chrysler introduces the Plymouth Voyager, the first 'Minivan'

1984

Safety Belts use required by driver.

California Air Resources (CARB) mandates Low-Emission Vehicle (LEV I) Program

1990

Mitsubishi offers laser-based ACC system in Japan with the Diamante. Marketed as "Preview Distance Control", this early system did not apply the brakes and only controlled speed through throttle control and downshifting.

California Air Resources (CARB) mandates Low-Emission Vehicle (LEV I) Program

1997

Honda introduces Civic GX, first commercially available natural gas vehicle. Consumers in California and other states.

1996 1998

Mitsubishi offers laser-based ACC system in Japan with the Diamante. Marketed as "Preview Distance Control", this early system did not apply the brakes and only controlled speed through throttle control and downshifting.

\$498 million Harbor Freeway Transit Way opens 10.3 mile bus and carpool facility in and sometimes above the 110 Freeway median

1996-ISTA

1995

Traffic Calming

Chrysler offers Electrojector on the 1958 Chrysler 300D, Dodge D500, Plymouth Fury, and DeSoto Adventurer, arguably the first series-production cars equipped with an EFI system. However most of the 35 vehicles sold are retrofitted with carburetors.

Sepulveda Boulevard underpass running beneath LAX first tunnel of its kind.

1953

1958

Chrysler introduces the first modern cruise control on the Imperial

City of Los Angeles begins installing overhead freeway guide signs. Signs based on "lane assignment/action" roadway engineering concept.

1955

1956

1958

Interstate Highway act passes with Intra-urban segments, HWY Trust Fund, and 9:1 Federal/State funding

1961

Peak of CA HWY expenditures per 100 VMT.

1961

Last Red Car trolley lines ceases operation

"Botts Dots" appear on stretch of US 99 outside of Fresno. These raised circular lane markings become main form of freeway striping.

1953

Metropolitan Coach Lines acquires Pacific Electric's passenger service franchise.

Embarcadero Fwy opens in San Francisco

1972

Speed Bumps

1974

I-10 Failed Diamond Lane Pilot

Carpool lanes implemented on Santa Monica freeway, and later removed due to political backlash. Unofficial consensus that no existing lanes will be used for carpool lanes.

1976

First Southern California HOV lane [I-10 Busway between El Monte and Downtown LA] opened to carpools of 3 or more persons.

1986

CA reformulated gasoline

1984

City of Los Angeles implements initial phase of ATSAC (Automated Traffic Surveillance and Control), first system to monitor traffic flows and automatically change timing plans of signals.

1986

Groundbreaking for Metro Red Line Subway system

1988

Roger Smith, CEO of G.M., agrees to fund research efforts to build a practical consumer electric car. G.M. teams up with California's AeroVironment to design what would become the EV1.

1990

Metro Blue Line light rail opens between Downtown LA and Long Beach

1991

Embarcadero Fwy demolished

91 Toll Lanes

1995

1992

Metrolink begins operations connecting 5 counties with 11 stations over 112 miles of track. Southern California Regional Rail Authority (SCRRA) establishes unique business model. The authority only owns the rolling stock. Stations are owned and operated by partner cities, and all tracks are owned by either County Transportation authorities or freight companies.

1986

TCA forms in OC

Los Angeles Olympics City and county implement dramatic Transportation Demand Management program

1984

MTA begins operation, as the first public transit agency to serve Los Angeles County

1958

1959

DMV sends out 2.8 million travel surveys in LA, Orange, and Ventura county

1964

Congress passes Urban Mass Transit Act providing capital grants for up to two-thirds of transit capital improvements

1967

California establishes the Air Resources Board (ARB)

1969

CEQA signed into law

1970

NEPA

1980

Los Angeles County voters approve Proposition A, which increases sales tax by one-half cent to develop multi-modal transit system.

FLEET TURNOVER

DESIGN

INDUSTRY
REGULATORY
TECHNOLOGY

ROADS

TOLL ROADS

INFRASTRUCTURE

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LOCAL

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TRANSIT

PARKING

FEDERAL

LOCAL

POLITICS

PLANNING

REGULATORY

DEMOGRAPHICS



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1st Saturday
of every month

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Aug 6th

Sept 3rd

Oct 1st

Nov 5th

Dec 3rd

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CONTRIBUTORS

MARCO ANDERSON is a regional planner with the Southern California Association of Governments (SCAG). He currently works in the Comprehensive Planning division integrating land use and transportation policy. Mr. Anderson is currently the project manager for over ten SCAG-funded local land use plans and studies, and the Toolbox Tuesdays program of training sessions for planners from the SCAG region. Marco lived car-lite in the OC for eight months, but was tempted back into two-car ownership with the arrival of the 2011 Kia Soul and the commuting needs of a toddler in suburbia. He still can be seen riding to the train station on his modified 1988 Schwinn Circuit with steel-lugged frame.

COLLEEN CORCORAN is a graphic designer and design educator in Los Angeles. Her design and advocacy work focuses on ways to use design as a tool for education and positive change within the urban environment. She has collaborated on projects with a variety of public agencies and community organizations around LA, including the Los Angeles Metro's in house Design Studio, The City of Santa Monica Bike Program, The Museum of Contemporary Art, The Center for the Arts Eagle Rock, and the Green LA Coalition. Her graphic design work has been published in GOOD, Print Magazine, Design Mind and other print and online publications. She is a co-founder and board member of CicLAvia, an organization that opens several miles of LA's streets as a temporary park space on Sunday mornings.

SEAN DONAHUE is principle of ResearchCenteredDesign, a Los Angeles based design practice and Core Faculty of the Media Design Matters track in the Graduate Media Design Program at Art

Center College of Design in Pasadena, CA. Sean has accumulated a portfolio of projects that, through their execution, question how and where design is able to make a significant contribution. His persistence in moving from theory to practice has resulted in projects ranging from media impact studies for urban development to communication spaces that facilitate community lead outreach. Sean's work most recently has been included in the Cooper Hewitts' 2010 Design Triennial "Why Design Now?," the 2011 California Biennial "Action/Reaction," and acquired for inclusion in the Smithsonian permanent collection.

STEPHEN FINNEGAN has over 20 years of experience in transportation, finance, business, and advocacy. His career includes work as a financial analyst with Bank of America, positions in planning and operations with the Los Angeles County Metropolitan Transportation Authority, serving as a management consultant to public agencies and non-profit organizations, and leading government affairs, community relations, traffic safety, advocacy, and public policy work for the Automobile Club of Southern California. Mr. Finnegan received a Master of Arts degree in urban planning from the University of California at Los Angeles and a Bachelor of Arts from Claremont McKenna College. Steve loves to walk and takes transit and bikes when he can, but he treasures the freedom and opportunities that come with driving his own car – a 2008 Prius.

CHRISTOPHER J. GRAY, AICP, is a Senior Associate with Fehr & Peers Transportation Consultants working out of their Irvine and Riverside offices. He has 15 years experience in multi-modal transportation planning, corridor studies, travel demand forecasting,

CONTRIBUTORS

parking studies, transit studies, and Smart Growth. His work includes projects in California, other states in the US, and even international locations. He is a member of many professional organizations related to land use and transportation planning including APA, CNU, ULI, and AEP. Chris enjoys planning and using all modes of transportation ranging from automobiles to trains to cruise ships and underwater modes such as scuba diving.

A native of South Los Angles, **TERRY HAYES** grew up with a strong affinity to cars encouraged by both his parents. Terry's excitement about cars lead to an epic drive in a small Fiat from LA to Boston as he began his professional planning studies at the Harvard GSD. With a Masters in City Planning, Terry continued his interest in cars and his training in community impact in work with Alan Voorhees, Skidmore Owings and Merrill, and Gruen Associates. This focus has continued with Terry's own firm (founded in 1984) where his interest has broadened to include the assessment of the community and environmental justice impacts of most forms of transportation infrastructure (highways, railroads, as well as bus and rail transit. Outside of work, Terry has restored a classic 1967 mini. And for fun he races his Ferrari P3 in a computer simulation of the historic 400-mile Sicilian Targa Florio.

JOHN CHRIS JONES was born in Wales in 1927 and lives in London without a car but with a free pass on buses and trains throughout the city. He was formally educated in engineering, art and ergonomics and self-educated in design through childhood projects such as building a hut, an air raid shelter, a canoe, and a primitive cinema in the attic... his car of the future which appears in this book was a balsawood model

which won a prize in a public competition in 1946. His design for the automation of road traffic was entered in another competition in the early 60s. It has yet to be realized as a complete system but is appearing in bits and pieces. His best known book Design Methods 1970/1980/1992 is still in print and has appeared in Japanese, Spanish, Polish, Romanian, Russian and Chinese. His latest book, The Internet and Everyone, and his news letter Daffodil, can be obtained via his website: www.softopia.demon.co.uk.

BRIAN JUDD

SANG-EUN LEE lives in Los Angeles. She has grown up in Korea. She studied English and French Language and Literature in Seoul, Korea before she went to Art Center for studying Transportation Design. Her creativity and eager desire for sustainable world let her come up with an idea of Origami Manufacturing process for the future transportation design. She worked as design intern at BMW designworks in California and Renault Samsung in Korea. She recently graduated from Art Center with a degree of transportation design. She still challenges to become a transportation designer who can instill a soul into future cars in order for a buyer to identify him/herself better with it and at the same time in order to be harmonious with the environment. She has Ford Taurus 2001 which has been her bed, cafe, truck and her best friend during her Art Center life.

STUART MACEY Is a senior studio engineer with Hyundai Design America in Irvine and is also a part time faculty member at Art Center College of Design in Pasadena, teaching Vehicle Architecture to transportation design students. His career in the automotive industry has spanned three

CONTRIBUTORS

decades, designing cars & trucks for over thirty brands in five countries. He also co authored "H Point, the Fundamentals of Car Design and packaging". He studied engineering at Highbury Technical college in England whilst serving an apprenticeship with Vosper Thorneycroft, building and designing hovercraft structures. In 1979 he transitioned into the car industry as a body engineer with Pressed Steel Fisher (Rover) and subsequently worked around the globe as a studio engineer and designer for numerous clients such as; Volvo, Honda, Renault, Kia, Opel, Mazda, Ford, Porsche, Mercedes, Audi, Chevrolet, Daf trucks, Chrysler, Jeep and Dodge.

STEVE MAZOR - audiophile and Trekkie - is the Chief Automotive Engineer at the Automobile Club of Southern California. He has served as manager of the Club's Automotive Research Center (ARC) in Diamond Bar, California from 1985 to present. The ARC is a state-of-the-art automotive emissions/fuel economy/performance laboratory producing research on subjects including fuel economy, emissions, cost of operation, vehicle technology, safety, maintenance/repair, air quality, and aftermarket products. Steve was test engineer on the electric and hybrid vehicle project as well as the US Army methanol fuel project at the Jet Propulsion Laboratory from 1980 to 1986, and fuel system development engineer for Ford in Michigan from 1978 to 1980. Steve received a Bachelor of Science degree in automotive engineering from UCLA in 1978 and led a team there that designed, built demonstrated, and campaigned several hydrogen fueled passenger cars. He served a year as Chairman of the Southern California Section of the Society of Automotive Engineers.

SHANNON SANDERS McDonald is a practicing licensed architect and Assistant Professor in Architecture at Southern Illinois University in Carbondale exploring the future of mobility, sustainability and design. Shannon's book *The Parking Garage: Design and Evolution of a Modern Urban Form* published by the Urban Land Institute, was the basis for an exhibit at the National Building Museum titled *House of Cars*. She is a frequent speaker on architecture, parking, transportation, sustainability and community issues including The Library of Congress, the American Planning Association and the American Institute of Architects. Shannon is a 1992 graduate of the Yale School of Architecture, and worked with Carol Ross Barney in designing the award-winning Little Village Academy, in Chicago. She has also worked on many other community and transportation-related projects. Being in motion to understand our world is her top priority.

MONICA NOUWENS' extensive print photography work and films can be found in various collections worldwide. Amongst them are Stedelijk Museum, Amsterdam / Salvatore Ferragamo, Florence / Levi's, London / Prada - U.S.A Corp, New York / Imaginary Forces, Los Angeles / OMA, Rotterdam / Michael Maltzan Architecture, Los Angeles / Jon Jerde Partnership, Venice / Bartle Bogle Hegarty, London. Nouwens' solo exhibition *Rubbernecking* was displayed at the Stedelijk Museum Bureau Amsterdam. Other exhibitions include her recent exhibition at the Netherlands Photography Museum Rotterdam, the Netherlands Architecture Institute, Stedelijk Museum Helmond, Gallery Paul Andriess in Amsterdam and Trafalgar Square, London for World Aids Day. Nouwens was a lecturer at the Southern California Institute of Architecture (SCI-Arc).

CONTRIBUTORS

Her career has included publication in a number of magazines such as *Icon*, *Volume*, *Re-Magazine*, *Blueprint*, *Archis*, *Surface* and many others. Nouwens completed a postgraduate fellowship in Art Media Studies at the Rijksakademie in Amsterdam and attended the California Institute of the Arts exchange programme for film and photography, where she developed a fascination with California's urban landscapes. Monica has a car. Her website is www.paradox.nl/lookatme

SIMON PASTUCHA lives in Los Angeles without a car. He heads the Urban Design Studio of the Los Angeles Department of City Planning. He began 20-year career after graduating from California State Polytechnic University Pomona with a degree in Landscape Architecture with an emphasis on ecosystematic design. He was part of the core team that developed the first context sensitive street solutions in the city. Simon implemented new design details in the City Engineer's Street Standard plans and now works on creating simplified processes for the adaptation of roadways, flexible development standards for new construction and a community-based vision for the City. He teaches, lectures and writes on the subject of urban design and adaptation of cities.

Kati Rubinyi is Senior R&D specialist with The Planning Center, an Orange County based urban planning firm. She is project director of the Car Future Group and the founder of the non-profit Civic Projects Foundation. Her goal is to draw others into experimenting with new approaches to urban planning issues. Prior to joining The Planning Center, Kati was an instructor in architectural history and design. This followed ten years as an architect and architectural intern working on mostly institutional buildings. Originally from Montreal,

Canada, Kati has a B.A. in philosophy and a B.Arch. degree in professional architecture. She received architectural registration in 1998 upon which Kati moved to Southern California to attend the Art Center College of Design's graduate fine art program, receiving an MFA in 2002. Chances look good that in 2035, Kati will still be driving that most glamorous of vehicles; a 2004 Honda CRV.

JOHN STUTSMAN, who grew up in Indianapolis within earshot of the Indy 500 and later sold newspapers on race day during the glory years of the Offy Roadsters and the inimitable supercharged V-8 Novi race cars, at one point considered attending the General Motors Institute. Instead, he pursued mechanical engineering at Purdue University. Discovering that his interests were more in the area of fluid mechanics and heat transfer, he had a brief stint in aerospace engineering working on both launch and re-entry vehicles. Recognizing that this was important work for the nation, but not for him, he returned to school to pursue urban and regional planning at USC. Though an auto enthusiast, his professional career has focused on urban transit projects, which provide a viable alternative to our auto-dominated and increasingly grid-locked and fragmented communities. John is a principal at the transportation planning firm Fehr and Peers.

A former London bus driver [routes 43 and 134] **JOHN THACKARA** is a writer, educator and design producer. He is the author of *In The Bubble: Designing In A Complex World* (MIT Press) and of a widely-read blog at designobserver.com. As director of *Doors of Perception*, John organises festivals around the world in which communities imagine sustainable futures - and take practical steps to realize them. The most recent *Doors*, in Delhi, was about food systems and

CONTRIBUTORS

design; this brought together paradigm-changing designers, technology innovators, and grassroots innovators. John - a Brit who now lives in southern France - studied philosophy, and trained as a journalist, before working for 10 years as a book and magazine editor. He was the first director (1993-1999) of the Netherlands Design Institute in Amsterdam, and was program director of Designs of the Time (Dott 07), a new social innovation biennial in England. John is a Fellow of The Young Foundation, the UK's social enterprise incubator, and sits on the advisory boards of the Pixelache Festival in Helsinki and the Pecha Kucha Foundation in Tokyo. He is also a member of the UK Parliament's Standing Commission on Design.

BILL TRIMBLE grew up in Lakewood, California, an early post-WWII suburb where he could go almost everywhere on his bicycle. He has worked for more than twenty years as a land use planner with the City of Pasadena, California. In the twenty-two years between Lakewood and Pasadena, he learned to walk at the University of California, Berkeley and then in cities from Albuquerque to New Haven. He continues to learn. Pasadena's specific place in the Los Angeles region gives him plenty of opportunities to consider how people get from one place to another. In Pasadena, he gives much of his attention to the connections, historical and future, between the city and the rest of Southern California.

After a successful global career as a car designer and now a transportation design educator, Geoff Wardle is passionate about bringing visionary design and systems thinking to future transportation solutions. He believes designers should lead the

facilitation of the many disciplines required to create smart, sustainable and fulfilling mobility. He is particularly interested in the research and development of autonomous road vehicles, which he believes could be the silver bullet for the automobile industry and for sustainable personal mobility. He is cofounder of OnGoing Transportation and consults with select vehicle manufacturers on design and innovative product development strategies. Geoff is also Director of Advanced Mobility Research at the renowned Art Center College of Design in Pasadena, California. Having enjoyed his time as a car designer, Wardle is now repenting for his sins by focusing his energies on solving the issues that automobiles bring to the world as well as their pleasures.

ILLUSTRATIONS BY

p. xx Mr. Artistic Precision , Adam Porrino

p. xx Dolly Crespo

THANKS TO

Ewan Branda, Rob Tallini, Anita Pace,
Tim Durfee, Valerie Watson, Ken Chafin,
Marshall Glick, Heather Glick,
David DeRosa, Robin Gilliam, Geoffrey Mak,
Mitch Wyzgowski, Michelle Katz, Jered Gold,
Elizabeth Collins

PARTIAL FINANCIAL SUPPORT

The Auto Club of Southern California

Art Center College of Design

The Planning Center

Fehr and Peers



