Good morning, SANDAG Board. My name is Howard Myers and I am a lifetime resident of San Diego County, having resided here for most of my 75 years. Thank you for the opportunity to provide comment on the Vision for the 2021 Regional Plan, which will shape our region for decades to come.

Every San Diegan deserves access to high-quality transportation and economic mobility, and today, that does not exist. COVID-19 and the economic crisis have only further revealed the unacceptable inequalities that have plagued our communities for far too long.

We urge SANDAG to adopt a Regional Transportation Plan (RTP) that:

- provides a world-class transit system for all San Diegans
- promotes racial and economic justice
- cleans our air and decreases vehicle miles driven
- reduces greenhouse gas emissions towards a Zero Carbon future
- stops the climate crisis!

Despite the sudden and tragic consequences of the coronavirus crisis, I urge you: **move forward** with an RTP that reduces emissions and stops climate change. This is your opportunity to finally take bold action to build a greener, healthier, prosperous, and more just future in San Diego. Thank you.
CAUTION: This email originated from outside of SANDAG. Do not click links or open attachments unless you are expecting the content.

I am a resident of San Diego County.
I oppose any attempt to reduce green house gases through elimination of private care ownership.
RUC will charge users of paved roads in the county and add expense to all users of the road. I assume governments will be exempt from road use charge leaving private residents to pay the charge.

Cries of global warning are real because in artic areas where snow and ice have melted, houses, farms and roads are being revealed. It seems that we are enjoying a time of restored land availability

I don’t think the end of our species will result in our green house gases in this county.

-Bill

This email was made possible by the Veteran's Administration.
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Steve Vaus, Chair of the SANDAG Board
c/o Clerk of the Board

Please acknowledge receipt with any feedback.

PUBLIC COMMENTS FOR INCLUSION IN THE RECORD:

Dear Mr. Steve Vaus, Chair, and SANDAG Board of Directors:

VISION for the 2021 Regional Plan

Good Morning Everyone. I am Phil Birkhahn, retired civil engineer from Rancho Bernardo. Thanks for the chance to speak. Today I speak as member of San Diego 350.

Staff’s vision for our 2021 Regional Transportation Plan is finally here. It will guide detailed work presented in the final plan next year.

It is a good long-term plan that I fully support pending those details. I think it is likely to meet the 19% GHG reduction requirement set by the state.

Those GHG goals drive priority changes if San Diego wants to keep its share of State funding. Adjusting projects called out in 2004 should be expected, however many times the Board votes to prioritize them as originally conceived.

Managed Lane versions without expanding the right-of-way are a good choice.

We also need to add a kind of Early Action Program to provide relief to our largest EJ communities south of I-8 to the border.

A lot can be accomplished in the next two or three years, while we get Covid under control and see where travel demand is going. I nominate the following projects:

- Managed Lane demonstration project on a few miles of SR-52,
- Implement the bus plan in MTS ElevateSD2020, and frequency and schedule span on the Blue Line,
- Identify and implement similar improvements for a few routes in North County, and
- Prepare a detailed plan for part of the proposed fast commuter rail along the I-805 alignment from south Chula Vista to Sorrento Valley, which I am certain will benefit the most people.

Rush-hour traffic on four freeways from the south county residence zone to the mid-county employer zone is our largest traffic jam by far. Yet the Board gave it no prioritization. It should do so now.

Respectfully,
Phil Birkhahn
From: Karl Aldinger
To: Clerk of the Board
Subject: August 14, Board Meeting Public Comment Item 3
Date: Thursday, August 13, 2020 1:53:00 PM

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Members of the SANDAG Board and Staff,

We get distracted, and some of us ask, “What’s in it for me”, or “How can we consider something this big when money is tight and people are suffering?”

But it is our responsibility as those who are planning for the future, to not get distracted, to remind ourselves what planning is, and who it affects, our community.

Climate Crisis will hurt us, and it will forever affect our communities deeply. If you came to this meeting believing that simply expanding or lightly modifying our freeways is our solution, I challenge you to dig deeper and understand the magnitude of our situation.

It is up to us to invest, today, because we plan for others. The 5 Big Moves is that investment. I hope that some of the proposed highly efficient commuter rail that we’ve seen stripped out of the most recent vision, is revisited. I hope we have the courage and conviction to plan with the magnitude of change that Climate Crisis demands of us, because small gains of reducing car travel will not be enough.

Despite my reservations about some details, I know that the 5 Big Moves is the foundation we need for a comprehensive rethinking of how San Diegans commute and travel. We are morally responsible to fight for everyone with a bold plan for our inevitable decarbonized future.

Sincerely,

Karl Aldinger
Conservation Organizer
Sierra Club San Diego
760-331-7885

Pronouns: He, him, his
Hello SANDAG Board Members,

Thank you for providing an opportunity for public comments on the Vision for the 2021 Regional Plan.

Every San Diegan deserves access to high-quality transportation and economic mobility, and today, that does not exist. COVID-19 and the economic crisis have laid bare the unacceptable inequalities that have plagued our communities for far too long.

We urge SANDAG to adopt a Regional Transportation Plan (RTP) that:

- provides a world-class transit system for all San Diegans

- promotes racial and economic justice

- cleans our air and decreases vehicle miles driven

- reduces greenhouse gas emissions towards a Zero Carbon future

- stops the climate crisis!

Despite the sudden and tragic consequences of the coronavirus crisis, I urge you: move forward with an RTP that reduces emissions and stops climate change. This is your opportunity to finally take bold action to build a greener, healthier, prosperous, and more just future in San Diego. Thank you.

Regards,

Gwen Fish
August 14, 2020 - SANDAG Board of Directors ITEM 3

Item 3: 2021 Regional Plan - Comments from BikeSD

BikeSD is supportive of SANDAG’s 5 Big Moves and the proposed vision of the 2021 Regional Transportation Plan. We urge that the Board of Directors move forward with this framework, which represents a revolutionary change in how San Diegans could get around. Once implemented it would create meaningful alternatives to single-occupancy automobiles, which our region is so dependent on today.

This is an unique opportunity to bring San Diego into a more equitable, sustainable and prosperous future with a transit system that works for everyone. The impacts of the coronavirus pandemic have made our regional disparities more glaring, with communities of color seeing the disproportionate share of COVID-19 cases and negative economic impacts like job loss. Many of these same communities have historically been left out of transportation infrastructure investments and going forward, that’s where the investments are needed first.

We cannot achieve our regional climate goals without addressing the fact that over 40% of our region’s greenhouse gas emissions come from the transportation sector. We need significant investments in alternative transportation that includes commuter rail, light rail, rapid bus, walking and especially biking. BikeSD believes this plan will get us there and we are ready to advocate for projects to implement it and we are ready to work with SANDAG on realizing a connected and safe bicycle network.

SANDAG must move forward with a bold plan that addresses the racial and economic disparities in our region while ensuring meaningful progress towards California climate targets. Let’s get to work.

Thank you,

Kyle Heiskala
Interim Executive Director, BikeSD

Kyle Heiskala
Interim Executive Director
BIKESD
e: director@bikesd.org
c: (619) 300-9484
August 14, 2020 - SANDAG Board of Directors ITEM 3

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SANDAG must move forward with a bold plan that addresses the racial and economic disparities in our region while ensuring meaningful progress towards California climate targets. Let’s get to work.

Thank you,

Kyle Heiskala
Interim Executive Director, BikeSD
Public comment for item #3.

I am David Harris, a resident of La Mesa and a member of San Diego 350, a grassroots climate advocacy organization. Now is the time to envision and plan for a better transportation future. We can build a world-class transportation system that provides clean, efficient, and affordable alternatives to our current system. As a society we have been warming our planet through human activities for the past 200 years, it is imperative that we find solutions now to drastically reduce carbon emissions during the next 15 years. Since transportation accounts for 55% of emissions, we have to transform the ways we commute to work, school, and around town. That is why I support the bold new vision contained in the 2021 Regional Plan.

(David Harris, 8815 Mariposa St, La Mesa, CA 91941)
Honorable SANDAG Board Chair, Board Members, and Staff,

I. 3-Minute (350 Words) Summary Speech

I have had the honor and privilege to comment on SANDAG’s 2007, 2011, and 2015 RTP. Thanks primarily to AB 805 and Executive Director Ikhrata, the 2021 RTP may give humanity hope for the future.

I fully support what is contained in the RTP Vision’s 5 Big Moves (the “RTP Vision”).

However, given our climate emergency, the RTP Vision must include more.

The “Key Considerations” near the top of the August 14th RTP Vision, identifies the SB 375 driving-reduction mandate from CARB and says that capital investments alone will not achieve that mandate.

It says:

innovative policies, programs, and technologies will be a necessary component of the 2021 Regional Plan

And:

a discussion of those components will be brought forward this fall

However, given the cold, hard fact that CARB’s 2035 target (a 19% driving reduction) does NOT support climate stabilization (shown below) and the fact that cars and light-duty trucks emit the most greenhouse gas (GHG), we must state the most important requirement of the 2021 RTP Vision: the RTP Vision must conform to a set of enforceable measures to ensure that cars and light-duty trucks support climate stabilization, because climate destabilization would end most life forms on Earth, including our own species.

We have a climate emergency. For example:

1. We are losing our Amazon rain forests, which sequester a large amount of carbon and
2. We are melting our permafrost, a process which will eventually release enormous amounts of methane gas, a powerful greenhouse gas (GHG).

At some point, these processes will become irreversible. Our first climate stabilization requirement (sometimes called a “target”) is that the industrialized world must emit GHG at a level that is 80% below what it emitted back in 1990, by 2030. If the industrialized world fails to do this, nothing humanity could do would prevent the earth’s climate from transitioning rapidly to one that will not support our species. Mostly, we will starve.

SANDAG Board, please ask your Director to produce an RTP that will support climate stabilization at a livable level. This can be done, as shown in the rest of this email message. The Vision needs additional measures.

II. Additional Introductory Comments

Please read the Resolutions attached to this email as the 3rd and 4th attachments. As you may know, similar resolutions are being proposed for the San Diego County Democratic Party. The parking resolution describes the same system proposed by the Sierra Club in their lawsuit challenging the County’s bogus CAP. Our gas tax is wildly regressive and has no future. California needs a Road Use Charge (RUC), ASAP. We want a good RUC; not a bad RUC. Transit cannot compete against an unfair system. All lanes become managed!

Reading this email will be a good refresher on climate literacy and transportation policy. If you are an elected official, your staff should read it. We live in serious times.

This email is a more complete explanation as to why these resolutions are needed than the “Whereas” statements that are in the resolutions, which are around 400 words. Reading this email is a big request but we all know that climate change is an existential-near-certainty and we have to do more than we might like. ASAP. Please.

The 3rd and 4th attachments are the resolutions for your consideration.

So here we are, with this question: why in the world would we want to support systems to improve the way California drivers pay for the use of roads and parking and put these systems into your 5 Big Moves and the RTP? That is shown in the first attached file, which has been peer-reviewed by the Air and Waste Management Association (AWMA). I presented the paper at a virtual conference. The AWMA’s reputation was on the line. The AWMA had reviewers read the report and ask me questions about my assertions, my derivations, and my assumptions. The paper is about how we could implement a set of enforceable measures causing cars and light-duty trucks to achieve the CO2 emissions level that is the first (2030) climate-stabilizing target. The target is necessary but not sufficient. There is a later target for zero net GHG emissions. However, if we fail to achieve the 2030 target, the later target won’t matter. The paper derives the 2030 target from a clear statement from our best climate scientist. The 2nd attached file is the Power Point presentation of the paper.

I am going to summarize what is in the paper, so you don’t have to read the paper.

I will start here:
III. Characterization of the Climate Problem to Be Solved

Humanity must stabilize the climate at a livable level. Otherwise we will suffer a “devastating collapse of the human population” to quote from *Scientific American*. If the temperature is 120 Deg. F and if there is sufficient humidity, for just a day, not much will survive, that is not in air conditioning. This could happen over the SE US or the SW US. The damage would be staggering. If the power and air conditioning went out over a wide area, heaven forbid, millions of people could die. I suspect Africa has suffered the most, so far, from climate change. Famines have been made worse by climate change. Taken seriously, BLM means we have to get interested in climate change and learn what must be accomplished.

There are several warming feedback processes that could cause an unmitigated disaster to happen and this could happen earlier than we might imagine. For example, warming beyond what we have now could accelerate the melting of our permafrost, which could emit large amounts of methane, a powerful greenhouse gas, that would further warm the planet, speeding up the permafrost melting. This is sometimes called a “tipping point.” The way this kills us off is indirect (mostly starvation), if we are in air conditioning. Heat waves could kill crops, wildlife, and livestock. This can happen over a wide area. This could happen in our Southeastern states or our Southwestern states. Or in the Middle East, Europe, Asia, or Africa.

To stabilize the climate at a livable level, the first step is to achieve the first climate-stabilizing target, which is designed to get the atmospheric CO2 level to stop going up. Our atmospheric CO2 should be at 280 PPM but it is currently around 415 PPM.

The current slope is around 3 PPM per year, which looks like infinity on this plot, due to the time scale:

*Atmospheric CO₂ and Mean Temperature from 800,000 Years Ago*
Note that the red is temperature, compared to a current reference, and blue is atmospheric CO2 in the units of Parts Per Million, or PPM. It's all fine and no problem (Neanderthal Man lived through all of that), except for that crazy spike on the far right. We are living in that spike.

If we look at just 1% of that first distance, from 0 to 100,000 years, before now, in other words, just 1000 years; we see the spike differently:

Atmospheric CO2 and Mean Temperature, Over the Last 1,000 Years

Here, the atmospheric CO2 is shown in red and the blue is temperature. All that change in temperature is caused by solar activity. It is no big deal. The CO2 is fairly flat, until we discovered coal and other fossil fuels. By the end of the plot, which is now, the slope is very steep. The first thing we have to do is to make that slope (Slope = the increase in atmospheric CO2, per year) be exactly zero. Note also that the temperature is going up. How does 100 Deg F in the arctic circle make you feel? You may have read that 100 Deg. F has been recently measured in the arctic circle. We need to change quite a bit before 2030.

The climate scientists tell the industrialized world that they must do the following, to do their part, to get a slope of zero:
This brings up a key question: by when do we need to do this?

Well, the 2005 Governors Executive Order, S-3-05, signed by Governor Schwarzenegger in 2005, had this very reduction (80% below the 1990 CO2 emission level) achieved by 2050. The problem is that from 2005 to 2015, the world did not do enough and we also learned more about the urgency of our climate predicament. It became clear that we must get that zero slope sooner.

Here is what my paper found, based on what the best climate scientists in the world were saying:

**The industrialized world must emit at 80% below the 1990 level, by 2030!** That is not a typo. We must do by 2030 what we thought we had to do by 2050.

This caused Alexandria Ocasio Cortez to exclaim, in 2018, "**World's gonna end in 12 years if we don't address climate change.**" (This world won’t end in 2030 but it will be too late to avoid catastrophe. Also “address climate change” should have been, “achieve our first climate-stabilizing target.”)

Here is what that target looks like, compared to our current California climate mandates (SB 32 and B-55-18) and our old climate mandate of S-3-05.
If every category of emissions (cars, agriculture, electricity, etc.) achieved that target (shown in orange), then we would be doing our part.

That concludes the characterization of the problem to be solved.

**IV. Why Pick on Cars?**

(technically, “Cars” is really “LDVs”, for “Light-Duty-Vehicles”, meaning: Cars and Light-Duty-Trucks.)

Here’s why we need to pick on cars:
This was true back in 2012, when electricity was less than 10% renewable. It is currently about 45% renewable. Therefore the electricity percent would be much less, causing the LDV percentage to go well above 41%. The conclusion is that cars are by far the biggest emitters of GHG and therefore, if we fail with cars, we fail.

V. Here is the Solution, for 4 Cases

I am not going to say a single word about how I solved this problem. If you are curious, look at the paper and feel free to ask me (phone or email) any question about what is there. It has been peer reviewed.

I am a systems engineer and I have worked this problem, for 4 cases. Here are the primary results, for the car-efficiency part of the problem. Note that this is for 2030 and “ZEV” stands for “Zero-Emission Vehicle”, which probably means, for the most part, Battery Electric Vehicles or BEVs. The “% ZEVs” means the per-cent of the new cars purchased, in California, for the year shown.

### Four-Case Summary of Requirements

<table>
<thead>
<tr>
<th>Case Designations</th>
<th>Balanced_1</th>
<th>Balanced_2</th>
<th>2005 Driving</th>
<th>Mary Nichols</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Renewable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year</td>
<td>Electricity</td>
<td>% ZEVs</td>
<td>% ZEVs</td>
<td>% ZEVs</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
</tr>
<tr>
<td>2016</td>
<td>85.0%</td>
<td>2.0%</td>
<td>2.0%</td>
<td>2.0%</td>
</tr>
<tr>
<td>2017</td>
<td>90.0%</td>
<td>2.0%</td>
<td>2.0%</td>
<td>2.0%</td>
</tr>
<tr>
<td>2018</td>
<td>90.0%</td>
<td>3.0%</td>
<td>3.0%</td>
<td>3.0%</td>
</tr>
<tr>
<td>2019</td>
<td>90.0%</td>
<td>4.0%</td>
<td>4.0%</td>
<td>4.0%</td>
</tr>
<tr>
<td>2020</td>
<td>90.0%</td>
<td>8.0%</td>
<td>8.0%</td>
<td>8.0%</td>
</tr>
<tr>
<td>2021</td>
<td>90.0%</td>
<td>20.0%</td>
<td>15.0%</td>
<td>82.0%</td>
</tr>
<tr>
<td>2022</td>
<td>90.0%</td>
<td>35.0%</td>
<td>25.0%</td>
<td>97.0%</td>
</tr>
<tr>
<td>2023</td>
<td>90.0%</td>
<td>55.0%</td>
<td>45.0%</td>
<td>99.0%</td>
</tr>
<tr>
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<td>90.0%</td>
<td>80.0%</td>
<td>70.0%</td>
<td>99.0%</td>
</tr>
<tr>
<td>2025</td>
<td>90.0%</td>
<td>94.0%</td>
<td>95.0%</td>
<td>99.0%</td>
</tr>
<tr>
<td>2026</td>
<td>90.0%</td>
<td>97.0%</td>
<td>97.0%</td>
<td>99.0%</td>
</tr>
<tr>
<td>2027</td>
<td>90.0%</td>
<td>98.0%</td>
<td>98.0%</td>
<td>99.0%</td>
</tr>
<tr>
<td>2028</td>
<td>90.0%</td>
<td>99.0%</td>
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<td>99.0%</td>
</tr>
<tr>
<td>2029</td>
<td>90.0%</td>
<td>99.0%</td>
<td>99.0%</td>
<td>99.0%</td>
</tr>
<tr>
<td>2030</td>
<td>90.0%</td>
<td>99.0%</td>
<td>99.0%</td>
<td>99.0%</td>
</tr>
</tbody>
</table>

| Reduction in Per-Capita Driving With Respect to Year 2005 | 32.0% | 32.0% | 0% | 50.5% |

Purple denotes difficult; red denotes impossible. We need to implement either the “Balanced_1” or the “Balanced_2” case.

**IV Light-Duty Vehicle Success Rests on a 3-legged stool.**

Looking at the table above we see that by 2030, we must have:

1. Electricity that is at least 85% renewable
2. Fleet electrification that is so fast that by just 2026 most new cars that are purchased in California must be Zero Emission Vehicles or “ZEVs”
3. A reduction in per-capita driving that is 32% below 2005 driving levels.

I am not going to lie. All three things are difficult. Do you want to give up? What about my 5 grandchildren? What about BLM?

Now we are getting close to the need for the Resolutions. We are almost there. Obviously the resolutions are needed to help get the needed reduction in per-capita driving. Obviously we need to get that 32% reduction in per-capita driving, with respect to 2005 driving. (Per-capita driving with respect to 2005 driving matches the convention used for SB 375.)

**V How do we reduce driving that much, in the real world, in just 10 years?**
First, we must understand **Induced Traffic Demand** and how it works, despite human nature, which always sees some easy way out of our problems.

For starters, “congestion” is a loaded and misleading word. So-called “congestion” is just the traffic level and the travel uncertainty that is exactly what people will accept, given the relative costs of the travel options and also given our cultural expectations. For many decades, silly people (my D5 Supervisor, for example) and con artists have said that if there is “congestion” on a roadway, the problem could be solved *if more lanes were added*. It never worked. It never worked because of **Induced Traffic Demand**. The Induced Traffic Demand rule is that ANYTHING that creates space on the freeway, will induce enough additional driving to fill in that space. (Mobility offered is always mobility accepted.) Note that “space” could be thought of as more speed and less uncertainty, for those using the road.

As another example, many now say, “let’s build great mass transit.” Many also say that telecommuting will solve our problems. Or better bike facilities to attract people out of their cars and onto bikes. Some say Automated Vehicles will solve our problem because the vehicles can drive very close together at higher speeds, resulting is more “space on the road”. However, Induced Traffic Demand informs us that more driving speed will always induce enough additional driving to eliminate that increased speed. All of the ideas presented in this paragraph (except Automated Vehicles) will NOT create more driving, as would adding lanes. However, NONE OF THEM, will, after steady-state is reached, reduce driving. If we think these things will save us, we are sadly mistaken. We must do something else, either alone or with these things.

Also, some of the folks that say “the problem will go away on its own” also say Automated Vehicles will result in more car-pooling. But there again, car-pooling also adds space on the road. And additional space will induce enough additional driving to fill in that space.

Regarding the need to reduce driving in 2030 to 32% below 2005 levels, we have to understand that people decide how they travel based on

- **Time** (This leads to Induced Traffic Demand, which means that ANYTHING done that creates space on the road (more speed) will induce enough additional traffic to fill in that space.)
- **Money** (This is powerful! For example, *congestion pricing* would actually reduce congestion and this would last forever, if needed; it’s how the algorithms work.)
- **Culture** (what is acceptable and expected. As long as advertising for cars is legal and we remain mostly uninformed on Climate Change, we will have no problem with driving, even driving Internal Combustion Engine (ICE) cars.

“Money” is our only hope to get the needed results: 80% down from 1990 levels, by 2030. It means we must do pricing. We need systems to improve the way we (drivers) pay for the use of parking and roads.

That is what the 2nd and 3rd lines in Table 11, from the first attached file, is about.

**Table 11**

**Requirements to Achieve a 32% Reduction in 2030**

**Per-Capita Driving, with Respect to 2005**
Driving Reduction Requirements

<table>
<thead>
<tr>
<th></th>
<th>Percent Reduction</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legislated (SB 375) Plans to Reduce Driving</td>
<td>12%</td>
<td>0.88</td>
</tr>
<tr>
<td>Value-Priced Road Use Charge (RUC)</td>
<td>10%</td>
<td>0.90</td>
</tr>
<tr>
<td>Value-Priced Parking (Unbundling the Cost)</td>
<td>8%</td>
<td>0.92</td>
</tr>
<tr>
<td>Transfer Highway Expansion Funds to Transit</td>
<td>2%</td>
<td>0.98</td>
</tr>
<tr>
<td>Increase Height &amp; Density by Transit Stations</td>
<td>2%</td>
<td>0.98</td>
</tr>
<tr>
<td>&quot;Complete Streets&quot;, &quot;Road Diet&quot; (walk/bike)</td>
<td>1%</td>
<td>0.99</td>
</tr>
<tr>
<td>Pay-to-Graduate Bicycle Traffic-Skills Class</td>
<td>1%</td>
<td>0.99</td>
</tr>
<tr>
<td>Bicycle Projects to Improve Access</td>
<td>1%</td>
<td>0.99</td>
</tr>
</tbody>
</table>

Product of Factors 0.68
% Reduction 32%

The 2nd and 3rd lines are why we must adopt the resolutions and then do the implementations that are described in those resolutions and described in more detail in the 1st attached file. Regarding the 3rd lines, there is more detail in the 5th and 6th attached files. The 5th attached file is focused on a demonstration project at a place of employment. The 6th file shows that the parking system, which was called “Intelligent Parking”, in that report, works for all types of parking, such as at
- offices or other places of employment
- apartments
- shopping centers
- mixed-use developments
- train stations and at
- all types of retail, including grocery stores

The 6th attached file even contains a congestion pricing algorithm which would guarantee some desired maximum occupancy rate. Note that retired UCLA Professor Shoup, author of “The High Cost of Free Parking”, recommends an upper limit of 85% occupancy in a downtown Central Business District (CBD).

The 7th attached file is a draft version of a document that would support a Request for Proposal or Request for Information, that would be used by a municipal government or other entity to identify the most worthy 3-party vendor.

Please let me know if you feel you can or can’t support the resolutions. Please send me your comments or questions.

I apologize for the length of this email. The resolutions are a bit complicated. The line of reasoning as to why we need the resolutions is also a bit long.

Thank you for your leadership.
Highest regards,

Mike Bullock
1800 Bayberry Drive
Oceanside, CA 92054
760-754-8025

California Democratic Party Delegate, 76 AD (author of 2 adopted resolutions and 5 Platform changes)
Elected Member of the San Diego County Democratic Party Central Committee (author of 5 adopted resolutions)

Satellite Systems Engineer, 36 years (Now Retired)
Air and Waste Management Association published and presented papers:
Author, *The Development of California Light-Duty Vehicle (LDV) Requirements to Support Climate Stabilization: Fleet-Emission Rates & Per-Capita Driving*
Author, *A Climate-Killing Regional Transportation Plan Winds Up in Court: Background and Remedies*
Co-author, *A Plan to Efficiently and Conveniently Unbundle Car Parking Cost*
Deriving a Climate-Stabilizing Solution Set of Fleet-Efficiency and Driving-Level Requirements, for Light-Duty Vehicles in California

AWMA Paper 796315
Mike R. Bullock
mike_bullock@earthlink.net
Why pick on cars?

Greenhouse Gas (GHG) Emissions, SD County
Source: Energy Policy Initiatives Center (EPIC, USD)


On Road Transportation: 46%

Cars and light-duty trucks: 41%

Heavy Duty Vehicles: 5%
Why is there a Climate Problem?

Any Earth Science text book* contains the following facts:

• **Atmospheric CO2 traps heat**
  – CO2 Molecules absorb and then emit, in a random direction, infrared radiation, heat given off by the Earth’s surface
  – This effect is significant

• **Combustion of fossil fuels adds great quantities of CO2 to our Earth’s atmosphere**
  – The amount of CO2 in the atmosphere is well known
  – Our yearly emissions are well known

How Bad Could It Get?

• *Scientific American* June 2008 issue
  – 550 PPM CO2 possible in several decades
  – This could (5% probability) lead to 8 Deg. Celsius of warming
  – 8 Deg. Celsius could lead to “a devastating collapse of the human population, perhaps even to extinction”

• December 24/31 2012 Issue of Nation magazine:

  A recent string of reports from impeccable mainstream institutions-the International Energy Agency, the World Bank, the accounting firm of PricewaterhouseCoopers-have warned that the *Earth is on a trajectory to warm by at least 4 Degrees Celsius*.

  [4 Degrees Celsius] would be *incompatible with continued human survival*.

Winter, *UU World* magazine (p. 57) “Lags in the replacement of fossil-fuel use by clean energy use have put the world on a pace for 6 degree Celsius by the end of this century. Such a large temperature rise occurred 250 million years ago and extinguished 90 percent of the life on Earth. The current rise is of the same magnitude but is occurring faster. We must reduce or eliminate all uses of fossil fuels.
Climate Data

• Keeling Curve:
  http://en.wikipedia.org/wiki/An_Inconvenient_Truth#Scientific_basis

Atmospheric Carbon Dioxide
Measured at Mauna Loa, Hawaii

- Burning a gallon of gasoline releases about 19 #’s of CO2!
  Likewise
  A barrel of oil, about 700 #’s
  A ton of coal, about 3 tons
  Etc.

Currently around 415 PPM!
Climate Change, Mostly Normal

**This spike is not normal. It is anthropogenic (man made).**

Currently over 410 PPM!!

A&WMA Conference & Exhibit, 2020; Paper 796315
Let’s Zero In on that Spike

- Earth & Space Research (ESR) website: http://www.esr.org/outreach/climate_change/mans_impact/man1.html

Current level over 410 PPM

Start of Industrial Revolution
We must *stabilize* the value of the earth’s atmospheric $CO2_e$

**CO2_e Emissions**

$E_N$ + $E_A$ + $E_{WFB}$

- **Natural:** rotting, fire, digestion, respiration
- **Anthropogenic:** combustion of fossil fuel, methane, other
- **Warming Feed Back:** such as methane from melting permafrost

Sequestration (Photosynthesis)

- $> \rightarrow$ Positive Slope
- $= \rightarrow$ Zero Slope
- $< \rightarrow$ Negative Slope

Growth of plants on Earth

The Warming Feed Back term, $E_{WFB}$, is the wild card. It must not become dominant.
We must stabilize the value of the earth’s atmospheric CO2_e. Here is Step 1:

If Anthropogenic emissions were sufficiently low, the slope would be zero, thus capping the value of the Earth’s atmospheric CO2_e. To achieve this, industrialized nations must limit their emissions to 80% below their 1990 levels.

Warning: The Warming Feed Back terms must not become dominant.
A. Parties and Amici. Except for the following, all parties, intervenors, and amici appearing before the district court and in this Court are listed in the Brief for Plaintiffs-Appellants. James Hansen, David Beerling, Paul J. Hearty, Ove Hoegh-Guldberg, Pushker Kharecha, Valérie Masson-Delmotte, Camille Parmesan, Eelco Rohling, Makiko Sato, Pete Smith, and Lise Van Susteren are amici curiae in this appeal (referred to hereinafter as “Amici Scientists.”).
From the Climate Scientists

From Page 21: . . . the required rate of emissions reduction would have been about 3.5% per year if reductions had started in 2005, while the required rate of reduction, if commenced in 2020, will be approximately 15% per year.

• My math:
  – 15% means a factor of 0.85, year after year
  – Consider the 10 years from 2020 to 2030
  – $(.85)^{10} = .20$, which is 80% down
  – Other articles, describing Hansen’s work: “decarbonization by 2030”
New Climate-Stabilization Prescription

Shown with 3 California Mandates: EO S-3-05 (Red Line & 4 Square Points), SB 32 and EO B-55-18

Area 1 is the net CO2 e emitted from Year 2010 to 2020.

Area 2 is the net CO2 e emitted from Year 2020 to 2050.

SB 32: 40% down by 2030

EO B-55-18: 100% down by 2045

80% Below 1990 Value by 2050

Climate Stabilizing Target
How, for LDVs:

Deriving a Climate-Stabilizing Solution Set of Fleet-Efficiency and Driving-Level Requirements, for Light-Duty Vehicles in California

We have the climate scientist’s target. We must now derive the LDV Requirements.
Notes on Methods

• Base year 2005

• Intermediate year 2015

• Car Efficiency Factor from 2005 to 2015
  – Steve Winkelman’s data

• Car Efficiency Factor, 2015 to 2030
  – Derived in paper (and here)
  – Results in car-efficiency requirements

• Cars last 15 years

From a California law (SB 375) giving per-capita driving reduction targets to be achieved in Regional Transportation Plans

Cars that survive beyond 2030 are balanced out by those that don’t survive to 2030.

Report on SB 375 See its Table 1.
Data Relating 1990, 2005, & 2015 Data

Purple (Low carbon fuel), Green (C02/Mile), & Gold (S-3-05)

Figure 1, from: http://www.ecovote.org/sites/default/files/pdf/sb375.pdf
## Definitions

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>$e_k$</td>
<td>LDV Emitted CO2, in Year “k”</td>
</tr>
<tr>
<td>$L_k$</td>
<td>Low Carbon Fuel Standard (LCFS) Factor that reduces the Per-Gallon CO2 emissions, in Year “k” (k denotes Year 2030)</td>
</tr>
<tr>
<td>$C_k$</td>
<td>LDV CO2 emitted per mile driven, average, in Year “k”, not accounting for the Low Carbon Fuel Standard (LCFS) Factor</td>
</tr>
<tr>
<td>$c_k$</td>
<td>LDV CO2 emitted per mile driven, average, in Year “k”, accounting for the Low Carbon Fuel Standard (LCFS) Factor</td>
</tr>
<tr>
<td>$p_k$</td>
<td>Population, in Year “k”</td>
</tr>
<tr>
<td>$d_k$</td>
<td>Per-capita LDV driving, in Year “k”</td>
</tr>
<tr>
<td>$D_k$</td>
<td>LDV Driving, in Year “k”</td>
</tr>
<tr>
<td>$M_k$</td>
<td>LDV Mileage, miles per gallon, in Year “k”</td>
</tr>
<tr>
<td>$m_k$</td>
<td>LDV Equivalent Mileage, miles per gallon, in Year “k” accounting for the Low Carbon Fuel Standard (LCFS) Factor, so this is $M_k/L_k$</td>
</tr>
<tr>
<td>$N$</td>
<td>Number of pounds of CO2 per gallon of fuel but not accounting for the Low Carbon Fuel Standard (LCFS) Factor</td>
</tr>
</tbody>
</table>
Fundamental Equations

Future Year $k$:  
$$e_k = c_k \times d_k \times p_k$$

Base Year $i$:  
$$e_i = c_i \times d_i \times p_i$$

$$\frac{e_k}{e_i} = \frac{c_k}{c_i} \times \frac{d_k}{d_i} \times \frac{p_k}{p_i}$$

To work with mileage:  
$$\frac{m_i}{m_k} = \frac{c_k}{c_i}$$
Solution Overview

“k” denotes Year 2030
“i” denotes Year 2005

From the known 1990-to-2005 factor and the Climate-Stabilizing-Target, which is the factor of 2030 emissions to 1990 emissions

Car Efficiency Factor
From existing mileage requirements and the requirements defined herein

From existing and predicted population

\[
e_{k} = \frac{m_{i}}{m_{k}} \times \frac{d_{k}}{d_{i}} \times \frac{p_{k}}{p_{i}}
\]

The Independent Variable
It becomes the required per-capita driving reduction with respect to 2005 driving
Solution Using Intermediate Year of 2015

From the **Climate-Stabilizing-Target**, which is the factor of 2030 emissions to 1990 emissions

\[
\frac{e_{2030}}{e_{1990}} \times \frac{e_{1990}}{e_{2005}}
\]

Taken from the Winkelman data: the known 1990-to-2005 factor of emissions (the light blue line)

**Car Efficiency Factor**
From existing mileage requirements and the *requirements defined herein*

\[
\frac{c_{2030}}{c_{2015}} \times \frac{c_{2015}}{c_{2005}} \times \frac{d_{2030}}{d_{2005}} \times \frac{p_{2030}}{p_{2005}}
\]

From Winkelman. It is the product of the factor from the green line and the purple line.

**The Independent Variable**
It becomes the *required 2030 per-capita driving reduction with respect to 2005 driving*
Putting In the Easy-to-Get Values

From the **Climate-Stabilizing-Target**, which is the factor of 2030 emissions to 1990 emissions (“80% down”)

\[
0.20 \times 0.87 = \frac{c_{2030}}{c_{2015}}
\]

**Car Efficiency Factor**
From existing mileage requirements and the **requirements defined herein**

\[
\times 0.90 \times 0.93 \times \frac{d_{2030}}{d_{2005}} \times 1.17446
\]

From Winkelman. It is the product of the factor from the green line and the purple line. There is less CO2 per mile, thanks to the LCFS

This ratio is the **Independent Variable.**
It is the required per-capita 2030 driving reduction with respect to 2005 driving

Taken from the Winkelman data: the known 1990-to-2005 factor of emissions (the light blue line)
Combining the Easy-to-Get Values, Solving for the Independent Variable, and Changing the 2015-to-2030 Car Efficiency from CO2-Per-Mile to Equivalent-Miles-Per-Gallon

\[
0.17700 = \frac{c_{2030}}{c_{2015}} \times \frac{d_{2030}}{d_{2005}}
\]

\[
\frac{d_{2030}}{d_{2005}} = 0.17700 \times \frac{c_{2015}}{c_{2030}}
\]

\[
\frac{d_{2030}}{d_{2005}} = 0.17700 \times \frac{m_{2030}}{m_{2015}}
\]

The required per-capita 2030 driving with respect to 2005 driving

Equivalent Mileage in 2030 is what we make it. It better be as high as possible, because a large driving reduction will be difficult. = “NUMERATOR MILEAGE”

2015 Fleet Mileage is computed = “DENOMINATOR MILEAGE”
Some **Requirements** Defined to Achieve 2030 Fleet Equivalent-Mileage

- Low-Carbon Fuel Standards (LCFS)
- Corporate Average Fuel Efficiency (CAFÉ) Standards from 2015 to 2030
- Driving Reduction Factors \( f_n \) for bad-mileage years (Year n)

Both California’s existing and extended, “L_k”

Existing, to 2025 **Specified to 2030**

**For example, 0.75 means 25% less driving**
- **Cash for Gas-guzzlers?**
Three More Requirements

*Defined to Achieve 2030 Fleet Equivalent-Mileage*

- CAFÉ Standards only apply to Internal Combustion Engine (ICE) LDVs
- New Requirement: Fraction of fleet sold that must be *Zero Emission Vehicles* (ZEVs)
- In 2030, only 15%, or (the other case) 10% of electricity is from fossil fuels

Define “z” to be the fraction of fleet sold that must be ZEVs
## Fleet Mileage for Intermediate Year 2015

<table>
<thead>
<tr>
<th>LDV Set</th>
<th>Years Old</th>
<th>Model Year</th>
<th>CAFE MPG</th>
<th>LCFS Factor L&lt;sub&gt;Year&lt;/sub&gt;</th>
<th>Factor Driven f</th>
<th>Gallons Used Per 100 Miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>14-15</td>
<td>2001</td>
<td>24.0</td>
<td>1.0</td>
<td>1.0</td>
<td>4.17</td>
</tr>
<tr>
<td>2</td>
<td>13-14</td>
<td>2002</td>
<td>24.0</td>
<td>1.0</td>
<td>1.0</td>
<td>4.17</td>
</tr>
<tr>
<td>3</td>
<td>12-13</td>
<td>2003</td>
<td>24.0</td>
<td>1.0</td>
<td>1.0</td>
<td>4.17</td>
</tr>
<tr>
<td>4</td>
<td>11-12</td>
<td>2004</td>
<td>24.0</td>
<td>1.0</td>
<td>1.0</td>
<td>4.17</td>
</tr>
<tr>
<td>5</td>
<td>10-11</td>
<td>2005</td>
<td>25.0</td>
<td>1.0</td>
<td>1.0</td>
<td>4.00</td>
</tr>
<tr>
<td>6</td>
<td>9-10</td>
<td>2006</td>
<td>25.7</td>
<td>.9933</td>
<td>1.0</td>
<td>3.87</td>
</tr>
<tr>
<td>7</td>
<td>8-9</td>
<td>2007</td>
<td>26.3</td>
<td>.9867</td>
<td>1.0</td>
<td>3.75</td>
</tr>
<tr>
<td>8</td>
<td>7-8</td>
<td>2008</td>
<td>27.0</td>
<td>.9800</td>
<td>1.0</td>
<td>3.63</td>
</tr>
<tr>
<td>9</td>
<td>6-7</td>
<td>2009</td>
<td>28.0</td>
<td>.9733</td>
<td>1.0</td>
<td>3.48</td>
</tr>
<tr>
<td>10</td>
<td>5-6</td>
<td>2010</td>
<td>28.0</td>
<td>.9667</td>
<td>1.0</td>
<td>3.45</td>
</tr>
<tr>
<td>11</td>
<td>4-5</td>
<td>2011</td>
<td>29.1</td>
<td>.9600</td>
<td>1.0</td>
<td>3.30</td>
</tr>
<tr>
<td>12</td>
<td>3-4</td>
<td>2012</td>
<td>29.8</td>
<td>.9533</td>
<td>1.0</td>
<td>3.20</td>
</tr>
<tr>
<td>13</td>
<td>2-3</td>
<td>2013</td>
<td>30.6</td>
<td>.9467</td>
<td>1.0</td>
<td>3.09</td>
</tr>
<tr>
<td>14</td>
<td>1-2</td>
<td>2014</td>
<td>31.4</td>
<td>.9400</td>
<td>1.0</td>
<td>2.99</td>
</tr>
<tr>
<td>15</td>
<td>0-1</td>
<td>2015</td>
<td>32.6</td>
<td>.9333</td>
<td>1.0</td>
<td>2.86</td>
</tr>
</tbody>
</table>

Sum of Gallons: 54.29
Miles = 100*Sum(f's): 1500
MPG = Miles/(Sum of Gallons): 27.63

Computed DENOMINATOR MILEAGE
# ZEV Derivation Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>$m_z$</td>
<td>ZEV Equivalent mileage (miles per equivalent gallon)</td>
</tr>
<tr>
<td>$m_{zr}$</td>
<td>ZEV Equivalent mileage if the electricity is from 100% renewables</td>
</tr>
<tr>
<td>$m_{zf}$</td>
<td>ZEV Equivalent mileage if the electricity is from 100% fossil fuels</td>
</tr>
<tr>
<td>$r$</td>
<td>fraction of electricity generated from sources not emitting CO2</td>
</tr>
<tr>
<td>$G$</td>
<td>Gallons of equivalent fuel used</td>
</tr>
<tr>
<td>$D$</td>
<td>Arbitrary distance travelled</td>
</tr>
<tr>
<td>Num</td>
<td>$m_{zr} \times m_{zf}$</td>
</tr>
<tr>
<td>Den</td>
<td>$r \times m_{zf} + (1 - r) \times m_{zr}$</td>
</tr>
</tbody>
</table>
ZEV Derivation

\[ G = \frac{r \times D}{m_{zr}} + \frac{(1 - r) \times D}{m_{zf}} \]

\[ m_z = D/G = D/\left(\frac{r \times D}{m_{zr}} + \frac{(1 - r) \times D}{m_{zf}}\right) \]

\[ m_z = m_{zr} \times m_{zf} / \left(r \times m_{zf} + (1 - r) \times m_{zr}\right) \]

\[ m_z = \text{Num}/(\text{Den}) \]

<table>
<thead>
<tr>
<th>(m_{zr})</th>
<th>(m_{zf})</th>
<th>(r)</th>
<th>(1-r)</th>
<th>Num</th>
<th>Den</th>
<th>(m_z)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5000</td>
<td>70</td>
<td>0.80</td>
<td>0.20</td>
<td>350000.00</td>
<td>1056.00</td>
<td>331.44</td>
</tr>
<tr>
<td>5000</td>
<td>70</td>
<td>0.85</td>
<td>0.15</td>
<td>350000.00</td>
<td>809.50</td>
<td>432.37</td>
</tr>
<tr>
<td>5000</td>
<td>70</td>
<td>0.90</td>
<td>0.10</td>
<td>350000.00</td>
<td>563.00</td>
<td>621.67</td>
</tr>
</tbody>
</table>
Four Variable Definitions & Selecting a Target Numerator Mileage Value

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>$D_i$</td>
<td>Distance travelled by ICE vehicles</td>
</tr>
<tr>
<td>$D_z$</td>
<td>Distance travelled by ZEV vehicles</td>
</tr>
<tr>
<td>$G_i$</td>
<td>Gallons of equivalent fuel used by ICE vehicles</td>
</tr>
<tr>
<td>$G_z$</td>
<td>Gallons of equivalent fuel used by ZEVs</td>
</tr>
</tbody>
</table>

This previously-derived equation was used.

\[
\frac{d_{2030}}{d_{2005}} = 0.17700 \times \frac{m_{2030}}{m_{2015}}
\]

The driving reduction, $\frac{d_{2030}}{d_{2005}}$, was set to 0.68, corresponding to a 32% reduction in driving.

Then, using the previously-computed $m_{2015} = 27.63$ mile per gallon (MPG), the **Numerator Mileage** ($m_{2030}$) was computed to be around **106 MPG**.

Finally, the $z$ values were selected in the following table, by trial and error, to get the **Numerator Mileage** ($m_{2030}$) to be close to that **106 MPG** value.
**ICE Parameters and Calculations**

<table>
<thead>
<tr>
<th>Year</th>
<th>CAFÉ MPG</th>
<th>LCFS</th>
<th>Eq. MPG</th>
<th>f</th>
<th>(D_i)</th>
<th>(G_i)</th>
<th>(z)</th>
<th>(D_z)</th>
<th>(G_z)</th>
<th>Total Miles</th>
<th>Total Gallons</th>
<th>2030 MPG</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>34.3</td>
<td>0.9267</td>
<td>37.01</td>
<td>0.3</td>
<td>29.4</td>
<td>0.7943</td>
<td>0.02</td>
<td>2</td>
<td>0.005</td>
<td>31.40</td>
<td>0.7989</td>
<td>39.30</td>
</tr>
<tr>
<td>2017</td>
<td>35.1</td>
<td>0.9200</td>
<td>38.15</td>
<td>0.4</td>
<td>39.2</td>
<td>1.0275</td>
<td>0.02</td>
<td>2</td>
<td>0.005</td>
<td>41.20</td>
<td>1.0321</td>
<td>39.92</td>
</tr>
<tr>
<td>2018</td>
<td>36.1</td>
<td>0.9133</td>
<td>39.53</td>
<td>0.5</td>
<td>48.5</td>
<td>1.2271</td>
<td>0.03</td>
<td>3</td>
<td>0.007</td>
<td>51.50</td>
<td>1.2340</td>
<td>41.73</td>
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<tr>
<td>2019</td>
<td>37.1</td>
<td>0.9067</td>
<td>40.92</td>
<td>0.6</td>
<td>57.6</td>
<td>1.4077</td>
<td>0.04</td>
<td>4</td>
<td>0.009</td>
<td>61.60</td>
<td>1.4169</td>
<td>43.47</td>
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<tr>
<td>2020</td>
<td>38.3</td>
<td>0.9000</td>
<td>42.56</td>
<td>0.7</td>
<td>64.4</td>
<td>1.5133</td>
<td>0.08</td>
<td>8</td>
<td>0.019</td>
<td>72.40</td>
<td>1.5318</td>
<td>47.26</td>
</tr>
<tr>
<td>2021</td>
<td>40.3</td>
<td>0.8500</td>
<td>47.41</td>
<td>0.8</td>
<td>64.0</td>
<td>1.3499</td>
<td>0.20</td>
<td>20</td>
<td>0.046</td>
<td>84.00</td>
<td>1.3961</td>
<td>60.17</td>
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<tr>
<td>2022</td>
<td>42.3</td>
<td>0.8000</td>
<td>52.88</td>
<td>0.9</td>
<td>58.5</td>
<td>1.1064</td>
<td>0.35</td>
<td>35</td>
<td>0.081</td>
<td>93.50</td>
<td>1.1873</td>
<td>78.75</td>
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<tr>
<td>2023</td>
<td>44.3</td>
<td>0.8000</td>
<td>55.38</td>
<td>1.0</td>
<td>45.0</td>
<td>0.8126</td>
<td>0.55</td>
<td>55</td>
<td>0.127</td>
<td>100.00</td>
<td>0.9398</td>
<td>106.40</td>
</tr>
<tr>
<td>2024</td>
<td>46.5</td>
<td>0.8000</td>
<td>58.13</td>
<td>1.0</td>
<td>20.0</td>
<td>0.3441</td>
<td>0.80</td>
<td>80</td>
<td>0.185</td>
<td>100.00</td>
<td>0.5291</td>
<td>188.99</td>
</tr>
<tr>
<td>2025</td>
<td>48.7</td>
<td>0.8000</td>
<td>60.88</td>
<td>1.0</td>
<td>6.0</td>
<td>0.0986</td>
<td>0.94</td>
<td>94</td>
<td>0.217</td>
<td>100.00</td>
<td>0.3160</td>
<td>316.48</td>
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<tr>
<td>2026</td>
<td>51.2</td>
<td>0.8000</td>
<td>64.00</td>
<td>1.0</td>
<td>3.0</td>
<td>0.0469</td>
<td>0.97</td>
<td>97</td>
<td>0.224</td>
<td>100.00</td>
<td>0.2712</td>
<td>368.70</td>
</tr>
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<td>2027</td>
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**ZevMileage = 432.37**

**Sum of Miles and then Gallons of equivalent fuel:** 1235.60 | 11.64

**Equivalent MPG of LDV Fleet in 2030:** 106.17

**ZEV Miles Driven = 795.0**

**Fraction of Miles Driven by ZEVs = 64.3%**
Computing the Ratio of Per-Capita 2030 Driving to Per-Capita 2005 Driving

Equivalent Mileage in 2030 = “NUMERATOR MILEAGE”

\[
\frac{d_{2030}}{d_{2005}} = 0.1770 \times \frac{106.17}{27.63} = 0.68
\]

2015 Fleet Mileage was computed before = “DENOMINATOR MILEAGE”

The factor of 0.68 means there is a 32% reduction in per-capita driving, from 2005 to 2030.

Again, for the next case, the z values were selected by trial and error, to get the 106 MPG value, corresponding to a 32% decrease in driving.
**ICE Parameters and Calculations**

<table>
<thead>
<tr>
<th>Year</th>
<th>CAFÉ MPG</th>
<th>LCFS</th>
<th>Eq. MPG</th>
<th>f</th>
<th>(D_i)</th>
<th>(G_i)</th>
<th>(z)</th>
<th>(D_z)</th>
<th>(G_z)</th>
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**Sum of Miles and then Gallons of equivalent fuel:** 1233.60 11.61

**Equivalent MPG of LDV Fleet in 2030:** 106.22

**ZEV Miles Driven = 761.0**  
**Fraction of Miles Driven by ZEVs = 61.7%**
Selecting a Target Numerator Mileage Value to Get a 0% Reduction in Driving

This previously-derived equation was used.

\[
\frac{d_{2030}}{d_{2005}} = 0.17700 \times \frac{m_{2030}}{m_{2015}}
\]

The driving reduction, \(\frac{d_{2030}}{d_{2005}}\), was set to 1.00, corresponding to a 0% reduction in driving.

Then, using the previously-computed \(m_{2015} = 27.63\) mile per gallon (MPG), the **Numerator Mileage** \((m_{2030})\) was computed to be around **156 MPG**.

Finally, the \(z\) values were selected in the following table, by trial and error, to get the **Numerator Mileage** \((m_{2030})\) to be close to that **156 MPG** value.
### “2005 Driving Case”, 90% Renewable Electricity

**Zev mileage** = 621.67, So \( G_z = \frac{D_z}{621.67} \)

#### ICE Parameters and Calculations

<table>
<thead>
<tr>
<th>Year</th>
<th>CAFÉ MPG</th>
<th>LCFS</th>
<th>Eq. MPG</th>
<th>f</th>
<th>D_i</th>
<th>G_i</th>
<th>z</th>
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#### ZEVs

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**Sum of Miles and then Gallons of equivalent fuel:** 1254.20, 8.04

**Equivalent MPG of LDV Fleet in 2030:** 155.99

**ZEV Miles Driven = 990.0**  
**Fraction of Miles Driven by ZEVs = 78.9%**

**Computed NUMINATOR MILEAGE** 32
Computing the Ratio of Per-Capita 2030 Driving to Per-Capita 2005 Driving

Equivalent Mileage in 2030 is what we made it by selecting the “z” values in the previous table. = “NUMERATOR MILEAGE”

\[
\frac{d_{2030}}{d_{2005}} = 0.1770 \times \frac{155.99}{27.63} = 1.00
\]

2015 Fleet Mileage was computed = "DENOMINATOR MILEAGE"

For the next case, the z values were taken from a published article describing values selected by the Chair of the California Air Resources Board, Mary Nichols.
### "Mary Nichols Case", 90% Renewable Electricity

**Zev Mileage = 621.67**  
**So \( G_z = \frac{D_z}{621.67} \)**

<table>
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<th>CAFÉ MPG</th>
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<td>0.161</td>
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<td>0.1609</td>
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</tr>
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</table>

**Sum of Miles and then Gallons of equivalent fuel:**  
1236.00  16.00

**Equivalent MPG of LDV Fleet in 2030:** 77.24

**ZEV Miles Driven = 457.9**  
**Fraction of Miles Driven by ZEVs = 37.0%**
Computing the Ratio of Per-Capita 2030 Driving to Per-Capita 2005 Driving

Equivalent Mileage in 2030 is what resulted from the Mary Nichols statement. It is the “NUMERATOR MILEAGE”

\[
\frac{d_{2030}}{d_{2005}} = 0.1770 \times \frac{77.24}{27.63} = 0.495
\]

2015 Fleet Mileage was computed = “DENOMINATOR MILEAGE”

CARB may not understand that the fleet electrification schedule suggested by their Board Chair would require that per-capita driving be about half what it was in 2005, if LDVs are to achieve climate-stabilizing targets.
Net Driving Decrease with Respect to 2005 Driving for the “Balanced” Cases

(Per-Capita Driving Factor) \times (Population Factor) = Net Driving Factor

\[
(0.68) \times (1.1744) = 0.80
\]

Therefore, even though the population will grow 17\%,

\textit{net driving must decrease by 20\%}.

Therefore, why add highway lanes?

We need enforceable measures to reduce driving so much there will be no more congestion!
4 Cases that Support Climate Stabilization

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Enforceable Measures to Reduce 2030 Driving by 32% With Respect to 2005

These enforceable measures are described in the AWMA paper.

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California designs and implements this

Local governments do this with a 3rd party vendor
An Important **Pricing** Strategy

**A Road-Usage-Charge (RUC) Pricing & Payout System**

**THEREFORE, BE IT RESOLVED,** that the Democratic Club of Carlsbad and Oceanside (DEMCCO) supports a road-usage charge (RUC) pricing & payout system that would (1) cover all road-use costs, including the environmental & health costs caused by driving; (2) mitigate impacts on low-income users; (3) protect privacy; (4) include congestion pricing; (5) keep the per-mile price incentive to drive energy-efficient cars at least as large as it is with today’s fuel excise tax; and (6) send its earnings to all citizens and institutions that are currently losing money by subsidizing road use.
Another Important Pricing Strategy

A good car-parking system: value-priced (with congestion pricing), shared, automated, and providing earnings to those losing money because the parking is being provided.

The first such systems should be installed by a third-party vendor (such as Google, Qualcomm, Uber, or Lime Bicycle), selected by a RFP (Request for Proposal) process, for municipal government employees, as part of the government’s Climate Action Plan. It would be operated for the financial gain of the employees. The RFP would specify that even employees that continue to drive every day would at least break even. The winning third-party vendor would be skilled at monetizing parking, whenever it is not being used by the employees; at monetizing data; and at expanding the system. The system would be automated with a useful phone app to find the best parking at the user-specified price and walk-distance.
1500-Character Extended Abstract

After two introductory slides, the presentation starts with the definition of two commonly-used, car-parking systems: the bundled-price system and the bundled-cost system. The flaws of these systems are exposed. The Dividend Account Parking (DAP) parking system is introduced; with the motivation for its implementation: the importance of cars in reducing GHG and how DAP fits into a plan to ensure that cars support climate-stabilization.

The rest of the slides present a specific DAP proposal, in downtown Oceanside, CA, for city employees. Outcomes, an overview, and a definition of DAP are given. Charge & payout formulations are specified. Methods to prevent cheating are described. A brief, simplified example of a DAP implementation is shown, where it would be difficult to not drive to work, showing DAP to still be a good choice. Results from cases of car parking cash-out (where employees are paid to get to work without driving) are given, showing that if a price differential (between driving and not driving to work) is introduced (DAP does this), driving alone to work is significantly reduced.

Money cash flow calculations are presented, using reasonable simplifying assumptions and then reasonably-conservative assumptions of how much money could be earned from employee parking, whenever it is not being used by an employee. The results from three cases (“Baseline”, “Worse”, and “Better”) are shown.

Twenty six back up slides appear, but they are NOT part of the presentation.
COVID-19 Lessons Learned (Or Not)

1. Bad things *can* happen*

2. Ignoring science can be deadly

*Suffering from childhood catechism?*

Catechism fix: *If there is a God, he or she will NOT protect us from physics.*

*Say this 10 times daily for moderate relief 😊*
1. To avoid climate destabilization (human extinction), industrialized nations must reduce their Greenhouse Gas (GHG) emissions by 80%, by 2030

2. Congress-member Ocasio-Cortez: “World’s gonna end in 12 years . . . “ (2030 target meant she had a point!)

3. Cars are the biggest category of GHG emissions

4. Internal combustion engine cars last 15 years

5. We will not have a sufficiently-electrified fleet by 2030

6. We must reduce vehicle-miles-travelled (VMT)
Eliminating the Harm of Bundled-Cost or Bundled-Benefit Parking

- Definitions of Parking Systems
- New System: *Dividend-Account Parking*
  - Motivations for change
  - Definition and features
  - A demonstration project

Mike Bullock
mike_bullock@earthlink.net
760-754-8025
A Bundled-Cost Parking System

The most common of all parking systems. Erroneously called “free”

The cost of the parking is contained within some other payment, such as:

- Rent
- Train fare (at least 1 train station with so-called “free” parking)
- Price of consumer items, including food
A Bundled-Benefit Parking System

The 2nd most common of all parking systems. Erroneously called “free”

The parking is part of a benefit package being provided, such as:

- Compensation for work
- Public education
- Public anything, such as a library or park
The harm of a *Bundled-Cost* or a *Bundled-Benefit* car-parking system is that they take *money* from people without their knowledge or consent.

These systems also increase the choice to drive alone.

**Sierra Club Resolution:** Appropriate pricing of parking is the least costly way to reduce vehicle miles travelled.
Bundled-Cost or Bundled-Benefit systems should be replaced with the DAP Car-Parking system!

Dividend Account Parking (DAP)

**Brief System Definition**

1. Automated (nothing to do; just park and run)
2. Value-priced, with a congestion-pricing option
3. Earnings (AKA “Dividends” or “Financial Support”) go to the people for whom the parking is built (for example, employees)
4. Cars must be recognizable & associated with an Account
5. Parking is available to all (“Shared Parking”) driving such a car
From the California Democratic Party (CDP) 2018 Platform

Transportation Sub-Plank Statement

• Work for shared, convenient, and value-priced parking, operated with a system that provides financial support to those paying higher costs or getting a reduced wage, due to the cost of providing the parking.

Note: this is DAP!
Motivation for Change, 1 of 4

Cars and Light-duty vehicles (LDVs) emit the most GHG of any category

On Road Transportation: 46%

Cars and light-duty trucks: 41%

Heavy Duty Vehicles: 5%
Motivation for Change, 2 of 4

- Fleet Efficiency *Will Not Come Soon Enough*, as shown in this peer-reviewed report:

  2020 Air & Waste Management Association (AWMA) Report

Deriving *Climate-Stabilizing Solution Sets of Fleet-Efficiency and Driving-Level Requirements* for California Light-Duty Vehicles

*Available upon request from mike_bullock@earthlink.net*
## Climate-Stabilizing Requirements, for Four Cases

<table>
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<tr>
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Driving as much as we did in 2005 might seem nice, but these % ZEV jumps are not possible. Air Resources Board Mary Nichols has a nice electrification schedule but it would require a very difficult reduction in driving.
## Motivation for Change, 4 of 4

Requirements to Achieve the Needed **32% Reduction** in Per-Capita Driving, With Respect to 2005

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EUEC 2020
Conclusion & Path Forward

• A big part of the needed 32% reduction will need to come from car-parking reform.

• The first step will be a simplified demonstration project of a Dividend Account Parking System at a work location.

• A proposal is now be presented.
A Dividend-Account Parking System for Oceanside’s Civic Center Garage

A System to Eliminate the Harm of Bundled-Benefit Car Parking for City Employees
300 North Coast Highway

• Top-Level Outcome & Overview
• Some Top-Level Calculations
• Who gets to use the system
• Overcoming problems & perceptions
• Outcomes of a new incentive
• Cash flow (“Hey, where does the $$ come from?”)

Mike Bullock
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760-7548025

EUEC 2020
Top-Level Outcomes

• Employees that drive every day break even (Lose no money!)

• Employees that don’t drive every day get paid to not drive (Make more money!)

• Fewer employees drive, reducing Greenhouse Gas (GHG) emissions (Less GHG!)
Overview

- Fully-automated parking system, implemented by a 3rd-party vendor (RFP selection process)
- operated for the financial gain of employees
  - Earnings = Money Generated Minus Vendor Earnings
  - Earnings go to employees
- Price is cost per minute
  - Such as 1.85 cents per minute (= $1.11 per hour)
- An employee’s Earnings (“Dividend”) is proportional to their time spent at work
Calculations of an Employee’s Earnings

- An employee’s earning is proportional to time spent at work (automatic collection of enter/exit times, using employee RFID)

<table>
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<th>Definitions to Compute an Employee's Monthly Earnings</th>
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<tr>
<td>( T_{\text{Employee}} )</td>
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<td>( T_{\text{AllEmployees}} )</td>
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<tr>
<td>( E_{\text{AllEmployees}} )</td>
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Employee Earnings = \( E_{\text{AllEmployees}} \times \left( \frac{T_{\text{Employee}}}{T_{\text{AllEmployees}}} \right) \)
“Add In” Payment so Those that Drive Every Day Will Lose No Money

Note: This is for an individual employee, “Joe”

Joe’s Parking Payment =

Joe’s Earnings – Price per Minute x Minutes Joe Parked + Joe’s “Add In”

“Add In” is zero, unless it must take on a positive value so that Joe loses no money

“Add In” payments will be easily covered by Dividend Account Parking parkers that are not employees.
Charge, Earnings, & Add-In, Payment For Each Employee

• **Charge**
  – Total Minutes Parked x Cost per Minute

• **Earnings**
  – As shown on earlier slide (proportional to employee’s time spent at work)

• **Add-In**
  – Zero, unless Charge > Earnings
  – If Charge > Earnings, Add-In = Charge – Earnings

• **Payment** = Earnings – Charge + Add-In
Who Gets To Use Dividend-Account Parking

• **Anyone** (not necessarily an employee) driving a car registered in the system
  – There is a person with an account associated with the car
  – The car will be identified
    • License plate reader and/or
    • RFID tag not needed
  – Account can be established on the spot, in less than 5 minutes: credit card info and license number
Employee Behavior 1 of 2

Employees Must Park in Their Parking Lot if they Drive to Work
Measures to Reduce “Cheating” = Parking in the Neighborhood

• Soft, pre-emptive measure: messaging
  – Perceived integrity is every employee’s responsibility
  – Insufficient perceived integrity can cost employees
    • Reduced chance of promotion
    • Smaller pay raises
    • More chance of terminated employment
  – Parking free in the neighborhood will not be tolerated
  – The City wants to be a good neighbor: this is the reason for off-street parking ordinances
Employee Behavior 2 of 2

Employees Must Park in Their Parking Lot if they Drive to Work

Measures to Reduce “Cheating” = Parking in the Neighborhood

• Soft, pre-operational measure: data collection
  – Operate the system for a time, perhaps even a year, before actually collecting or distributing money
  – Self-identified non-drivers are recognized, thanked, and asked to provide details as to how they are getting to work without driving

• Soft, In-Operation Mode: New non-drivers are thanked and interrogated as to how they do it

• Hard: cameras or RFID sensors can identify employees walking into the work perimeter from the neighborhoods
Hard-to-Not-Drive Example
Fictional, Simplified Case with Pricing and Payout Considered per Day, Page 1

• Employment Center (factory and office)
• Outside Hemet, California
• 100 employees; parking lot has 100 spaces
• No Transit, 110 degree temperature with poor roads for biking, culture of not car-pooling
• Before installing
  – 99 drive
  – 1 bikes
Hard-to-Not-Drive Example
Fictional, Simplified Case with Pricing and Payout Considered per Day,

- Dividend-Account Parking charges $10/day
- After installing
  - 99 drive
  - 1 bikes
- Total collected each day: $990
- Each employee gets $9.90 earnings per day ($990/100)
- Each driver loses 10 cents per day
- The “crazy” bike rider gets $9.90 per day extra

Hey, isn’t this an improvement? I would say the “crazy” bike rider is earning his money!

If another employee bikes, the drivers would lose 20 cents per day and the bike riders would get $9.80 per day. If the company president rented out the 2 extra spaces for $10 per day, the drivers would lose nothing and the bike riders would get $10 per day. Biking would increase by 100%! What’s wrong with that?
Results of 3 Actions, Including Cash-out
Case (#1), Reference Patrick Siegman’s article in Bicycle Pedestrian Federation

- Company: CH2M Hill
  - Location: Bellevue, WA (Seattle suburb)
  - Engineering Firm with 430 employees

- Actions
  - $54/month (1995 $’s), to not drive
  - Improved Transit
  - Improved Bike/Ped facilities

<table>
<thead>
<tr>
<th>CH2M Hill Work Trips</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mode</strong></td>
</tr>
<tr>
<td>Drive Alone</td>
</tr>
<tr>
<td>Carpool</td>
</tr>
<tr>
<td>Bus</td>
</tr>
<tr>
<td>Bike, Walk</td>
</tr>
</tbody>
</table>

100% 100%

Since these changes are brought about by more than just cashout, this case is not used in the tabulation of cashout results (next chart)
Cash-Out Results
(11 Locations, 3 Groups, 1995 Dollars)


3 Largest Responses
– 38%, 36%, 31%

3 Smallest Responses
– 15%, 18%, 24%

Responses are the change; car vacancy rates would be larger

<table>
<thead>
<tr>
<th>Impact of Financial Incentives on Parking Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Location</strong></td>
</tr>
<tr>
<td><strong>Group A: Areas with little or no public transportation</strong></td>
</tr>
<tr>
<td>Century City District, West Los Angeles</td>
</tr>
<tr>
<td>Cornell University, Ithaca, NY</td>
</tr>
<tr>
<td>San Fernando Valley, Los Angeles</td>
</tr>
<tr>
<td>Costa Mesa, CA</td>
</tr>
<tr>
<td><strong>Average for Group</strong></td>
</tr>
<tr>
<td><strong>Group B: Areas with fair public transportation</strong></td>
</tr>
<tr>
<td>Los Angeles Civic Center</td>
</tr>
<tr>
<td>Mid-Wilshire Blvd., Los Angeles</td>
</tr>
<tr>
<td>Washington DC Suburbs</td>
</tr>
<tr>
<td>Downtown Los Angeles</td>
</tr>
<tr>
<td><strong>Average for Group</strong></td>
</tr>
<tr>
<td><strong>Group C: Areas with good public transportation</strong></td>
</tr>
<tr>
<td>University of Washington, Seattle Wa.</td>
</tr>
<tr>
<td>Downtown Ottawa, Canada</td>
</tr>
<tr>
<td>Bellevue, WA</td>
</tr>
<tr>
<td><strong>Average for Group, but not Bellevue Washington</strong></td>
</tr>
<tr>
<td><strong>Over All Average, Excluding Bellevue Washington</strong></td>
</tr>
</tbody>
</table>

*Patrick Siegman, of Nelson Nygaard

1 Parking vacancy would be higher! 2 Not used, since transit & walk/bike facilities also improved.
Dividend-Account Parking Oceanside  
Civic Center Parking Garage  
Money Flow Calculations

Simplifying Assumptions

1. All workers are at this location for 9 hours, each day they report to work (8 hours of work and 1 hour for lunch)
2. All workers work 8 AM to 5 PM
3. Evening hours are 5 PM to 9 PM
4. All workers that work on week-ends also work on week days, for a total of 7*9 = 63 hours at the work location per week
### Notation Conventions

<table>
<thead>
<tr>
<th>Letters</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Number</td>
</tr>
<tr>
<td>DAP</td>
<td>Dividend Account Parking</td>
</tr>
<tr>
<td>VP</td>
<td>Value Priced</td>
</tr>
<tr>
<td>WE</td>
<td>Week End</td>
</tr>
<tr>
<td>WD</td>
<td>Week Day</td>
</tr>
<tr>
<td>WH</td>
<td>Work Hours, Meaning 8 AM to 5 PM</td>
</tr>
<tr>
<td>AH</td>
<td>After Hours, Meaning 5 PM to 9 PM</td>
</tr>
</tbody>
</table>
**Dividend-Account Parking**

**Money Flow Calculations**

---

Assume This is the "Value-Price" of the Parking

*Use $10 per 9 Hours at the Work Site*

<table>
<thead>
<tr>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.8519</td>
<td>Cents per Minute</td>
</tr>
<tr>
<td>1.11</td>
<td>Dollars per Hour</td>
</tr>
</tbody>
</table>
### Dividend-Account Parking

**Money Flow Calculations**

#### Assumed Values Used in the Following Performance Assessment

<table>
<thead>
<tr>
<th>Description</th>
<th>Name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of parking places</td>
<td>N_DAP</td>
<td>250</td>
</tr>
<tr>
<td>Number of employees</td>
<td>N_Emp</td>
<td>250</td>
</tr>
<tr>
<td>% employees that drive on week day &amp; week end</td>
<td>%Drive</td>
<td>80</td>
</tr>
<tr>
<td>Value-price to park, per 9 hours day (8 hours work + lunch)</td>
<td>VP_9Hrs</td>
<td>$10.00</td>
</tr>
<tr>
<td>% employees that work on Sat. and on Sun.</td>
<td>%WE</td>
<td>20</td>
</tr>
<tr>
<td>Yearly bonus paid to all workers</td>
<td>Y_Bonus</td>
<td>$100.00</td>
</tr>
</tbody>
</table>

#### Non-Workers Use This Per-Cent of the Parking That Is Not Used by Workers

<table>
<thead>
<tr>
<th>Description</th>
<th>Name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week Day, Work Hours</td>
<td>%NonWrkWDWH</td>
<td>50</td>
</tr>
<tr>
<td>Week Day, After Hours (5 to 9)</td>
<td>%NonWrkWDAH</td>
<td>30</td>
</tr>
<tr>
<td>Week End, Work Hours</td>
<td>%NonWrkWEWH</td>
<td>50</td>
</tr>
<tr>
<td>Week End, After Hours (5 to 9)</td>
<td>%NonWrkWEAH</td>
<td>30</td>
</tr>
</tbody>
</table>
### Dividend-Account Parking

#### Money Flow Calculations

Calculations to get the Weekly Earnings From Employees & the Weekly "AddIns" Required, per Employee

<table>
<thead>
<tr>
<th>Description</th>
<th>Formula</th>
<th>Name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Employees That Drive on a Week Day</td>
<td>N_Emp * %Drive / 100</td>
<td>N_DrWD</td>
<td>200</td>
</tr>
<tr>
<td>Money From Employees on a Week Day</td>
<td>VP_9Hrs * N_DrWD</td>
<td>$_AIIE_WD</td>
<td>$2,000</td>
</tr>
<tr>
<td>Number of Employees That Work on a Week End</td>
<td>N_Emp * %WE / 100</td>
<td>N_WrkWE</td>
<td>50</td>
</tr>
<tr>
<td>Number of Employees Driving on a Week-End Day</td>
<td>N_WrkWE * %Drive / 100</td>
<td>N_DrWE</td>
<td>40</td>
</tr>
<tr>
<td>Money From All Employees Each Week-End Day</td>
<td>VP_9Hrs * N_DrWE</td>
<td>$_AIIE</td>
<td>$400</td>
</tr>
<tr>
<td>Weekly Money From Employees From Both the Week End &amp; the Week Days</td>
<td>5 * $_AIIE_WD + 2 * $_AIIE</td>
<td>$_AIIE</td>
<td>$10,800</td>
</tr>
<tr>
<td>Total Hours at This Location Per Week</td>
<td>N_Emp * 9 * 5 + N_Emp * %WE / 100 * 9 * 2</td>
<td>HrsPerWeek</td>
<td>12150</td>
</tr>
<tr>
<td>Weekly Earnings for an Employee at the Location for 45 Hours</td>
<td>$_AIIE * 45 / HrsPerWeek</td>
<td>PerWeek45</td>
<td>$40.00</td>
</tr>
<tr>
<td>AddIn for an Employee at the Location for 45 Hours per Week</td>
<td>5 * VP_9Hrs - PerWeek45</td>
<td>AddIn45</td>
<td>$10.00</td>
</tr>
<tr>
<td>Weekly earnings for an employee at the location for 63 hours</td>
<td>$_AIIE * 63 / HrsPerWeek</td>
<td>PerWeek63</td>
<td>$56.00</td>
</tr>
<tr>
<td>Per Week AddIn for an Employee at the location for 63 Hours per week</td>
<td>7 * VP_9Hrs - PerWeek63</td>
<td>AddIn63</td>
<td>$14.00</td>
</tr>
</tbody>
</table>
## Dividend-Account Parking

### Money Flow Calculations

**Calculation of the Weekly Amount Generated by Spaces Not Used by Workers, Week Day Work Hours (8 to 5)**

<table>
<thead>
<tr>
<th>Description</th>
<th>Formula</th>
<th>Name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spaces Available for Non-Workers, Work Day, Work Hours</td>
<td>( N_{\text{DAP}} - N_{\text{DrWD}} )</td>
<td>( S_{4NW_WDWH} )</td>
<td>50</td>
</tr>
<tr>
<td>Spaces Used by Non-Workers, Work Day Work Hours</td>
<td>( S_{4NW_WDWH} \times \frac{%\text{NonWrkWDWH}}{100} )</td>
<td>( \text{SNW_WDWH} )</td>
<td>25</td>
</tr>
<tr>
<td>Money from Spaces Used by Non-Workers Per Day</td>
<td>( \text{SNW_WDWH} \times \text{VP_9Hrs} )</td>
<td>( \text{NW_WDWH} )</td>
<td>$250</td>
</tr>
<tr>
<td>Money from Spaces Used by Non-Workers Per Week</td>
<td>( 5 \times \text{NW_WDWH} )</td>
<td>( W$\text{NW_WDWH} )</td>
<td>$1,250</td>
</tr>
</tbody>
</table>

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**Money Flow Calculations**

**Calculation of the Weekly Amount Generated by Spaces Not Used by Workers, Week Day Work Hours (8 to 5)**

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<tr>
<td>Spaces Used by Non-Workers, Work Day Work Hours</td>
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<td>25</td>
</tr>
<tr>
<td>Money from Spaces Used by Non-Workers Per Day</td>
<td>( \text{SNW_WDWH} \times \text{VP_9Hrs} )</td>
<td>( \text{NW_WDWH} )</td>
<td>$250</td>
</tr>
<tr>
<td>Money from Spaces Used by Non-Workers Per Week</td>
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<tr>
<td>Spaces Available for Non-Workers, Work Day, Work Hours</td>
<td>( N_{\text{DAP}} - N_{\text{DrWD}} )</td>
<td>( S_{4NW_WDWH} )</td>
<td>50</td>
</tr>
<tr>
<td>Spaces Used by Non-Workers, Work Day Work Hours</td>
<td>( S_{4NW_WDWH} \times \frac{%\text{NonWrkWDWH}}{100} )</td>
<td>( \text{SNW_WDWH} )</td>
<td>25</td>
</tr>
<tr>
<td>Money from Spaces Used by Non-Workers Per Day</td>
<td>( \text{SNW_WDWH} \times \text{VP_9Hrs} )</td>
<td>( \text{NW_WDWH} )</td>
<td>$250</td>
</tr>
<tr>
<td>Money from Spaces Used by Non-Workers Per Week</td>
<td>( 5 \times \text{NW_WDWH} )</td>
<td>( W$\text{NW_WDWH} )</td>
<td>$1,250</td>
</tr>
</tbody>
</table>

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**Money Flow Calculations**

**Calculation of the Weekly Amount Generated by Spaces Not Used by Workers, Week Day Work Hours (8 to 5)**

<table>
<thead>
<tr>
<th>Description</th>
<th>Formula</th>
<th>Name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spaces Available for Non-Workers, Work Day, Work Hours</td>
<td>( N_{\text{DAP}} - N_{\text{DrWD}} )</td>
<td>( S_{4NW_WDWH} )</td>
<td>50</td>
</tr>
<tr>
<td>Spaces Used by Non-Workers, Work Day Work Hours</td>
<td>( S_{4NW_WDWH} \times \frac{%\text{NonWrkWDWH}}{100} )</td>
<td>( \text{SNW_WDWH} )</td>
<td>25</td>
</tr>
<tr>
<td>Money from Spaces Used by Non-Workers Per Day</td>
<td>( \text{SNW_WDWH} \times \text{VP_9Hrs} )</td>
<td>( \text{NW_WDWH} )</td>
<td>$250</td>
</tr>
<tr>
<td>Money from Spaces Used by Non-Workers Per Week</td>
<td>( 5 \times \text{NW_WDWH} )</td>
<td>( W$\text{NW_WDWH} )</td>
<td>$1,250</td>
</tr>
</tbody>
</table>
### Dividend-Account Parking

#### Money Flow Calculations

<table>
<thead>
<tr>
<th>Calculation of the Weekly Amount Generated by Spaces Not Used by Workers, Week Day After Hours (5 to 9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spaces Available for Non-Workers, Work Day, 5 to 9, AKA After Hours</td>
</tr>
<tr>
<td>Spaces Used by Non-Workers, Week Day After Hours</td>
</tr>
<tr>
<td>Money From Spaces Not Used by Workers, Week Day After Hours</td>
</tr>
<tr>
<td>Money per Week from Spaces Not Used by Workers, Week Day After Hours</td>
</tr>
</tbody>
</table>
## Dividend-Account Parking

### Money Flow Calculations

**Calculation of the Weekly Amount Generated by Spaces Not Used by Workers, Week End Work Hours (8 to 5)**

<table>
<thead>
<tr>
<th>Description</th>
<th>Formula</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spaces Available for Non-Workers, Week End Work Hours</td>
<td>N_DAP - N_DrWE</td>
<td>S_4NW_WEWH 210</td>
</tr>
<tr>
<td>Spaces Used by Non-Workers, Week End Work Hours</td>
<td>S_4NW_WEWH * %NonWrkWEWH / 100</td>
<td>SNW_WEWH 105</td>
</tr>
<tr>
<td>Money From Spaces Used by Non-workers Per Week-End Day, Work Hours</td>
<td>SNW_WEWH * VP_9Hrs</td>
<td>$NW_WEWH $1,050</td>
</tr>
<tr>
<td>Money From Spaces Used by Non-workers On the Week End After Hours, Per Week</td>
<td>2 * $NW_WEWH</td>
<td>$NW_WEWH $2,100</td>
</tr>
</tbody>
</table>
### Calculation of the Weekly Amount Generated by Spaces Not Used by Workers, Week End After Hours (5 to 9)

<table>
<thead>
<tr>
<th>Description</th>
<th>Formula</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spaces Available for Non-Workers, Week End After Hours</td>
<td>N_DAP</td>
<td></td>
</tr>
<tr>
<td>Spaces Used by Non-Workers, Week End After Hours</td>
<td>$S_{4NW _WDAH} \times %NonWrk \div WDAH \times 100$</td>
<td>75</td>
</tr>
<tr>
<td>Money From Spaces Used by Non-workers Per Week-End Day After Hours</td>
<td>$4/9 \times SNW_WDAH \times VP_9Hrs$</td>
<td>$333</td>
</tr>
<tr>
<td>Money From Spaces Used by Non-workers on Week-End Days After Hours, Per Week</td>
<td>$2 \times NW_WDAH$</td>
<td>$667</td>
</tr>
</tbody>
</table>

- $S_{4NW \_WDAH}$ represents the spaces available for non-workers at the week end after hours.
- $\%NonWrk$ represents the percentage of non-workers.
- $WDAH$ represents the week end after hours.
- $VP\_9Hrs$ represents the value per hour for 9 hours.
- $NW\_WDAH$ represents the money from spaces used by non-workers per week-end day after hours.
- $WNW\_WDAH$ represents the money from spaces used by non-workers on week-end days after hours, per week.
# Dividend-Account Parking

## Money Flow Calculations

The Weekly Earnings From Non-Employees, the Weekly "AddIns" Required, the Weekly Surplus Generated, the Yearly Surplus, and the Yearly Surplus After Giving Employees a $100 Per Year Bonus

<table>
<thead>
<tr>
<th>Description</th>
<th>Formula</th>
<th>Name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekly Money Earned by the spaces not taken by workers</td>
<td>( W$NW_{WDWH} + W$NW_{WDAH} + W$NW_{WEWH} + W$NW_{WEAH} )</td>
<td>( W$NW )</td>
<td>$ 5,683</td>
</tr>
<tr>
<td>Weekly Money Required to Pay All of the AddIn Amounts</td>
<td>( N_DrWD \times \text{AddIn45} + N_DrWE \times \text{AddIn63} )</td>
<td>( \text{AddInPerWeek} )</td>
<td>$ 2,560</td>
</tr>
<tr>
<td>Weekly Money Left Over After Paying Add Ins</td>
<td>( W$NW - \text{AddInPerWeek} )</td>
<td>( $\text{PerWeek} )</td>
<td>$ 3,123</td>
</tr>
<tr>
<td>Yearly Money After Paying Add Ins From the Money From Non-Workers</td>
<td>( 52 \times $\text{PerWeek} )</td>
<td>( $\text{PerYear} )</td>
<td>$ 162,413</td>
</tr>
<tr>
<td>Yearly Money After Paying Add Ins and Also a $100 Bonus Per Year for Each Employee</td>
<td>( $\text{PerYear} - $100 \times N_\text{Emp} )</td>
<td>( $\text{PerYear} )</td>
<td>$ 137,413</td>
</tr>
</tbody>
</table>
### Dividend-Account Parking

#### Money Flow Calculations

<table>
<thead>
<tr>
<th>3 Cases of Dividend-Account Parking Performance</th>
<th>Baseline</th>
<th>Worse</th>
<th>Better</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oceanside Civic Center Garage</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| % employees that drive on week day & week end   | 80%      | 85%   | 75%    |
| % employees that work on Sat. and on Sun.      | 20%      | 25%   | 15%    |

<table>
<thead>
<tr>
<th>% Parking Not Used by Workers, That is Used by Non-Workers</th>
<th>Week Day, Work Hours</th>
<th>Baseline</th>
<th>Worse</th>
<th>Better</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50%</td>
<td>45%</td>
<td>55%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>30%</td>
<td>25%</td>
<td>35%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>50%</td>
<td>45%</td>
<td>55%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>30%</td>
<td>25%</td>
<td>35%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Yearly Amount Left Over After Paying Add-Ins</th>
<th>$162,413</th>
<th>$125,242</th>
<th>$210,374</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount Left After Paying Add-Ins &amp; $100 Bonus</td>
<td>$137,413</td>
<td>$100,242</td>
<td>$185,374</td>
</tr>
</tbody>
</table>
Back up Slides
Measures to Get 32%

- Predictions, Regional Transportation Plans
  
- Stop expanding most roads and all freeways
  - No need, Eliminate congestion with less driving

- Reallocate freeway-expansion $$$ to transit

- Payment methods, to increase fairness & choice
  
  - Demonstration projects: Dividend-Account Parking
  
  - Legislation
    - Replace Bundled-Cost or Bundled-Benefit Parking
    - Equitable and environmentally-sound road-use fees

- Smarter growth, complete streets, bike classes
THEREFORE BE IT RESOLVED, that the California Democratic Party reinforces the need for all high school students to know, before they graduate, and elected officials to know, acknowledge, and address, as soon as possible, (1) both the existence of and the reason for anthropogenic climate change; (2) its potential for harm; (3) the difference between stabilizing the climate at a livable level and destabilization; (4) science-based, climate-stabilizing, GHG reduction targets; (5) the primary variables and considerations in identifying those targets and (6) the approximate amount of life style and technology change required to achieve those climate-stabilizing targets.
XXX Implementation Example

The City could have the vendor operate the system, for the first 10 years. Over those years, the vendor would be motivated to debug the system and continue to look for operational efficiencies. The vendor could receive 10% of the revenue, for the first 5 years; 5% of the revenue, for the next 3 years; and 2%, for the final 2 years. If 600 cars are parked for 8 hours, 200 days per year, at 50 cents per hour, then the yearly revenue would be $480,000. The vendor would collect $240,000 over the first 5 years, $72,000 over the next 3 years, and $28,800 over the last two years.
How Bad Could It Get?

Governor Brown to the Pope:

*Humanity must Reverse Course* or *Face Extinction*

*Must be quantified*
Climate Data

• Keeling Curve:
  http://en.wikipedia.org/wiki/An_Inconvenient_Truth#Scientific_basis

Atmospheric Carbon Dioxide
Measured at Mauna Loa, Hawaii

Burning a gallon of gasoline releases about 19 #’s of CO2!
  Likewise
  A barrel of oil, about 700 #’s
  A ton of coal, about 3 tons
  Etc.

Currently 400 PPM!
Our Climate Crisis

- From: http://en.wikipedia.org/wiki/An_Inconvenient_Truth#Scientific_basis

Current Level of CO₂ is 400 PPM

S-3-05’s goal is to cap CO₂ at 450 PPM

S-3-05 Achievement Outcomes
- X% chance > 4 (Extinction?)
- 30% chance > 3 (very bad)
- 50% chance > 2 (bad)
Our Climate Crisis

- Earth & Space Research (ESR) website: http://www.esr.org/outreach/climate_change/mans_impact/man1.html

Current level = 400 PPM

S-3-05’s Goal is to cap CO2 at 450 PPM, which is off this chart.

Start of Industrial Revolution
Fixing the Problem

We must stabilize the value of the earth’s atmospheric \( \text{CO}_2_e \)

\[ E_N + E_A + E_{WFB} \]

- **Natural**: rotting, fire, digestion, respiration
- **Anthropogenic**: combustion of fossil fuel, methane, other
- **Warming Feed Back**: such as methane from melting permafrost

Sequestration (Photosynthesis)

\[ S \]

The Warming Feed Back term is the wild card. It must not become dominant.

Growth of plants on Earth

\[ \begin{align*}
\geq & \rightarrow \text{Positive Slope} \\
\equiv & \rightarrow \text{Zero Slope} \\
\leq & \rightarrow \text{Negative Slope}
\end{align*} \]

If Anthropogenic emissions were to be sufficiently low (80% below 1990 levels has been allocated to developed countries), the slope would be zero, thus capping the value of the Earth’s atmospheric \( \text{CO}_2_e \).
Motivation for Change

• Fairness to individuals
  – Costs no longer hidden
  – Costs avoided or recovered, by not using parking

• Less driving, to reduce environmental harm
  – Motivates choosing alternative modes
  – Less driving to find parking

• Cost Effective Development
  – Less parking needed reduces land and building costs
Goals, 1 of 2

• One agency operates all parking
• Nearly all parking is shared
• Parking costs are effectively unbundled
  – From wages and rents
  – From costs of goods and services
• No change to how parking gets built
  – Generally, municipalities require & developers build
Goals, 2 of 2

• Priced right
  – Value Priced: Base price derived from costs
  – Driver demand determines a congestion price

• No need to search for parking
  – Directions to parking that meets user’s needs
  – Accurate price predictions

• Each parking space’s use is archived
  – Supports informed decisions

• Privacy and the needs of the disabled are supported
Definitions and Methods, 1 of 6

• Definition & Examples of *Parking Beneficiary Group*
  – Owners
    • Private investors or governments operating public parking
  – Those losing money due to provided parking
    • Employees
    • Apartment renters or condominium owners
    • Hotel or restaurant patrons
    • Shoppers
  – Those offered specific parking
    • Driving-age students at a school with parking
    • Driving-age train riders using a station with parking
Definitions and Methods 2 of 6

• How to Effectively Unbundle the Cost or the Benefit
  – Price charged per minute
    • Base price rate established to cover all costs
    • Congestion price rate
      – Dynamically set as a function of occupancy rate
      – Charge is time average, if rate changes, while car is parked
  – Parking generally available to all drivers
  – Earnings distributed to members of Beneficiary Group
    • Calculation of individual’s earnings depends on situation
Definitions and Methods, 3 of 6

• Calculation of monthly earnings
  – If parking is provided for several groups, each group’s portion of the earnings is proportional to its original contribution to cost (Mixed use case)
  – Each beneficiary group’s total is divided up among its members
    • Condominium owners: proportional to spaces effectively purchased
    • Renters: proportional to spaces effectively renting
    • Shoppers: proportional to money spent
    • Employees or students of driving age: proportional to time spent at work or school
    • Train riders of driving age: proportional to time spent on round trips
Definitions and Methods, 4 of 6

- For congestion pricing, define **Cluster of Parking**
  - 20 to 40 contiguous spaces nearly equal in desirability
  - Assigned the same price

- Pricing
  - Base price
    - Covers all costs
    - Report’s Page 13 & 14 provides details
  - Congestion price, for each cluster

\[ r_{\text{HourlyRate}} = r_{\text{BaselineHourly}} \times \left( B^{(30-V)/5} \right), \text{ for } V < 30; r_{\text{BaselineHourly}}, \text{ otherwise} \]

- \( B \) is nominally 2; adjusted to keep vacancy above 15%
- \( V \) is the vacancy % rate (Report’s Eq. 2, Table 2, Pages 14 & 15)
• Pricing predictions
  – For any set of dates, start times, durations, and destinations
  – Availability of predictions
    • Broadcast into navigational units
    • Website or phone

• Help to find desired parking
  – Driver gives times and locations and stipulates . . .
    • Max price, to get space at minimum walk distance
    • Max walk distance, to get space at minimum price
  – Voice-activated navigational system for ease and safety
Definitions and Methods, 6 of 6

• Monthly statements
  – All parking charges and earnings
    • First, within state
    • Then, within nation
    • Finally, within North and South America
  – Customer selects presentation detail
    • Less detail for ease and more privacy
    • More detail to know and adjust parking decisions
  – Packaged with other statements
    • All utilities, transit use, road use
Implementation Plan, 1 of 3

• Prototype design
  – Most likely a Climate Action Plan Mitigation Measure
• Requirements document to support request for proposal (RFP)
• Winning proposal leads to design
  – Hardware selection and design
  – Software generation
• Prototype installation
  – Most likely a Climate Action Plan Mitigation Measure
  – Debug
  – Adjustments to satisfy stakeholders
Implementation Plan, 2 of 3

• Government agency develops and executes full installation strategy
  – To minimize impact on institutions
  – To maximize early success and driving reductions
    • Large employment centers with “free” parking
    • Train stations with large, “free” parking lots
  – Supported by new law that requires cooperation but very little effort, from . . .
    • Private and public institutions
    • Individuals
Implementation Plan, 3 of 3

• Basis for a new law supporting installations
  – To provide equal protection of the law
    • Government has required parking for 50 years
    • Those driving less than average often lose money
  – Prototype will have demonstrated feasibility
  – Global warming considerations show subsidized parking to be a public nuisance
    • Global warming will likely cause a human catastrophe
    • Short term strategies are critical
    • Electric cars and getting most electricity from renewables will take decades
    • Properly pricing parking is relatively cheap and quick (5 years)
## Unbundle Flow Diagram Definitions

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>$P_{\text{INP}}$</td>
<td>Company payroll if there were no parking costs</td>
</tr>
<tr>
<td>$P_{\text{cost}}$</td>
<td>Total parking cost. Price will be sized to recover this.</td>
</tr>
<tr>
<td>$P_{\text{earned}}$</td>
<td>Parking earnings equals parking cost minus collection cost</td>
</tr>
<tr>
<td>$v_i$</td>
<td>Employee value. Fraction of available pay. For the average employee, $1/n$</td>
</tr>
<tr>
<td>$c_i$</td>
<td>Fraction of parking cost paid. Zero, if the employee never parks.</td>
</tr>
<tr>
<td>$f$</td>
<td>Parking earnings divided by parking cost. Close to 1 for efficient collection</td>
</tr>
<tr>
<td>$w_i$</td>
<td>time worked divided by total time worked of all employees. If average, this is $1/n$.</td>
</tr>
</tbody>
</table>
For the average $i^{th}$ employee, $v_i = 1/n$ and $w_i = 1/n$. If this employee never parks, their pay is $(1/n)P_{INP} - (1/n)P_{cost}(1-f)$. If $f = 1$, the pay is what it would be with no parking.
Mike Bullock, 1 of 2

• Personal
  – Married, two daughters, 3 grand daughters, 1 grandson
    • Daughter Laura Bullock White (Berkeley)
    • Heidi Bullock (Oceanside)
  – Moved from Cupertino to Oceanside in April 2007
  – Oceanside home (1800 Bayberry Dr) and 4-plex (506 N. Ditmar)
  – Swims with and competes for Oceanside Swim Masters

• Education
  – BSEE, Lamar University
  – MSE, University of Texas at El Paso

• Professional
  – Lockheed Martin Systems Engineer, 1971 to 2007
    • Last 2 years, Space Based Infrared System (SBIRS, satellite to detect and track missiles)
    • 10 Years previous: Milstar (communication satellite)
      – Verification of antenna pointing accuracy
      – Antenna pointing calibration
Most Recent Activities

- California Democratic Party
  - Delegate, 76th AD
  - Elected member of the San Diego County Central Committee
  - CDP Resolutions and Platform
San Diego County’s Climate Action Plan Misadventures

- The Sierra Club proposed Dividend-Account parking, as a demonstration project for County employees.
- The County argued it was infeasible.
- Superior Court Judge Taylor ruled that the County failed to show it was infeasible.
- The County appealed on a 3-2 vote.
- This is the 2nd failed CAP for the County. The first was ordered rescinded on the same issue and resulted in a published Appellant Court Ruling.
DRAFT

These entities or others may become interested in issuing a Request for Information as described herein

City of Encinitas in cooperation with the cities of Oceanside, Carlsbad, Solana Beach, and Del Mar, the United States Marine Corps Base at Camp Pendleton, and North County Transit District

REQUEST FOR INFORMATION (RFI)
OR A REQUEST FOR AN INDICATION OF INTEREST (RFIOI) IN RESPONDING TO AN RFI
Design, Install, and Operate a Dividend-Account Car Parking System at Selected Work Locations for Employees
CM RFI 18-XX

Date Issued: Month j, 2018 or 2019
Questions Due: Month k, 2018, 5:00 PM
Proposals Due: Month l, 2018, 2:00 PM

IF YOU DID NOT DOWNLOAD, OR DIRECTLY RECEIVE THIS DOCUMENT FROM THE XXX WEBSITE AT WWW.xxx.GOV/BIDS, YOU ARE NOT LISTED AS AN OFFICIAL DOCUMENT HOLDER FOR THIS SOLICITATION AND WILL NOT BE NOTIFIED BY THE CITY OF ADDENDA ISSUED. YOU MUST ACKNOWLEDGE ANY ADDENDA ISSUED IN YOUR SUBMITTAL OR RISK BEING CONSIDERED NON RESPONSIVE. PLEASE BE SURE TO VISIT THE WEBSITE ABOVE TO REGISTER AS A DOCUMENT HOLDER FOR THIS SOLICITATION.
# Table of Contents

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ATTACHMENT 1 ......................................................................................................................14
I. INTRODUCTION

The City of Encinitas, or one of the other entities shown above, may want, at some future date, to request information that will aid in the selection of a vendor for a possible Dividend-Account Car-Parking System Demonstration pilot on behalf of the themselves and other entities, such as Oceanside, Carlsbad, Encinitas, Solana Beach, and Del Mar, the United States Marine Corps Base at Camp Pendleton, and the North County Transit District (collectively referred to as “Partners”). The Partners may seek to evaluate the benefits, effectiveness, and popularity of a Dividend-Account Car Parking System for employees in the north coastal region of San Diego County through the operation of a temporary pilot program lasting from twelve (12) to thirty-six (36) months. It could become the goal of the Partners to determine whether permanent Dividend-Account Car-Parking systems would be successful in our region based on the outcome of a pilot program. Partners may decide to be actively coordinating with the San Diego Association of Governments (SANDAG), the agency that may be leading regional Dividend-Account Car-Parking Systems coordination around topics including data collection and monitoring, public outreach, policy/regulations. The partners are more likely to want to proceed if there is an identified interest on the part of vendors to respond to an actual RFI. To save time, the rest of this document is written as if one of the Partners has already decided to issue an RFI. However, that is not currently the case. This document, perhaps best described as Request for Indication of Interest has been adapted from a dock-less bike share RFI. Thank you for considering this concept. Please indicate if you would be interested in designing and operating such a system.

Mike Bullock
Oceanside, CA 92054
760-754-8025; Cell: 760-421-9482

A. Location

The study area includes the cities of Oceanside, Carlsbad, Encinitas, Solana Beach, and Del Mar, and the United States Marine Corps Base at Camp Pendleton, all of which are located in northern San Diego County along the coast. The region has a mild climate with average temperatures ranging from the mid-60s in the winter to mid-80s in the summer. The terrain is relatively flat along the coast, particularly when traveling in the north-south directions. Each of the cities have dense urban centers of varying sizes with grid street plans and relatively flat terrain. Generally, most of the cities in the study area have more hilly terrain and a suburban layout east of Interstate 5 (I-5). The combined population of the cities is approximately 365,000 and the combined geographical area of the cities is approximately 106 square miles. Highway 101 runs along the coast through each of the cities for a contiguous distance of approximately 20 miles. Highway 101 is one of the most popular bicycling routes in the San Diego region. North County Transit District (NCTD) operates two rail lines and 34 bus routes throughout North County. Thirteen rail and/or bus transit centers are located within the study area. Total annual NCTD ridership is approximately 10.7 million passengers. The Camp Pendleton Marine Corps base is located just north of Oceanside and serves as a major employer for both enlisted and non-enlisted personnel. The southwest corner of the base adjacent to Oceanside Harbor and west of I-5 features relatively flat terrain and could benefit from increased biking connections.

Table 1: General information about the region
<table>
<thead>
<tr>
<th>City</th>
<th>Population</th>
<th>Employment</th>
<th>Size (sq. mi.)</th>
<th>Coastline (mi.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oceanside</td>
<td>175,948</td>
<td>35,662</td>
<td>42</td>
<td>3.5</td>
</tr>
<tr>
<td>Carlsbad</td>
<td>112,930</td>
<td>66,596</td>
<td>39</td>
<td>6.3</td>
</tr>
<tr>
<td>Encinitas</td>
<td>61,928</td>
<td>22,443</td>
<td>20</td>
<td>6</td>
</tr>
<tr>
<td>Solana Beach</td>
<td>13,494</td>
<td>7,843</td>
<td>3.6</td>
<td>1.5</td>
</tr>
<tr>
<td>Del Mar</td>
<td>4,274</td>
<td>3,474</td>
<td>1.8</td>
<td>2.9</td>
</tr>
</tbody>
</table>

1. SANDAG Current Estimates, 2016
2. U.S. Census Bureau, 2015

B. Background

The cities in the North County coastal region of San Diego County are increasingly aware of the need to reduce local greenhouse gas (GHG) emissions to limit the effects of climate change.
while offering viable transportation alternatives to driving alone. Many of the cities have adopted Climate Action Plans (CAPs) or are in the process of developing CAPs. CAPs establish environmental initiatives by which cities aim to achieve GHG emissions reduction goals and targets. Transportation, especially travel via single occupancy vehicle, is a major source of GHG emissions in North County. Facilitating safe, convenient, and affordable alternative transportation options is often a component of these plans and initiatives. Car parking systems that increase economic fairness and choice, compared to bundled-employee-benefit car parking systems (erroneously called “free parking”) at places of employment will reduce single occupancy vehicle (SOV) commuting and increase the need for first/last mile solutions. For this reason, this RFI will be provided to those firms that would benefit from increasing the demand for first/last mile solutions.

The Marine Corps Mobility Transformation Strategy calls for demonstration projects at installations like Camp Pendleton to meet official business mobility with capabilities that are smarter, more efficient, more accessible, and cheaper.

Partners will seek to coordinate with SANDAG on Dividend-Account Car-Parking Systems data analysis while ensuring the selected Dividend-Account Car-Parking Systems vendor can meet data sharing requirements that assist in quantifying the impacts of Dividend-Account Car-Parking Systems on vehicle miles traveled (VMT), access to transit, economic development, and other benefits.

Offering and promoting programs, like Dividend-Account Car-Parking Systems, that replace vehicle trips with active transportation and/or transit trips, is one of the ways the Partners can help to reduce emissions while offering more efficient and more affordable transportation modes for residents, employees, and visitors. A Dividend-Account Car-Parking System is a system which operates employee car parking for the financial gain of the employees by value-pricing the parking and distributing the earnings, which are the revenue minus a fair cost of operation, among employees. The earnings are provided in proportion to the time an employee spends on the work premises. There may also be an “add in” payment provided by either the employer or from a grant, such as a Greenhouse Gas Reduction Fund (GGRF) grant, sized so that an employee that continues to drive every day will lose no money under the system. This system will in effect pay each employee an additional amount of income for each day they get to work without relying on the single occupancy vehicle (SOV) mode. See Reference 1 for more details on the Dividend-Account Car Parking System. The References are listed at the end of Section II, Request for Information.

C. Purpose and Objectives of the RFI

The purpose of this Request for Information (RFI) is to identify vendors with the resources to pilot a Dividend-Account Car-Parking System program in the Partners’ jurisdictions, in accordance with the objectives set forth in this RFI.

The Partners seek a qualified vendor to design, establish, implement, operate, and maintain an innovative, valuable, and mutually-beneficial Dividend-Account Car-Parking System pilot program. The pilot should enable and encourage residents, employees, and visitors to affordably and conveniently travel by car pool, transit, active transportation or some combination of these modes. The pilot should also facilitate a decrease in vehicular parking demand, vehicular traffic, and (GHG) emissions, while promoting active and healthy transportation options.
Qualified vendors are invited to submit proposals based on the information provided in this RFI.

This RFI is a mechanism for gathering information and does not constitute a binding procurement process, however, selection of goods and/or services may result from information obtained through this RFI process, where deemed appropriate. The Partners, jointly or individually, are not obligated to make an award or issue a Request for Proposal as part of this process. In addition, the Partners, in their sole discretion, may decide to engage in direct question and answer sessions with one or more vendors and may decide to enter into an agreement or issue permits based upon those discussions/interviews or a resulting proposal.

If a single demonstration pilot project or multiple demonstration pilot projects were successful, given the severity of our anthropogenic climate change crisis, it is anticipated that other employers will decide to install Dividend-Account car-parking systems. Since municipal governments are required under CEQA to adopt General Plan Updates (GPUs) that include, perhaps using a Climate Action Plan, a set of enforceable measures that will achieve climate-stabilizing targets, and since cars and light-duty trucks (LDVs) are the largest category of GHG emissions, it is further anticipated that municipal governments will, over time, update their off-street parking ordinances to include requirements for Dividend-Account Car Parking systems. Reference 2 shows that this system is adaptable to all types of parking. A selected vendor would have access to a market of more than 365,000 residents living in the north coastal region, more than 135,000 employees that work in the region, and others that visit the region for leisure.

Potential Dividend-Account Car-Parking Systems program marketing opportunities may include, but are not limited to: being listed as a preferred vendor on the Partners websites, co-branded sustainability campaigns, signage, event sponsorship, press releases, and social media announcements.

D. Obtaining RFI Documents

The website for this RFI and related documents is: PlanetBids (http://www.encinitasca.gov/bids). All correspondence will be posted on the PlanetBids website. It is the responsibility of Proposers to check the website regularly for information updates and RFI clarifications, as well as any RFI addenda. To submit a proposal, a Proposer must be registered with the City of Encinitas as a vendor. To register as a vendor, go to the following link (http://www.encinitasca.gov/bids), and then proceed to the “New Vendor Registration” link. All addenda will be available on the PlanetBids website.

E. RFI Contact

The City of Encinitas will receive questions and information requests on this RFI up to 5:00 p.m. on some TBD Month “n”, 2018. All questions regarding the RFI documents shall be submitted through PlanetBids. All project correspondence will be posted on the PlanetBids website. It is the responsibility of the Proposers to check the website regularly for information updates, clarifications, and addenda.

II. REQUEST FOR INFORMATION or REQUEST FOR INDICATION OF INTEREST

This section describes the information being requested by the Partners to learn about prospective Dividend-Account Car-Parking System (“System”) vendors and optionally to select a vendor to operate in the Partners’ jurisdictions. Interested vendors must include all
information outlined below in a submitted proposal.

A. Dividend-Account Car-Parking System ("System") Pilot Program Requirements

Vendors responding to this RFI must describe their proposed system that is capable of providing the following services and shall describe these services in their submission:

1. System pilot program(s), as described in Reference 1, to include the following installed and maintained capabilities:

2. A capability to establish and maintain a database of System Vehicles, System Members, System Parking and System Accounts. A System Account includes the mailing name and address of a person that has agreed to receive payments and pay bills that are the result of the implementation of the System and the actions taken by the person, or some other person driving the System Vehicle or System Vehicles, as described herein. Such a person is a "System Member." A "System Vehicle" is one that can be identified when it is parked in the System and one that is associated with a System Account and System Member. A System Member may take responsibility to pay for the cost of parking for multiple System Vehicles.

3. A capability to provide an easy method for Employees and others to become System Members by establishing a System Account with their chosen System Vehicles.

4. A capability to provide signage to designate System Parking areas well enough to prevent nearly all accidental entries by unauthorized vehicles, meaning vehicles that are not System Vehicles.

5. A capability to provide written materials to explain to employees and others that may want to become System Members how the System will work and why it is an important improvement to economic fairness and environmental outcomes, assuming a reasonable level of cooperation with the City and other affected groups, such as City vendors and sub-contractors.

6. A capability to operate the system for an agreed-upon amount of time, with no money exchanges, to establish a pre-install database of commute behavior including using questionnaires to determine how non-drivers say they are getting to work.

7. A capability to identify a System Vehicle within a minute of its being parked in a System Parking space and to store the System Vehicle identifier and the time it was recognized as being parked.

8. A capability to recognize when a System Vehicle exits a System Parking space, within a minute and to store the vehicle identifier and the recognized exit time.

9. A capability to identify vehicles that are NOT System Vehicles when they are in the System Parking area and are therefore trespassing, while they are in the System Parking area.

10. A capability to record the start time and end time of the trespassing vehicle’s trespassing, to within an accuracy of 1 minute, as well as its license plate image, sufficient to support a conviction of trespassing.

11. A capability to send the license plate of the trespassing vehicle and its start time and end time of its trespassing to law enforcement officials with 5 minutes of the recorded start time of the trespass.

12. A capability to provide notice and evidence of this trespassing in real time and as stored
information for law enforcement so that they can then ticket and prosecute the owners of any and all vehicles that have been illegally parked in a System Parking space. It is anticipated that this would include the capture and storage of the license plate numbers of the vehicles that are parked in the System Parking lot whenever it is the case that the vehicle is not a System Vehicle.

13. A capability to compute an instantaneous charge rate (cost per minute) for the case of an application of “congestion pricing”, whereby an agreed-upon base price is increased by an agreed-upon congestion-pricing algorithm, designed to prevent the occupancy rate from exceeding an agreed-upon upper bound value, such as 90% occupied. An example of such an algorithm is in Reference 2.

14. A capability to compute and store the time that the charge rate changes, for the case of an application of a congestion-pricing algorithm. Note that this time is called the Rate Change Time. At these times, the rate could either increase, by the addition of a car being parked in a System Space or the rate could be decreased, by the subtraction of a car in a System Space.

15. A capability to accumulate a total charge for each System Member, where the total charge is the sum of the products of each parked duration time over which a fixed charge rate applies and the length of that time duration, for all the System Vehicles associated with the System Member, over a month. This total charge is called the System Member Monthly Charge (“SMMC”). Note that the Member may or may not be an employee.

16. A capability to compute the total charges, for all System Members over a month for the System. This amount is the Total System Monthly Charge (“TSMC”).

17. A capability to compute a Total System Monthly Earnings (“TSME”), which is the TSMC, reduced by a agree-to amount, such as 5%, where the 5% is taken out of the TSMC to cover the operator’s expenses.

18. A capability to record all the times an employee enters and leaves the work premises. One way to do this is to require employees to have an RFID. There may also be an GPS or a license plate reading solution. Note that a privacy requirement will prevent this information from being shared, with the employer, for example, with the exception of providing it to a law enforcement person, in the event a warrant is signed by a presiding judge.

19. A capability to use the times an employee enters and leaves the work premises to compute the time, over a month, an employee has spent at or within the work premises. This time is known as the Employee Monthly Time (“EMT”).

20. A capability to compute the total time all employees spent at the premises over a month, to be known as the Total Employee Monthly Time (“TEMT”).

21. A capability to compute an Employee’s Monthly System Earnings (“EMSE”) as the Total System Monthly Earnings (“TSME”), multiplied by the employee’s Employee Monthly Time, EMT divided by the TEMT. This is also described in Reference 1.

22. A capability to compute an Employee’s Add-In “EAI”, as follows. If the employee’s System Member Monthly Charge, SMMC, value is greater than the employee’s earnings, TSME; then, for that case, the EAI is equal to the employee’s SMMC minus the employee’s TSME. If the employee’s System Member Monthly Charge, SMMC value is not greater than the employee’s earnings, TSME; then the employee’s EAI is equal to zero. This is also described in Reference 1.

23. A capability to accept Employee’s Add-In, EAI money from the Employer, with the
expectation that the money would originate from a grant funded by, for example, the
Greenhouse Gas Reduction Fund (GGRF), or could come from the Employer’s budget,
as a Climate Action Plan (CAP) or other expense. It could also be generated by
converting some “free” parking to be a different Account Parking System Parking
(System Parking), thereby generating new money to the City.

24. A capability to compute an employee’s monthly payment (“EMP”), as follows: It is equal
to the Employee’s Monthly System Earnings, EMSE plus the employee’s Add-In, EAI
minus the System Member Monthly Charge, SMMC. This is also described in Reference
1.

25. A capability to automatically send out monthly statements to all System Members.
System Members who are not employees will receive a bill if they have parked in the
System parking during the month. The bill will then be for the member’s SMMC. Each
employee will receive a statement showing SMMC, EMSE, and EAI. If the employee’s
EAI is zero, then the employee will receive a payment in the form of cashable check for
the employee’s EMP. This is also explained in Reference 1.

26. A capability to protect employee privacy where privacy means that the employee’s data
will never be shared, with the sole exception of sharing with law enforcement officials in
accordance with a valid court order requesting the data. For example, at no time will the
data be shared with other employees, including those working in the management of the
employer that is providing the employee parking that is the System Parking.

27. A capability to protect System Member privacy where privacy means that the System
Member’s data will never be shared, with the sole exception of sharing with law
enforcement officials in accordance with a valid court order requesting the data.

28. A capability to allow visitors, vendors, and others, that are identified by the Company
management, to be treated as employees. There could also be “visitor” parking that is
not associated with the System.

29. A capability to identify System Vehicles that are parked in the visitor parking or other
inappropriate parking places, since it is expected that it will required as a part of City
Policy that System Vehicles that are associated with employees will be required to be
parked in the System Parking. Since employees are earning money from the System
Parking, it would be inappropriate for them to not use the System Parking. This
information would be shared with City Management, as soon as it is collected.

30. A capability to perform regular inspection, maintenance, and repair of all System Parking
facilities and associated capabilities often enough to eliminate nearly all system failures.

31. A capability to perform vendor-managed methods of enforcement.

32. A capability to have demonstrated secured financial backing with the ability to operate at
full capacity for the life of the pilot program and beyond with a sustainable business
model.

33. A capability to provide close coordination with all Partners, including real-time sharing of
System Parking data collected, active promotion of the Dividend-Account Car-Parking
Systems program in coordination with each Partner, and timely response to any
complaints received or requests made by the Partners and Dividend-Account Car-
Parking Systems users. Describe the type of data that is collected and can be provided
to the Partners. Promotion and advertisement of the Dividend-Account Car-Parking
Systems program must comply with all Partners’ municipal codes and ordinances.

34. A capability to offer a Dividend-Account Car-Parking Systems program that can be
deployed, operated, managed, and maintained by the vendor at no cost, except for the
possibility of the EAI payments, to the Partners and with minimal oversight needed from the Partners.

35. A capability to establish and operated multiple Dividend-Account Car-Parking Systems programs including for for cases other than employee parking, as described in Reference 2, that can be deployed, operated, managed, and maintained by the vendor at no cost, except for the EAI payment, for employee parking, to the Partners and with minimal oversight needed from the Partners.

36. A capability to conform to contract specifications, including general liability insurance, worker’s compensation, automobile liability insurance, indemnification, and termination clauses. Sample contract attached.

B. Proposal Elements

Vendors interested in responding to this RFI must prepare a proposal that includes the following information:

1. Describe how drivers can become System Members.

2. Provide a detailed System maintenance plan.

3. Describe the vendor’s capability to provide data and reports to the Partners, including raw and summarized data. Summarized data could include both user data (e.g., demographics, trip purpose, repeat usage, percent of trips starting and ending in close proximity to transit, mode shift, and transit usage) and trip data (e.g., average trip length, average trip time, trip start and end hotspots, trip path, estimated GHG emissions per trip). Ideally, this data should be provided via a publicly accessible API in your suggested General Dividend-Account Car-Parking Systems Feed Specification (GBFS) format. Describe vendor’s ability to collect quantitative and qualitative data and report out findings from users (e.g. in-app surveys).

4. Describe how the vendor will employ anti-theft and anti-vandalism measures to ensure Systems do not pose a nuisance to the community.

5. Since the establishment of Dividend-Account Parking systems will increase bike usage, describe how the vendor will address bicycle safety concerns, including helmet use, riding at night and other safety concerns that may or may not be regulated by state vehicle codes.

6. Describe how the Dividend-Account Car-Parking Systems program may operate in conjunction with existing bike rental businesses operating in the Partners’ cities.

7. Describe the vendor’s plans for future growth and expansion, including possible anticipated increases in demand for good car parking systems as the public becomes more aware of the threat of anthropogenic climate change and how good systems improve economic fairness, etc.

8. Provide an estimated timeline for a twelve-to-twenty-four-month pilot Dividend-Account Car-Parking System program, including any needed permitting, set-up, promotion, advertising, maintenance and servicing, data delivery to Partners, summary and reporting on the outcome of the pilot program and possible continuation of the program.
9. Describe a recommended minimum Dividend-Account Car-Parking Systems size for the North County Coastal operating area.

10. Describe strategies for effectively educating users on proper System Parking use and the reason that society needs to improve the way we pay for the use of car parking.

11. Describe any approach you would recommend to enhance access and fairness for disadvantaged communities.

12. Describe time required to deploy a Dividend-Account Car-Parking Systems pilot program if selected based on System Parking size, etc.

13. Describe an approach to increasing the use of Dividend-Account Parking to include most city car parking, then across City boundaries, and then across County, State, and international boundaries, with the final system being one wherein nearly all System Vehicles have a single, world-wide, System Account.

References Providing Additional Description

1. Eliminating the Harm of Bundled-Cost or Bundled-Benefit Parking, Presentation to the 2018 Energy Utility Environment Conference (EUEC), Mike Bullock, March 2018

2. A Plan to Efficiently and Conveniently Unbundle Car Parking Costs, paper presented to the Air and Waste Management Association (AWMA) Conference in 2010, Mike Bullock and Jim Stewart, June 2010

3. Oceanside Civic Center Garage Space Allocation, EXCEL Spread Sheet, Bullock, based on a file provided by Oceanside staff, July 2018

III. INSTRUCTIONS

A. Proposal Due Date

Proposals must be submitted electronically no later than 5:00 p.m. on TBD Month 2018 or 2019. Proposals must be submitted electronically via the PlanetBids system used to download the RFI. The maximum file size for submittal is 50 megabytes, and the file type shall be Portable Document Format (PDF). The electronic system will close submissions exactly at the date and time set forth in the RFI or as changed by addenda.

B. Proposal Acceptance

Respondents are responsible for submitting and having their submittal accepted before the closing time set forth in this RFI or as changed by addenda. NOTE: Pushing the submit button on the electronic system may not be instantaneous; it may take time for the Respondent’s documents to upload and transmit before the submittal is accepted. It is the Respondent’s sole responsibility to ensure their document(s) are uploaded, transmitted, and arrive in time electronically. The City of Encinitas will have no responsibility for submittals that do not arrive in a timely manner, no matter what the reason.
C. Page Limit

No submissions exceeding twenty-five (25) pages will be accepted (excluding attachments). In addition, attachments may not exceed twenty-five (25) pages. The City of Encinitas discourages “padding” of proposals with brochures, extensive literature, and boilerplate material not applicable to a pilot Dividend-Account Car-Parking Systems program.

D. Proposal Format

Proposals must be organized in the following format and include the following content:

1. Letter of transmittal signed by an individual authorized to bind the proposing entity stating the firm has read and will comply with all terms and conditions of the RFI.

2. General information about the firm, including the size of the organization, location of offices, number of years in business, organizational chart, name of owners and principal parties, number and position titles of staff.

3. Qualifications of principals, project managers and key personnel who would be assigned to this project. Include their position in the firm, and types and amount of relevant experience operating a Dividend-Account Car-Parking Systems program or similar program. Identify the primary contact that will be the overall project manager. Resumes are not required, but may be included as attachments. The selected respondent may not substitute personnel without written authorization from the Partners.

4. A work plan that establishes the Respondent’s understanding of, and ability to satisfy Partners’ objectives. Respondent shall succinctly describe the proposed approach for implementing a Dividend-Account Car-Parking Systems program, outlining the activities, including innovative ideas that would be undertaken in completing the various tasks and specifying who would perform them.

5. A preliminary estimated schedule for deployment of a pilot Dividend-Account Car-Parking Systems program. Show all critical paths, major milestones, and decision points in pilot schedule.

6. A list of the municipal or other government agencies your firm has worked with during the past three years. Provide the following information for at least one operational system that has at least some of the similar components as would a Dividend-Account Car-Parking System program that is managed by the respondent:

   a) Name, address, and telephone number of the agency;
   b) Time period for the project;
   c) Brief description of the scope of the services provided;
   d) Identify the staff members on the project and their specific responsibilities; and
   e) Person and contact information for a reference.

IV. PROPOSAL EVALUATION

A. Proposal Evaluation
A review committee comprised of representatives from each of the potential Partner cities will judge the merit of proposals received in accordance with the general criteria defined herein. Failure of proposers to provide in their proposal any information requested in this RFI may result in disqualification of the proposal. The sole objective of the review committee will be to select the proposal that is most responsive to the Partners’ needs. The Partners reserve the right to elect to not proceed with a pilot Dividend-Account Car-Parking System program and reject all proposals received through this RFI process.

1. Experience of the vendor and proposed staff. Experience of project staff with similar scope of services. Level of education, training, licensing and certification of staff

2. Approach to the project. Demonstrated understanding of the Partners’ needs and solicitation requirements. Approach is well organized and presented in a clear, concise and logical manner.

3. Availability and proposed use of technology and methodologies. Quality control and thoroughness is well defined.

4. Capability to Perform. Ability to complete work within deadlines. Availability and continuity of staff during the course of the project, if selected. Unsatisfactory past performance with the City of Encinitas (or any of the Partner cities) may be considered as determined by the City of Encinitas (or any of the Partner cities) in their sole and absolute discretion.

5. Relevant Experience. Experience in performing similar services for organizations of similar size to the Partner cities. Experience with public agencies. Years of experience with these types of services.


B. Final Negotiation

As reflected above, vendor selection will be based on a combination of factors as determined to be in the best interest of the Partners. After evaluating the proposals and discussing them further with the finalists, or the tentatively selected vendor, the City of Encinitas reserves the right to further negotiate the proposed program.

V. CONDITIONS GOVERNING THIS PROCUREMENT

A. Scope Changes, Additions and Deletions

All changes in proposal documents shall be through written addendum and furnished to all proposers. Verbal information obtained otherwise will NOT be considered in the evaluation process.

B. Rejection of Proposals

The City of Encinitas reserves the right to reject any or all Proposals and to waive informalities and minor irregularities in Proposals received and to accept any portion of Proposal or all items of Proposal if deemed in the best interest of the City of Encinitas to do so.
C. Proprietary Information

Any restrictions on the use of data contained within a Proposal must be clearly stated in the Proposal itself. Proprietary information submitted in response to this RFI will be handled in accordance with applicable City of Encinitas Procurement Regulations and the California Public Records Act.

D. Response Materials Ownership

All materials submitted regarding this RFI become the property of the City of Encinitas. Responses may be reviewed by any person at Proposal opening time and after final selection has been made. The City of Encinitas has the right to use any or all ideas presented in reply to this request, subject to the limitations outlined in Proprietary Information above. Disqualification of a proposer does not eliminate this right.

E. Acceptance of Proposal Content

The contents of the Proposal of the successful proposer will become contractual obligations if contractual agreements action ensues. Failure of the successful proposer to accept these obligations in a permit to operate, purchase agreement, purchase order, contract, delivery order or similar acquisition instrument may result in cancellation of the award and such proposer may be removed from future solicitations.

F. Cost of Proposal Preparation

The City of Encinitas shall not be liable for any pre-contractual expenses incurred by any submitting vendor. Each submitting vendor shall protect, defend, indemnify, and hold harmless the City of Encinitas from any and all liability, claims or expenses whosoever incurred by, or on behalf of, the entity participating in the preparation of its response to this RFI. Pre-contractual expenses are defined as expenses incurred by vendors in:

1. Preparing the proposal in response to this RFI;
2. Cost to acquire a permit; and
3. All other expenses incurred by a vendor related to preparation of proposal or establishment of a Dividend-Account Car-Parking System program.

G. Interview

Interviews with the top respondents may be requested. The selection of vendors invited to interview will be solely based on the Partners’ discretion. The vendors asked to interview will be notified in advance.
Sample License Agreement for Dividend-Account Parking Services

This License Agreement for Dividend-Account Car-Parking System Services ("Agreement") is made this day of September 2017, by and between the City of Encinitas ("City") and ___ ("Dividend-Account Car-Parking System Vendor").

RECITALS

1. A goal of City is to provide safe and affordable multi-modal transportation options to all residents, reduce traffic congestion, and maximize carbon free mobility.

2. Dividend-Account Car-Parking System services are a component to help the City achieve its transportation goals and the City desires to make this System available to residents and those who work or otherwise drive and park in the City.

3. Dividend-Account Car-Parking System Vendor proposes to operate a Dividend-Account Car Parking program within the City at an agreed-to location with an agree-to number of System parking spaces within the designated location or locations. As an example, based on Reference 3, there could be 239 spaces designated as System Parking, out of a total of 284 spaces in the Oceanside Civic Center Parking Garage. Note further, that if there are 259 employees that work for the City and are given parking spaces, there would be a need to establish 20 additional System Parking spaces outside of the Oceanside Civic Center Parking Garage.

4. Dividend-Account Car-Parking System Vendor will abide by all City ordinances and rules governing the use of public space.

5. Dividend-Account Car-Parking System Vendor possesses the technology necessary to install, operate, maintain, and expand such a system and multiple systems as demand expands.

AGREEMENT

1. Initial Term. This Agreement is effective for twelve to eighteen months from the date of execution ("Initial Term, Phase 1"), which will include a duration of installation during which no money is exchanged so as to establish a baseline of modal splits for employee commuting, and then a year of full operation to document the modal split changes and an estimated amount of greenhouse gas (GHG) emissions saved by the program. At the conclusion of the Initial Term Phase 1, the Agreement may be extended by mutual written agreement of the parties for an additional two-year term (Initial Term, Phase 2), subject to any new terms agreed between the parties, unless either party notifies the other party of its intent not to continue with the Agreement no later than 30 days before the expiration of the Initial Term, Phase 1 and Phase 2.

2. Exclusive Operator. During the Initial Term’s Phase 1 and Phase 2, the City designates Dividend-Account Car-Parking Systems Vendor as the exclusive provider of the System services within its city limits. This designation is personal to Dividend-Account Car-Parking Systems Vendor and may not be assigned or transferred to any party. This exclusivity provision shall expire and not be renewed past the Initial Term’s Phase 1 and Phase 2 unless agreed in writing by the parties.
3. **Use of City Property.** City authorizes Dividend-Account Car-Parking Systems Vendor to use ("License") City property, including the public right-of-way and System Parking areas that are suitable, solely for the purposes set forth in Section 4 of this Agreement. This authorization is not a lease or an easement, and is not intended and shall not be construed to transfer any real property interest in City Property.

4. **Permitted Use.** Dividend-Account Car-Parking System’s System Members may use City Property solely for parking System Vehicles. The City Property is maintained by the City. Dividend-Account Car-Parking Systems Vendor may operate an agree-to-amount of System Parking places on City Property as set forth in Exhibit A. If at any time during the term of the Agreement Dividend-Account Car-Parking Systems Vendor desires to place additional System Parking within the City limits, Dividend-Account Car-Parking Systems Vendor must request and receive authorization from the city to do so in writing. The City may limit the number of System Parking places upon identifying a potential harm to public health or safety. Dividend-Account Car-Parking Systems Vendor shall not place or attach any personal property, fixtures, or structures to City Property without the prior written consent of City.

- a. Use of City Property and Dividend-Account Car-Parking Systems Vendor's operations within the City, shall, at a minimum: a) not adversely affect City Property or the City's streets, or sidewalks; b) not adversely affect the property of any third parties; c) not inhibit pedestrian or vehicular movement, as applicable, within City Property or along other property or rights-of-way owned or controlled by the City; d) not create conditions which are a threat to public safety and security. Dividend-Account Car-Parking Systems Vendor shall instruct its customers not to park or leave any System Vehicle where they would impede pedestrian or vehicular traffic.

- b. Upon termination of this Agreement by either party, Dividend-Account Car-Parking Systems Vendor shall, at its sole cost and expense, immediately restore City Property to a condition which is visually and structurally indistinguishable from the immediately surrounding area.

5. **System Parking.** The City, at its own discretion, may support the System with the installation of signs and painting to further the orderly operation of the System Parking.

6. **Condition of City Property**

- a. City makes City Property available to Dividend-Account Car-Parking Systems Vendor in an "as is" condition. City makes no representations or warranties concerning the condition of City Property or its suitability for use by Dividend-Account Car-Parking Systems Vendor or its customers, and assumes no duty to warn either Dividend-Account Car-Parking Systems Vendor or the System Members concerning conditions that exist now or may arise in the future.

- b. City assumes no liability for loss or damage to Dividend-Account Car-Parking Systems System Members. Dividend-Account Car-Parking Systems Vendor agrees that City is not responsible for providing security at any location where Dividend-Account Car-Parking Systems Vendor's System Vehicles are parked, and Dividend-Account Car-Parking Systems Vendor hereby waives any claim against City in the event Dividend-Account Car-Parking System’s System Vehicles or other property are lost, stolen, or damaged.

7. **Maintenance and Care of Portion of City Property;** Dividend-Account Car-Parking Systems Vendor shall be solely responsible for: (i) maintaining City Property to the City standards applicable for use by the Dividend-Account Car-Parking Systems Vendor as
permitted under Section 3; and (ii) obtaining from the City any applicable permits or approvals required by the City. Dividend-Account Car-Parking Systems Vendor shall exercise due care in the use of City Property and shall be responsible for maintaining City Property in good condition and repair. Dividend-Account Car-Parking Systems Vendor shall not act, or fail to act, in any way that result in excessive wear or damage to City Property. Dividend-Account Car-Parking Systems Vendor expressly agrees to repair, replace or otherwise restore any part or item of real or personal property that is damaged, lost or destroyed as a result of the Dividend-Account Car-Parking Systems Vendor's use of City Property. Should the Dividend-Account Car-Parking Systems Vendor fail to repair, replace or otherwise restore such real or personal property, Dividend-Account Car-Parking Systems Vendor expressly agrees to pay City's costs in making such repairs, replacements or restorations. The obligations under this Section apply to all City facilities, infrastructure, or appurtenances located on City Property.

8. **Operations & Maintenance.** Dividend-Account Car-Parking Systems Vendor will cover all maintenance costs for the System and maintenance to minimum level of service and reporting outlined in Exhibit A.

9. **License Fee.** The parties intend to agree to a license fee before the Agreement may be extended beyond the Initial Term.

10. **Indemnification.** Dividend-Account Car-Parking Systems Vendor shall defend, pay, indemnify and hold harmless City, its officers, officials, employees, agents, invitees, and volunteers (collectively "City Parties") from all claims, suits, actions, damages, demands, costs or expenses of any kind or nature by or in favor of anyone whomsoever and from and against any and all costs and expenses, including without limitation court costs and reasonable attorneys' fees, resulting from or in connection with loss of life, bodily or personal injury or property damage arising directly or indirectly out of or from or on account of:

   a. Any occurrence upon, at or from City Property or occasioned wholly or in part by the entry, use or presence upon City Property by Dividend-Account Car-Parking Systems Vendor or by anyone making use of City Property at the invitation or sufferance of Dividend-Account Car-Parking Systems Vendor, except such loss or damage which was caused by the sole negligence or willful misconduct of City.

   b. Use of Dividend-Account Car-Parking Systems Vendor's System Parking by any individual, regardless of whether such use was with or without the permission of Dividend-Account Car-Parking Systems Vendor.

11. **Insurance.** Dividend-Account Car-Parking Systems Vendor shall procure and maintain for the duration of this agreement insurance against claims for which Dividend-Account Car-Parking Systems Vendor has indemnified the City pursuant to Section 10 of this Agreement. Dividend-Account Car-Parking Systems Vendor shall maintain general liability and automobile liability insurance policies with limits of no less than one million dollars ($1,000,000.00) per occurrence for bodily injury or death, personal injury and property damage, and two million dollars ($2,000,000.00) aggregate. Each insurance policy shall name the City as an additional insured and it shall be endorsed to state that:

   (i) coverage shall not be suspended, voided, or cancelled by either party, or reduced in coverage or in limits except after thirty (30) calendar days prior written notice by certified mail, return receipt requested, has been given to City; and (ii) for any covered claims, the Dividend-Account Car-Parking Systems Vendor's insurance coverage shall be primary insurance as respects the City and any insurance or self-insurance maintained by the City shall be in excess of the Dividend-Account Car-Parking Systems Vendor's
insurance and shall not contribute with it. The insurance required to be provided herein, shall be procured by an insurance company approved by City, which approval shall not be unreasonably withheld. Additionally, before Dividend-Account Car-Parking Systems Vendor shall employ any person or persons in the performance of the Agreement, Dividend-Account Car-Parking Systems Vendor shall procure a policy of workers’ compensation insurance as required by the Labor Code of the State of California, or shall obtain a certificate of self-insurance from the Department of Industrial Relations.

12. Compliance with Law. Dividend-Account Car-Parking Systems Vendor at its own cost and expense, shall comply with all statutes, ordinances, regulations, and requirements of all governmental entities applicable to its use of City Property and the operation of its System program, including but not limited to laws governing operation of vehicles. If any license, permit, or other governmental authorization is required for Dividend-Account Car-Parking Systems Vendor's lawful use or occupancy of City Property or any portion thereof, Dividend-Account Car-Parking Systems Vendor shall procure and maintain such license, permit and/or governmental authorization throughout the term of this Agreement. City shall reasonably cooperate with Dividend-Account Car-Parking Systems Vendor, at no additional cost to City, such that Dividend-Account Car-Parking Systems Vendor can properly comply with this Section and be allowed to use City Property as specified in Section 4, above.

13. Business License. Dividend-Account Car-Parking Systems Vendor is required to obtain and maintain a City Business License during the duration of this Agreement.

14. Required Reports. Dividend-Account Car-Parking Systems Vendor shall provide reports to the City concerning utilization of its System Parking not less than monthly, and shall cooperate with the City in the collection and analysis of any aggregated data concerning its operations.

15. No Joint Venture. Nothing herein contained shall be in any way construed as expressing or implying that the parties hereto have joined together in any joint venture or liability company or in any manner have agreed to or are contemplating the sharing of profits and losses among themselves in relation to any matter relating to this Agreement.

16. Termination. This Agreement may be terminated prior to the expiration date set forth in Section 1, above, upon the occurrence of any of the following conditions:

   a. Upon delivery of written notice from City to the Dividend-Account Car-Parking Systems Vendor terminating this agreement for any reason, or for no reason, by giving at least sixty (60) days' notice to the Dividend-Account Car-Parking Systems Vendor of such termination.

   b. An attempt to transfer or assign this Agreement.

Dividend-Account Car-Parking Systems Vendor shall not terminate this Agreement without first by giving at least 180 days' written notice of plans for termination.

17. Amendment. This Agreement may be amended by mutual agreement of the parties. Such amendments shall only be effective if incorporated in written amendments to this agreement and executed by duly authorized representatives of the parties.

18. Applicable Law and Venue. The laws of the State of California shall govern the interpretation and enforcement of this Agreement. Any action to interpret or enforce the terms or conditions of this Agreement shall be brought in the Superior Court for the County of San Diego, or in the United States District Court for the Southern District of California. Dividend-Account Car-Parking Systems Vendor hereby waives any right to remove any such action from San Diego County as is otherwise permitted under
California Code of Civil Procedure Section 394.

19. **Counterparts.** This Agreement may be executed simultaneously or in any number of counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same agreement.
IN WITNESS WHEREOF THE PARTIES HERETO have executed this Agreement on date first above written.

CITY OF ENCINITAS

Karen Brust, City Manager

Date

ATTEST:

City Attorney

DIVIDEND-ACCOUNT CAR-PARKING SYSTEMS VENDOR

[Title]

Date
**Exhibit A**

**Description of Dividend-Account Car-Parking Systems Vendor’s Service Level Agreement**

The following performance indicators shall be met and reported to help the City measure our success serving its citizens and improving the livability and mobility of Encinitas. Dividend-Account Car-Parking Systems Vendor will maintain its System in an excellent state of functionality and repair, with a minimum of error-free operation 95% of the time.

<table>
<thead>
<tr>
<th>Performance Indicator</th>
<th>Description</th>
<th>Measurement Tool</th>
<th>Minimum Performance Standard</th>
<th>Reporting Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>App &amp; customer service support portal: phone and internet.</td>
<td>A new account can be entered and audited. It can be edited and an audit can verify the edits. The time and method of the submissions can be retrieved.</td>
<td>Tool to audit accounts either by name or unique account number.</td>
<td>Accurate 99.5% uptime.</td>
<td>monthly</td>
</tr>
<tr>
<td>Ability to set the value price of the parking, a per minute value</td>
<td>The system can accept a “value price” and use the number as described in this report.</td>
<td>Tool to audit the fact of and the proper use of the value price</td>
<td>Accurate 99.5% uptime.</td>
<td>monthly</td>
</tr>
<tr>
<td>Ability to set the base multiplier, which is used in the congestion pricing algorithm as shown in Table 2 of Reference 2. It is expected to be a number between 1.5 and 2.5. It can be adjusted upwards if the parking is getting too full too often</td>
<td>The system can accept a “base multiplier” and use the number as described in Table 2 of Reference 2.</td>
<td>Tool to audit the fact of and the proper use of the value base multiplier</td>
<td>99.5% of the time</td>
<td>monthly</td>
</tr>
<tr>
<td>Ability to report out monthly statements</td>
<td>A feature to display each statement that can be viewed and verified for accuracy with an accuracy of 99.5%</td>
<td>Interface to allow a specification of</td>
<td>Statements can be viewed and verified for accuracy with an accuracy of 99.5%</td>
<td>monthly</td>
</tr>
<tr>
<td>Ability to accept money into an account and to pay earnings and “add-ins”, out of the account, as described in this report</td>
<td>Most of the money accepted will be car-parking charge but there will also money that is sent in to cover the “Add-in” payments. Most of the money will be via an automated transfer as is done for dockless bike rentals. However, an ability to accept a mailed check will also be required</td>
<td>Transactions will be put into a file that can be audited</td>
<td>Money transfers will occur and be observable with an accuracy of 99.5%</td>
<td>Monthly</td>
</tr>
<tr>
<td>Ability to report out the total amount charged to employees, paid to employees as earnings and, separately, as “add ins”, over any duration, from specific days to longer specified durations</td>
<td>This tool supports a request for the described data</td>
<td>Software interface that will show the results on a screen and allows for the result file to be stored or printed</td>
<td>Functional 99.5% of the time</td>
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<tr>
<td>Parking spot usage rate</td>
<td>The monthly use rate is reported for any single parking place or for a set of parking places</td>
<td>The result can be viewed on screen or in a file that can be stored or printed</td>
<td>Data collection failure would be reported within two (2) hours during business hours between 8am to 8pm Monday through Friday except for State and Federal holidays. Direct 24/7 contact line for true emergencies, either by phone, text, and/or email. Failure outside of business hours reported within two hours (2) of start of business hours</td>
<td></td>
</tr>
<tr>
<td>System failure detected or reported by a member</td>
<td>Error either automatically reported to the person responsible and their back-ups, as a text on their phones and an email to their computer, to include the error report time</td>
<td>A program collects the time of the data error recognition and the time of the correction</td>
<td>Within two (2) hours during business hours between 8am to 8pm Monday through Friday except for State and Federal holidays. Direct 24/7 contact line for true emergencies, either by phone, text, and/or email. For complaint outside of business hours, within two hours (2) of start of business hours</td>
<td></td>
</tr>
</tbody>
</table>
Support for an Equitable, Convenient, and Environmentally-Sound Car-Parking System that Protects Privacy and the Economic Interests of Low-Income Drivers

WHEREAS, (1) our greenhouse gas (GHG) emissions must be reduced, (2) about 40% of California’s emissions are from on-road transportation; (3) reducing car parking subsidies would (a) reduce GHG emissions, air-pollution, and congestion by reducing vehicle trips, (b) give employees more control over their potential earnings, and (c) give renters and consumers more control over their costs; and furthermore,

WHEREAS, (1) Too often, non-drivers lose money due to parking facilities being provided; (2) “free” employee parking is paid for by lower wages for all workers, including those who do not drive; (3) properly pricing parking would reduce the need to build so much parking and the resulting lower construction costs would help everyone; and (4) “free” parking at an apartment complex can sometimes increase rent by over $75 dollars per month, for all renters, even those that do not own a car; and finally,

WHEREAS, (1) methods to automatically charge car owners based on when and where their car was parked, could be implemented, while having safeguards to protect privacy and the economic interests of low-income drivers; (2) methods to automatically provide car-parking earnings to renters, residents, shoppers, train riders, employees, those residing on streets that have on-street parking, and others, could be implemented, using algorithms tailored to each group; (3) earnings algorithms for employees could ensure that even those that drive everyday would break even; (4) parking is optimized if it is available to all user groups, (5) pricing algorithms for on-street parking could protect neighborhoods from the excessive intrusion of parked cars, and (6) a car-parking phone app could direct users to the best parking space, given the driver’s willingness to pay and walk, thus reducing cars being driven around to look for parking.

THEREFORE, BE IT RESOLVED, that that the SANDAG Staff and/or Board supports a car-parking system in which the parking is valued-priced, shared; convenient to drivers (meaning fully automated as a phone app that, for example, finds the optimum available parking spot, based on the driver’s willingness to walk and pay), provides earnings to those losing money because the parking is being provided (such as employees, train riders, renters, and consumers), protects privacy by requiring a search warrant to get parking location information, and protects the economic interests of low-income drivers.

BE IT FURTHER RESOLVED, that SANDAG will help municipal governments use an RFP process to identity a vendor that will design, install, and operate such a system for employees, as a first demonstration project, as an enforceable measure, for a Climate Action Plan, with the goal of having the system being incorporated into to the 5 Big Moves of the 2021 RTP.
Mike Bullock, 760-754-8025, mike_bullock@earthlink.net
WHEREAS, (1) greenhouse gas (GHG) emissions must be significantly reduced by 2030; (2) about 40% of California’s GHG is emitted by on-road vehicles; and (3) even given the most ambitious estimates for fleet efficiency and fleet electrification, to support climate-stabilization requirements, it will be necessary to reduce per-capita driving; and furthermore,

WHEREAS, (1) California’s current road-use fees (our gas tax, our toll roads and our bridge-use tolls) do not cover the full cost of operating and maintaining roads; (2) having the full cost of road use hidden from users increases driving, thus adding significantly to air pollution, congestion, sprawl, and GHG emissions; (3) an assessment conducted by the California Transportation Commission (CTC) found that 58 percent of our state’s roads are in need of maintenance, 20 percent of our bridges need major or preventive maintenance, and 6 percent of our bridges require replacement; (4) a RUC has been shown to be feasible by the CTC (SB 1077); and (5) construction jobs are needed; and finally,

WHEREAS, (1) our gas tax is our most significant road-use fee; (2) state-mandated increases in battery-electric vehicles reduces gas-tax revenue; (3) a gas tax is inherently regressive because low-income drivers tend to drive older cars; and (4) a gas tax does not account for time, place, driver income, vehicle weight, vehicle pollution level, or instantaneous roadway congestion;

THEREFORE, BE IT RESOLVED, that the SANDAG Staff and/or Board supports a road-use charge (RUC) pricing and payout system that (1) would cover all road-use costs; (2) would protect the economic interests of low and middle-income drivers by use of a progressive price structure that also recognizes the needs of rural drivers; (3) would protect privacy by requiring a search warrant to obtain location or travel information; (4) would include an instantaneous congestion-pricing algorithm; (5) would ensure that the per-mile price incentive to drive energy-efficient cars would still be sufficient to support necessary fleet electrification; and (6) would send earnings to those losing money under the current system.

BE IT FURTHER RESOLVED, that SANDAG support be communicated to California and that such a RUC be included in the 5 Big Moves of the 2021 RTP.

Mike Bullock, 76 AD, 760-754-8025, mike_bullock@earthlink.net
A Plan to Efficiently and Conveniently Unbundle Car Parking Costs

Air and Waste Management Association Paper 2010-A-554-AWMA

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ABSTRACT

The Introduction shows documented driving reductions due to the pricing of parking. It notes that although the benefits of priced and shared parking are known, such parking has not been widely implemented, due to various concerns. It states that a solution, called “Intelligent Parking,” will overcome some of these concerns, because it is easy to use and naturally transparent. It asserts that this description will support a “Request for Proposal” (RFP) process. Eight background information items are provided, including how priced parking would help California achieve greenhouse gas reduction targets. A story demonstrates some of the key features of Intelligent Parking. Arguments for less parking, shared parking, and priced parking are made. Barriers to progress are identified. The fair pricing of parking is described. New ways to characterize transportation demand management are presented. Seven goals of Intelligent Parking are listed. Eleven definitions and concepts, that together define Intelligent Parking, are described. This includes a method to compute a baseline price of parking and how to adjust that price instantaneously to keep the vacancy above 15% (“Congestion Pricing”). An implementation strategy is described.

INTRODUCTION:

It has been well established that appropriately priced parking will significantly reduce driving. Most case studies presented in Table 1 are evaluations of the most general type of “car-parking cash-out”: a program that pays employees extra money each time they get to work without driving. They show that a price differential between using parking and not using parking will significantly reduce driving, even when transit is described as poor. Since driving must be reduced, the pricing of parking is desirable.

Shared parking is also recognized as desirable because it can sometimes result in less parking being needed.

Although the advantages of pricing and sharing parking have been recognized for many years, these practices are still rare. This paper identifies some of the reasons for this lack of progress. The pricing and sharing method of this paper has a natural transparency and ease of use that would reduce many of the concerns. This paper also suggests that those governments that have the necessary resources can take the lead role in developing and implementing the described systems. These governments will recover their investments, over time.

This paper describes how parking facilities could be tied together and operated in an optimum system, named Intelligent Parking. The description of Intelligent Parking is sufficient to support a “Request for Proposal” process, leading to full implementation.

There are two distinct parts to Intelligent Parking. The first is how to set the price. The second is how to distribute the earnings. Briefly, the earnings go to the individuals in the group for whom the parking is built.
Table 1  Eleven Cases of Pricing Impact on Parking Demand

<table>
<thead>
<tr>
<th>Location</th>
<th>Number of Workers @ Number of Firms</th>
<th>1995 $’s Per Mo.</th>
<th>Parking Use Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group A: Areas with poor public transportation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West Los Angeles</td>
<td>3500 @ 100+</td>
<td>$81</td>
<td>15%</td>
</tr>
<tr>
<td>Cornell University, Ithaca, NY</td>
<td>9000 Faculty &amp; Staff</td>
<td>$34</td>
<td>26%</td>
</tr>
<tr>
<td>San Fernando Valley, Los Angeles</td>
<td>850 @ 1</td>
<td>$37</td>
<td>30%</td>
</tr>
<tr>
<td>Costa Mesa, CA</td>
<td>Not Shown</td>
<td>$37</td>
<td>22%</td>
</tr>
<tr>
<td><strong>Average for Group</strong></td>
<td></td>
<td>$47</td>
<td>23%</td>
</tr>
<tr>
<td><strong>Group B: Areas with fair public transportation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Los Angeles Civic Center</td>
<td>10,000+ @ “Several”</td>
<td>$125</td>
<td>36%</td>
</tr>
<tr>
<td>Mid-Wilshire Blvd, Los Angeles</td>
<td>1 “Mid-Size” Firm</td>
<td>$89</td>
<td>38%</td>
</tr>
<tr>
<td>Washington DC Suburbs</td>
<td>5,500 @ 3</td>
<td>$68</td>
<td>26%</td>
</tr>
<tr>
<td>Downtown Los Angeles</td>
<td>5,000 @ 118</td>
<td>$126</td>
<td>25%</td>
</tr>
<tr>
<td><strong>Average for Group</strong></td>
<td></td>
<td>$102</td>
<td>31%</td>
</tr>
<tr>
<td><strong>Group C: Areas with good public transportation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U. of Washington, Seattle, WA</td>
<td>50,000 employees, students</td>
<td>$18</td>
<td>24%</td>
</tr>
<tr>
<td>Downtown Ottawa, Canada</td>
<td>3,500 government staff</td>
<td>$72</td>
<td>18%</td>
</tr>
<tr>
<td>Bellevue, WA</td>
<td>430 @ 1</td>
<td>$54</td>
<td>39%*</td>
</tr>
<tr>
<td><strong>Average for Group, except Bellevue, WA Case</strong></td>
<td></td>
<td>$45</td>
<td>21%</td>
</tr>
<tr>
<td><strong>Overall Average, Excluding Bellevue, WA Case</strong></td>
<td></td>
<td></td>
<td>25%</td>
</tr>
</tbody>
</table>

*Bellevue, WA case was not used in the averages because its walk/bike facilities also improved and those improvements could have caused part of the decrease in driving.

**PERTINENT BACKGROUND INFORMATION**

- Vehicle miles traveled (VMT) are a major cause of global warming and pollution\(^2,3\).
- California’s Metropolitan Planning Organizations (MPOs) will need to adopt strategies that reduce vehicle miles traveled (VMT), in order to meet SB375 GHG reduction targets, to be issued by the California Air Resources Board in late 2010, for years 2020 and 2035\(^2\).
- The appropriate pricing of parking is one of the least costly documented tools to reduce VMT.
- New technologies, such as sensors feeding computer-generated billing, offer the potential to efficiently bill drivers for parking and alert law enforcement of trespassers.
- Reformed parking policies can increase fairness, so that, for example, people who use transit or walk do not have to pay higher prices or suffer reduced wages, due to parking.
• Methods to unbundle parking cost are inefficient unless they support the spontaneous sharing of parking spaces. Shared parking with unbundled cost would ultimately allow cities to require significantly less parking.

• Typical systems of timed parking and metered parking are far from ideal. Parking has no automated record keeping, so it is difficult to know where there is too much or too little.

• Good policies will eventually let cities turn parking minimums into parking maximums.

A GLIMPSE INTO A POSSIBLE FUTURE

Jason is driving to work for the first time in several years. He has decided to save money by carrying home a new 3-D, big-screen computer, which he plans to purchase at a store near his office after work. He wanted to avoid paying delivery charges.

Things have been changing around his office development since they unbundled the cost of parking at the near-by train station. Many people who caught the early trains and lived close to the station stopped driving and parking in the best parking spaces; demand for housing close to the station went up; and wealthy riders, who insisted on driving, did so, confidant that they could always find parking as close to the platform as their schedules required, due to congestion pricing. Who would have guessed how much those people were willing to pay? It was shocking. Parking-lot earnings, paid to round-trip train riders, meant that the net cost to ride the train went significantly down. Ridership and neighborhood vitality both went significantly up. All Jason knew was that the price to park at his office had been going up yearly because of increased land values. His parking-lot earnings from his office had been increasing almost every month, due to the ripple effect of train riders parking off-site at cheaper parking. Some of them were using his office parking.

As he pulls out of his driveway, he tells his GPS navigation unit his work hours (it already knew his office location), the location of the store where he plans to buy the computer, and his estimated arrival and departure times at the store. He tells the GPS unit he wants to park once, park no more than 1 block from the store, walk no more than 1 mile total, and pay no more than an average of $2 per hour to park. He is not surprised to hear the GPS tell him that his request is impossible. He tells the GPS he will pay an average of $3 per hour and learns that the GPS has located parking.

It guides him into a church parking lot. He hopes the church will use his money wisely. The GPS tells him the location of a bus stop he could use to get to work and the bus’s next arrival time at the stop. With automatic passenger identification and billing, the bus has become easy to use, except that it is often crowded. Jason gets out of the car and walks to work, with no action required regarding the parking.

Three weeks later, when Jason gets his monthly statement for his charges and income for automotive road use, transit use, parking charges, and parking earnings, he finds that the day’s parking did indeed cost about $30 for the 10 total hours that he parked. He notes that the parking-lot earnings for his office parking averaged about $10 per day that month. He then notices the parking lot earnings from the store, where he spent about $1000 dollars. He sees that the parking-lot earnings percent for the store that month was 1.7%, giving him about $17. So for the day, Jason only spent a net of about $3 on parking. Then he realized that he should have had the computer delivered after all. If he would have bicycled that day, as he usually did, he would have still gotten the $27 earnings from the two parking facilities and he would have paid nothing
for parking. So the choice to drive cost him $30. He remembers that the delivery would have only been $25 dollars. Oh well. He enjoyed his before-work and after-work walks.

**THE CASE FOR LESS PARKING**

Less parking will support more compact development.¹ This makes walking and biking more enjoyable and less time consuming. There would certainly be less “dead space”, which is how parking lots feel to people, whether they arrive by car or not, after they become pedestrians.

Since parking can be expensive, less parking can reduce overhead costs significantly, such as leasing expense and parking-lot maintenance cost. Less overhead means more profit and less expense for everyone. A need for less parking can create redevelopment opportunities at existing developments and reduce project cost at new developments.

At new developments, car-parking costs could prevent a project from getting built.²

**THE CASE FOR SHARED PARKING**

Shared parking for mixed uses means that less parking is needed. For example, shared parking could be used mostly by employees during the day and mostly by residents at night.

Fully shared parking means that very little parking would be off limits to anyone. In a central business district with shared parking, drivers would be more likely to park one time per visit, even when going to several locations. Pedestrian activity adds vitality to any area.

**THE CASE FOR APPROPRIATELY-PRICED PARKING**

To Reduce Driving Relative to Zero Pricing

*Traditional Charging or Paying Cash-out Payments*

As shown in the Introduction, this relationship (pricing parking reduces driving) is not new.³ Using results like Table 1, at least one study⁴ has used an assumption of widespread pricing to show how driving reductions could help meet greenhouse gas (GHG) target reductions. Dr. Silva Send of EPIC http://www.sandiego.edu/epic/ghgpolicy/ assumes that all work locations with 100 employees or more in San Diego County will implement cash-out, to result in 12% less driving to work. Currently, almost all employees in San Diego County “park for free”, unless they happen to work in a downtown core area.

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¹ This is especially true of surface parking, which only accommodates 120 cars per acre.

² On September 23, 2008, a panel of developers reviewed the Oceanside, Ca. “Coast Highway Vision” http://www.ci.oceanside.ca.us/pdf/chv_finalvisionstrategicplan.pdf. Parts of this plan were described as smart growth.

At the review, developer Tom Wiegel said, “Parking is the number 1 reason to do nothing,” where “do nothing” meant “build no project.” The other developers at the meeting agreed.

³ For many years the Victoria Transport Policy Institute (VTPI) has been recognized as a source of reliable information on “Transportation Demand Management”, or TDM.

From [http://www.vtpi.org/tdm/tdm72.htm# Price Parking](http://www.vtpi.org/tdm/tdm72.htm# Price Parking):

Even a relatively small parking fee can cause significant travel impacts and provide significant TDM benefits.

“TDM Benefits” refers to the many public and private benefits of having fewer people choosing to drive.
**Current, Best-Practice “Unbundling”**

The “best-practice” use of the phrase, “unbundled parking cost”, is to describe the case where either the cost of parking, for the case of a condominium, or the rent for parking, for the case of an apartment, is separated from either the purchase price and common fees or the rent of the dwelling unit.

This gives the resident families the choice of selecting the number of parking spaces they would like to rent or buy, including the choice of zero. This would tend to reduce the average number of cars owned per dwelling unit and, in this way, would also tend to reduce driving. Its major drawback is that this method does not encourage sharing.

**To Increase Fairness and Protect the US Economy**

It is stated above that almost all employees in San Diego County “park for free”. Of course there is really no such thing as “parking for free”. So-called “free parking” always reduces wages or increases costs. At a work site, it reduces everyone’s wage, even those employees that never drive. At an apartment complex, so-called “free parking” increases the rent. Therefore, “free parking” at work or at apartments violates the fundamental rule of the free market, which is that people should pay for what they use and not be forced to pay for what they do not use. Parking should at least be priced to achieve fairness to non-drivers.

The US economy would also benefit. Reductions in driving would lead to reductions in oil imports, which would reduce the US trade deficit.\(^4\)

**BARRIERS TO PROGRESS**

Given all this, it might seem that the widespread pricing of parking should have happened by now. However there are barriers. In 2007, a majority of the City Council of Cupertino, Ca. indicated that they wanted their City Manger to negotiate reduced parking requirements with any company that would agree to pay sufficient cash-out payments. To this date, no company, including Apple Inc., has expressed an interest. Most companies probably perceive cash-out as expensive. Even if they realize they could get a reduced parking requirement in exchange for paying sufficient cash-out amounts and even if the economics worked in support of this action (quite possible where land is expensive), they want to stay focused on their core business, instead of getting involved in new approaches to parking, real estate, and redevelopment.

On the other hand, simply charging for parking and then giving all the employees a pay raise is probably going to run into opposition from the employees, who will feel that they would be losing a useful benefit.

In addition, neighbors fear the intrusion of parked cars on their streets. Permit parking, which could offer protection, is not always embraced. City Council members know that a sizable fraction of voting citizens believe that there can actually never be too much “free parking”,

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“The U.S. trade deficit is a bigger threat to the domestic economy than either the federal budget deficit or consumer debt and could lead to political turmoil. Right now, the rest of the world owns $3 trillion more of us than we own of them.”
Professor Shoup’s famous book notwithstanding. Some Council members probably feel that way themselves.

It doesn’t help that current methods of charging for downtown parking are often very inefficient. For example, downtown Oceanside, California has parking meters that will only accept coins. Besides this, all their on-street, downtown parking is timed, with maximums from 10 minutes to 4 hours. These time limits are enforced by a city employee, who applies chalk from a tire to the street and then records the time. However, by watching the time and moving their car soon enough, drivers can avoid getting a ticket. Of course, they could instead drive to the mall and not have to worry about having coins or elapsed time since parking. It is not surprising that downtown merchants often object to charging for parking.

In summary, those that resist charging for parking, based on their perceptions, include

- Companies, who fear the complexity and expense of paying cash-out payments;
- Employees, who fear of losing a current benefit;
- City leaders, who fear the political repercussions;
- Downtown patrons, who dislike the inconvenience and worry;
- Downtown business owners, who fear that it will drive away customers.

THE COST, VALUE, AND FAIR PRICE OF PARKING

Estimated and Actual Capital Cost

Surface Parking

One acre of surface parking will accommodate 120 cars. Land zoned for mixed use is sometimes expensive. At $1.2 million per acre, the land for a single parking space costs $10,000. Construction cost should be added to this to get the actual, as-built cost of each parking space. Estimated cost can be determined by using appraised land value and construction estimates. For new developments, after the parking is constructed, it is important to note the actual, as-built cost.

Parking-Garage Parking

One acre of parking-garage will accommodate considerably more than 120 cars. The construction cost of the garage and the value of its land can be added together to get the total cost. Dividing that total cost by the number of parking spaces yields the total, as-built cost of each parking space. Adding levels to a parking garage may seem like a way to cut the cost of each parking space, for the case of expensive land. However, there is a limit to the usefulness of this strategy because the taller the parking garage, the more massive the supporting structural members must be on the lower levels, which increases total cost. Parking-garage parking spaces are often said to cost between $20,000 and $40,000. The actual costs should be noted.

Underground Parking

In order to compute an estimate for the cost of a parking space that is under a building, it is necessary to get an estimate of the building cost with and without the underground parking. The difference, divided by the number of parking spaces, yields the cost of each parking space. The

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5 According to Bern Grush, Chief Scientist of Skymeter Corporation [http://www.skymetercorp.com/cms/index.php](http://www.skymetercorp.com/cms/index.php), often two-thirds of the money collected from parking meters is used for collection and enforcement costs.
cost or value of land plays no role in the cost of this parking. However, it does not follow that this parking is cheap. Underground parking spaces are often said to cost between $60,000 and $90,000 dollars each. Although there will be an “as built” cost of the building with the parking, there will never be an “as built” cost of the building without the parking. However, after the construction is done, the estimate for the cost of the underground parking should be reconsidered and re-estimated if that is needed. The final, best-estimate cost should be noted.

**Value**

Initially, value and cost are the same. For surface parking and parking-garage parking, the value would initially be the same as the as-built cost. For underground parking, the value would initially be the same as the best-estimate cost. However, over time, the value must be updated. Both construction costs and land-value costs will change. The value assigned to a parking place should always be based on the current conditions.

**Fair Pricing**

Parking space “values”, as described above, must first be converted to a yearly price by using a reasonable conversion factor. This conversion factor could be based on either the “cost of money” or the “earnings potential of money”. It is expected that this conversion factor would be 2% to 5% during times of low interest rates and slow growth; but could be over 10% during times of high-interest and high growth. For example, if the surface parking value is $12,000 and it is agreed upon to use 5% as the conversion factor, then each parking spot should generate $600 per year, just to cover capital costs. The amount needed for operations, collection, maintenance, depreciation, and any special applicable tax is then added to the amount that covers capital cost. This sum is the amount that needs to be generated in a year, by the parking space.

The yearly amount of money to cover capital cost needs to be re-calculated every year or so, since both the value and the conversion factor will, in general, change each year. The cost of operations, collection, maintenance, depreciation, and any special applicable tax will also need to be reconsidered.

Once the amount generated per year is known, the base price, per unit year, can be computed by dividing it (the amount generated per year) by the estimated fraction of time that the space will be occupied, over a year. For example, if a parking space needs to generate $900 per year but it will only be occupied 50% of the time, the time rate charge is $1800 per year. This charge rate per year can then be converted to an hourly or even a per-minute rate. The estimated fraction of time that the parking is occupied over a year will need to be reconsidered at least yearly.

**NEW DEFINITIONS TO PROMOTE AN OBJECTIVE VIEW OF PRICING**

- The “fair price” means the price that accounts for all costs.
- The “baseline amount of driving” means the driving that results from the application of the fair price.
- “Zero transportation demand management” (“zero TDM”) is the amount of demand management that results when the fair price is used. It will result in the baseline amount of driving.
- “Negative TDM” refers to the case where the price is set below the fair price. This will cause driving to exceed the baseline amount. Since TDM is commonly thought to be an action that reduces driving, it follows that negative TDM would have the opposite effect.
- “Positive TDM” refers to the case where the price is set above the fair price. This would cause the amount of driving to fall below the baseline amount.
Clearly, so-called “free parking” is an extreme case of negative TDM. The only way to further encourage driving would be to have a system that pays a driver for the time their car is parked.

THE GOALS OF INTELLIGENT PARKING

- There is only one agency operating all parking. (“All parking” does not include driveways and garages in single-family homes.) Intelligent Parking is designed and installed by regional or state government, using low-bid contractors, with design and start-up costs covered by the overhead portion of collection fees.
- Nearly all parking is shared. Almost always, anyone can park anywhere. Those who want exclusive rights to parking will pay “24/7” (all day, every day).
- Parking is operated so that the potential users of parking will escape the expense of parking by choosing to not use the parking. This characteristic is named “unbundled” because the cost of parking is effectively unbundled from other costs.
- Parking is priced and marketed to eliminate the need to drive around looking for parking.
- Parking at any desired price is made as easy as possible to find and use.
- Records of the use of each parking space are kept, to facilitate decisions to either add or subtract parking spaces.
- The special needs of disabled drivers, the privacy of all drivers, and, if desired, the economic interests of low-income drivers are protected.

DEFINITIONS & CONCEPTS OF INTELLIGENT PARKING

Parking Beneficiary Groups

There are at least 7 types of beneficiary groups. Note that in all cases, members of beneficiary groups must be old enough to drive.

1.) People who have already paid for the capital cost of parking. An example of this type of beneficiary group would be the owners of condominiums, where parking has been built and the cost is included in the price of the condominium. Note that although they have technically already paid for the parking, if they borrowed money to pay for some portion of the price, the cost is built into their monthly payment. This illustrates why the value of parking and the cost of borrowing money (rate of return on money) are key input variables to use to compute the appropriate base, hourly charge for parking.

2.) People who are incurring on-going costs of parking. An example of this type of beneficiary group is a set of office workers, where the cost of “their” parking is contained in either the building lease or the cost of the building. Either way, the parking costs are reducing the wages that can be paid to these employees.6

3.) People who are purchasing or renting something where the cost of the parking is included in the price. Examples of this beneficiary group are people that rent hotel rooms, rent an apartment, buy items, or dine in establishments that have parking.

6 Such parking is often said to be “for the benefit of the employees”. Defining this beneficiary group will tend to make this statement true, as opposed to the common situation where the employees benefit only in proportion to their use of the parking.
4.) People who own off-street parking as a business. They could be the individual investors or could be a government or government-formed entity.

5.) People who are said to benefit from parking, even though the money for the parking has been supplied by a source that may have very little relationship to those that are said to benefit. An example of this group would be train riders that make round trips from a station which has parking that is said to be “for riders”. Students at a school with parking would be another example.

6.) People who are considered by many to be the logical beneficiaries of on-street parking. Owners of single-family homes are the beneficiaries of the parking that is along the boundaries of their property. The same status is given to residents of multi-family housing.

7.) Governments. Since they build and maintain the streets, they should get a significant benefit from on-street parking.

**Unbundled Cost and Spontaneous Sharing**

“Unbundled cost” means those who use the parking can see exactly what it costs and those who don’t use the parking will either avoid its cost entirely or will get earnings to make up for the hidden parking cost they had to pay. This conforms to the usual rule of the free market where a person only pays for what they choose to use. Unbundled cost is fair.

“Spontaneous sharing” means that anyone can park anywhere at any time and for any length of time. Proper pricing makes this feasible.

**How to Unbundle**

The method of unbundling can be simply stated, using the concept of “beneficiary group” as discussed above. First, the fair price for the parking is charged. The resulting earnings amount is given to the members of the beneficiary group in a manner that is fair to each member. Methods are described below.

**Why this Supports Sharing**

Members of a beneficiary group benefit financially when “their” parking is used. They will appreciate users increasing their earnings. They are also not obligated to park in “their” parking. If there is less-expensive parking within a reasonable distance, they might park there, to save money. This is fine, because all parking is included in the Intelligent Parking system.

**Computing the Earnings for Individuals**

*Intelligent Parking* must be rigorous in paying out earnings. For a mixed use, the total number of parking spaces must first be allocated to the various beneficiary groups. For example in an office/housing complex, 63.5% of the parking might have been sold with the office. If so, the housing portion must be paying for the other 36.5%. For this case, it would follow that the first step is to allocate 63.5% of the earnings to the workers and 36.5% to the residents.

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7 The earnings amount is the revenue collected minus the collection cost and any other costs that will have to be paid due to the implementation of *Intelligent Parking*. The costs associated with the parking, paid before the implementation of *Intelligent Parking*, should not be subtracted from the revenue because they will continue to be paid as they were before the implementation of *Intelligent Parking*. Therefore, these costs will continue to reduce wages and increase the prices of goods and services.
How the monthly earnings are divided up among the members of the beneficiary group depends on the beneficiary group type. For each member, the group’s total monthly earnings amount is always multiplied by a quantity and divided by the sum (the sum is the denominator) of that quantity, for all members.

For example, for each employee, the multiplier is the number of hours that the employee worked over the month while the denominator is the total number of hours worked by all employees over the month. At a school, for each student, the numerator is the total time spent at the school, over the month, while the denominator is the sum of the same quantity, for all the students.

For a train station with parking being supplied for passengers that ride on round trips of one day or less, the numerator is the passenger’s monthly hours spent on such round trips, over the month; while the denominator is the total number of hours spent by all passengers on such round trips, over the month. Radio Frequency Identification (RFID) units on passengers could support an automated calculation of monthly charges for fares, as well as monthly hours on round trips.

At a shopping center, the numerator is the sum of the money spent by the shopper, over the month, while the denominator is the total amount of money spent by all shoppers over the month.

At a condominium, the numerator is the number of parking places that were paid for (directly or indirectly) by the resident family and the denominator is the total number of parking places at the condominium project; similarly, for apartment complexes.

Where Earnings Are Low

The goal is that if someone doesn’t park, they don’t pay, either directly or indirectly, because the earnings that they get will balance out their losses (like reduced wages, for example). However, charging for parking that few want to use will not sufficiently compensate the people that have been forced, or are being forced, to pay for such parking. The only remedy in this case is to redevelop the parking or lease the parking in some other way, for storage, for example. The earnings from the new use should go to those that are in the beneficiary group that was associated with the low-performing parking.

Why This Method of Unbundling Will Feel Familiar to Leaders

Developers will still be required to provide parking and will still pass this cost on, as has been discussed. There will be no need to force an owner of an exiting office with parking to break his single business into two separate businesses (office and parking).

Parking beneficiaries are identified that conform to traditional ideas about who should benefit from parking.8

Unbundling the Cost of On-Street Parking

The revenue from on-street parking in front of businesses will be split evenly between the city and the business’s parking beneficiaries. All of the earnings from on-street parking in front of apartments or single-family homes will be given to the resident families.9

8 Showing exactly where parking earnings go will reduce the political difficulties of adopting pay parking in a democracy where the high cost of parking is often hidden and rarely discussed.

9 Although governments own the streets, often, back in history, developers paid for them and this cost became embedded in property values. Admittedly, how to allocate on-street parking earnings is somewhat arbitrary. With
Special Considerations for Condominiums

Unbundling for a condominium owner means that, although their allocated amount of parking has added to their initial cost, their allocated amount of parking also earns money for them. Unbundling for a condominium could also mean that an owner can choose to have control over a single or several parking places. Such parking spaces could be equipped with a red light and a green light. If the red light is lit, this will mean that the space is not available for parking, except for the person who is controlling the spot. If the green light is lit, it will mean that the space is available to anyone. A space that is being reserved with a red light is charged at the full price to the condominium owner that has control over the space. The owner that controls these spaces can change the state of the parking space (available or not available) by either a phone call, online, or at any pay station system that might be in use for the system. After condominium owners experience the cost of reserving a space for themselves, they might give up on the idea of having their own, personal, unshared parking space; especially since Intelligent Parking will give most owners and their guests all the flexibility they need in terms of parking their cars.

Some people think that condominium parking should be gated, for security reasons. However, parking within parking garages needs to be patrolled at the same frequency level as on-street parking, which is enough to ensure that crime around either type of parking is very rare. Cameras can help make parking garages that are open to the public safe from criminal activity.

Special Considerations for Renters

Unbundling for renters means that, although their allocated amount of parking increases their rent, their allocated amount of parking also earns money for them. Therefore, their traditional rent (includes parking) is effectively reduced by the money earned by those parking spaces allocated to them. Renters will be motivated to either not own a car or to park in a cheaper location. Parking in a cheaper location is not a problem because all parking is part of the Intelligent Parking system. Renters will welcome anyone to park in “their” parking, because it will increase their earnings.

Special Considerations for Employers

At first, companies may want the option of offering “free parking” to their employees so as to be able to compete with traditional job sites. This means giving employees that drive every single day an “add-in” amount of pay so that the sum of the add-in and their parking-lot earnings equals their charge, for any given monthly statement. The operator of the parking, which sends out statements, can pay out the “add in” amount, in accordance with the company’s instruction. The company will then be billed for these amounts. There could be no requirement for the company to provide any such “add-in” amount to the employees that don’t drive every day. This would allow the company to treat its every-day drivers better than other employees and so this would be a negative TDM. However, this economic discrimination would be substantially less than the current, status-quo, economic discrimination, where drivers get “free” parking and non-drivers get nothing.

Clusters of Parking

Clusters are a contiguous set of parking spaces that are nearly equal in desirability and thus can be assigned the same price. They should probably consist of from 20 to 40 spaces. For off-street congestion pricing and efficient methods, governments may earn significantly more than they are under current practices.
parking, they could be on either side of the access lane to the parking spaces, so that an observer could see the 20 to 40 cars, and get a feel for the vacancy rate. At a train station, clusters will normally be organized so that their parking spaces are approximately an equal distance from the boarding area. On-street clusters would normally conform to our current understanding of what a block is, which is to say from one cross street to the next cross street. The width of the street and the length of the block should be taken into account in defining on-street clusters of parking and in deciding if the parking on either side of the street should or should not be in the same cluster of parking spaces.

Examples of Good and Bad Technology

Parking Meters or Pay Stations

Parking meters are a relic of an earlier period, before computers. Pay stations do not add enough usefulness to merit their inclusion in Intelligent Parking, except as a bridge technology. Once good systems are set up, pay stations should cost additional money to use because of their expense. It would be best to devise an implementation strategy that will minimize their use when the system is first put into effect and will take them out of service as soon as possible.

Radio Frequency Identification Backed Up by Video-Based “Car Present” and License Recognition

Government will eventually enter into an RFID (Radio Frequency Identification) age. Organizers of large athletic events already have. Organizers that put on large open-water swims, foot races, and bike rides have routinely used RFID for many years. An RFID vendor in San Diego states that passive RFID units cost less than $5, are reliable, are durable, and they could be used to identify cars as well as people. He also sees no problem in implementing most of the features of Intelligent Parking.

Automatic Data Collection and Sending Out Statements

Note that the “back end database” of Dr. Carta’s written statement refers to the ability to send statements of earnings and billing to students.

10 For example, over 20,000 people ran the 2008 Bay-to-Breakers foot race in San Francisco. Each runner had a “chip” in their shoe lace. Each runner’s start time and finish time were recorded and all results were available as soon as the last runner crossed the finish line.

11David R. Carta, PhD, CEO Telaeris Inc., 858-449-3454

12 Concerning a Final Environmental Impact Report-approved and funded new high school in Carlsbad, California, where the School Board has signed a Settlement Agreement to consider “unbundled parking”, “cash-out”, and “pricing”, Dr. Carta wrote, in a January 13th, 2010 written statement to the Board,

I wanted to send a quick note discussing the technical feasibility of tracking cars into a lot without impacting students or requiring the need for gates. Mike Bullock and I have discussed this project; it can be accomplished straightforwardly by utilizing Radio Frequency Identification and/or Video Cameras integrated with automated license recognition systems. The cars would need to register with the system at the start, but it would be fairly painless for the users after the initial installation. The back end database system can also be implemented both straightforwardly and at a reasonable price.

This is not necessarily a recommendation of the proposal for unbundled parking. Rather it is strictly an unbiased view of the technical feasibility of the proposal to easily and unobtrusively track cars, both registered and unregistered, into a fixed lot.

13 In an earlier email on this subject, Dr. Carta wrote,
Putting it Together

Certainly, government, and in particular transit agencies and parking agencies, could use RFID-based technology. For example, when a person with an RFID unit which is tied to a billable address or a credit card with an open account gets on a bus or a train, they should not have to pay at that time, visit a pay station, or “swipe a card” that has a positive balance. Utility customers that pay their bills are not required to pre-pay. The same courtesy should be extended to transit riders, people that drive on roads, people that get parking-lot earnings, and people that park cars. There should be one monthly bill or statement, for all four activities.

Global Positioning Systems GPS

An alternative model is to have GPS systems in cars that would detect the car’s parking location, that location’s current charge rate, and would perform all of the charging functions in the car. The only information the parking-lot-enforcement system would need is whether or not a car being parked is owned by a bill-paying owner. The car owner’s responsibility would be to pay the bills indicated by the box in the car. The box would need to process a signal that a bill had been paid. It would also need to process pricing signals.

Not Picking Winners

The purpose of this report is to describe what an ideal system would do, not how it is done. How a proposed system works is left to the systems, software, and hardware engineers that work together to submit a proposal based on this description of what an ideal system does.

Privacy

Privacy means that no one can see where someone has parked, without a search warrant. Also, the level of the detail of information that appears on a bill is selected by the customer.14

Ease of Use for Drivers

For credit-worthy drivers that have followed the rules of the system, pay parking will not require any actions other than parking. Paying for all parking fees over a month is then done in response to a monthly billing statement. Parking will feel to the consumer like a service provided by a municipality, such as water, energy, or garbage. One important difference is that users belonging to a “beneficiary group” will get an earnings amount in their monthly statement. Those that earn more than what they are charged will receive a check for the difference. This ease of use will make all parking less stressful.

Base Price

Off-Street

This is not too tough - we probably would integrate with a service that already sends physical mail from an electronic submission instead of re-inventing this wheel.

14 License plates that have no RFID tags fail to use the best technology to accomplish the primary purpose of license plates, which is to identify and help intercept cars used in a crime. Identifying cars is a legitimate government goal. Protecting privacy is also a legitimate goal. Both goals can be realized with good laws, good enforcement, and good systems engineering.
Off-street parking is priced so that even if demand does not threaten to fill the parking beyond 85%, the money generated will at least equate to an agreed-upon return on the parking value and pay all yearly costs. Equation 1 shows the calculation of the hourly rate.

\[
\tau_{\text{Baseline Hourly}} = \frac{(r_{\text{Investment}} \times v_{\text{Parking}}) + c_{\text{YOPD}}}{n_{\text{Hours Per Year}} \times f_{T0}}
\]

(Eq. 1)

where:

- \(\tau_{\text{Baseline Hourly}}\): the computed baseline hourly rate to park
- \(r_{\text{Investment}}\): yearly return on investment, such as .06
- \(v_{\text{Parking}}\): value of a parking space, such as (parking garage) $40,000
- \(c_{\text{YOPD}}\): yearly operations\(^{15}\) plus depreciation, per space, such as $100
- \(n_{\text{Hours Per Year}}\): number of hours per year, \(24 \times 365 = 8760\) Hours per Year
- \(f_{T0}\): fraction of time occupied, such as 0.55.

For the example values given, the base hourly rate of parking, to cover the cost of the investment, operations\(^{15}\), and depreciation is $0.519 per hour. This could be rounded up to $0.52 per hour. This price could also be increased to result in positive TDM, to reduce driving more than the fair-price, zero-TDM amount.

**On-Street**

If on-street parking is located within walking distance (one-quarter mile) of off-street parking, its base price is set equal to the closest off-street parking’s base price. Otherwise, it is set to some agreed-upon value, like fifty cents per hour. However, on-street parking has a special meaning for downtown merchants and for neighborhoods, two powerful political forces in any city. Merchants that have few cars parking on their street, even though it is permitted, are probably failing in their businesses. They would like free parking to help draw visitors to their store front. Neighborhoods that are not impacted by parking would probably prefer no pricing. For these reasons, for any on-street parking cluster, no price is charged until the cluster occupancy reaches 50%. (Time of day is irrelevant.)

**Congestion Pricing**

The time-rate price of parking is dynamically set on each cluster of parking, to prevent the occupancy rate from exceeding 85% (to reduce the need to drive around looking for parking). An 85% occupancy rate (15% vacancy) results in just over one vacant parking space per city block\(^5\). If the vacancy rate is above 30%, the price is left at the baseline hourly rate. If vacancies fall below 30%, the price can be calculated in a stair-step method, such as shown in Table 2.

Equation 2 is an alternative method.

In either case, the total charge is time parked, multiplied by the time-averaged, time-rate price. The base multiplier would be adjusted to be just large enough to keep the vacancy rate from falling below a desired level, such as 15%, so it is always easy to find parking.

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\(^{15}\) This includes money for policing, cleaning, maintenance, any applicable parking tax, and all collection costs. Collection costs will need to include an amount to recover the development and installation costs of **Intelligent Parking**.
Table 2  Hourly Rates for 2 Base Multipliers and a Baseline Hourly Rate of $0.52

<table>
<thead>
<tr>
<th>Vacancy Rate</th>
<th>Base Multiplier = 2</th>
<th>Base Multiplier = 2.5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Multiplication</td>
<td>Hourly Rate</td>
</tr>
<tr>
<td></td>
<td>Formula  Value</td>
<td>Formula  Value</td>
</tr>
<tr>
<td>Above 30%</td>
<td>$0.52</td>
<td>$0.52</td>
</tr>
<tr>
<td>25% to 30%</td>
<td>$1.04</td>
<td>$1.30</td>
</tr>
<tr>
<td>20% to 25%</td>
<td>$2.08</td>
<td>$3.25</td>
</tr>
<tr>
<td>15% to 20%</td>
<td>$4.16</td>
<td>$8.13</td>
</tr>
<tr>
<td>10% to 15%</td>
<td>$8.32</td>
<td>$20.31</td>
</tr>
<tr>
<td>5% to 10%</td>
<td>$16.64</td>
<td>$50.78</td>
</tr>
<tr>
<td>Below 5%</td>
<td>$33.28</td>
<td>$126.95</td>
</tr>
</tbody>
</table>

\[ r_{\text{HourlyRate}} = r_{\text{BaselineHourly}} \times \left( B^{(30-V)/5} \right), \text{ for } V < 30; r_{\text{BaselineHourly}}, \text{ otherwise (Eq. 2)} \]

where:

\[ r_{\text{HourlyRate}} = \text{the congestion-priced hourly rate to park} \]
\[ r_{\text{BaselineHourly}} = \text{the baseline hourly rate to park, such as$0.52 per hour (taken from from Eq. 1.} \]
\[ B = \text{the base of the multiplier being computed, such as 2.50} \]
\[ V = \text{the vacancy rate percent, such as 17.5, for 7 vacancies in a cluster of 40 spaces, } \frac{100\times(7/40)}{100} = 17.5 \]

For the example values given, the hourly rate of parking would be $9.88 per hour.

**Pricing Predictions and Notifications**

Drivers will develop strategies for their routine trips. The computer system that keeps records of parking use will also provide help for users. The Intelligent Parking website will direct a user to an appropriate cluster of parking if the user provides the destination location or locations, the time and date, and the hourly rate they wish to pay. If the walk is going to be long, the website could suggest using transit to get from the cheaply-priced parking to the destination. In such cases, the website may also suggest using transit for the entire trip.

Another user option is to specify the time, location, and the distance the user is willing to walk. In this case, the computer would give the cheapest cluster of parking available at the specified walk distance. The price prediction would be provided.

All price predictions would also have a probability of correctness associated with them. If a user can show that a computer has predicted a much lower price than what actually occurred, with a sufficiently high probability, it would be reasonable to charge the user the predicted price rather than the actual price.

Websites could routinely inform viewers when occupancy rates are expected to be unusually high, due to a special event (for example, a sporting event). The parking system website will always give current and predicted hourly rates for all locations. The hourly rates of parking will
also be available at a phone number and possibly at pay stations. The base-price hourly rate, for any parking cluster, would be stable and could therefore be shown on signs. Parking garage entrances could have large video screens showing both predicted and existing price. Users will also learn to look at parking and judge whether congestion pricing applies, or could apply, while their car is parked. It would not be long before these capabilities are added into GPS navigation systems.

**Prepaid RFID**

To be inclusive, pay stations or convenience stores will offer a pre-paid RFID that can be set on the dashboard of a car. This will support drivers with poor credit or drivers who have not obtained the necessary equipment to support the normal, trouble-free methods. This will also work for drivers that do not trust the system to protect their privacy for a certain trip (by removing or disabling the permanent RFID) or for all trips. No billing would occur.

**Enforcement**

The system would notify the appropriate law enforcement agency if an unauthorized car was parked. Authorized cars would need either a pre-paid RFID or equipment indicating that their owners had *Intelligent Parking* accounts and were sufficiently paid up on their bills.

**IMPLEMENTATION**

This description of *Intelligent Parking* will help to implement efficient parking systems. Parking at train stations, schools, and government buildings could introduce many of these concepts. This description of *Intelligent Parking* is sufficient to support a “Request for Proposal” process, which could lead to full implementation. Widespread installation should be done by a government agency, to minimize actions required on the part of the private sector. Laws would simply require the cooperation of all private-sector and government entities.

**SUMMARY**

A parking plan, *Intelligent Parking* has been described.

1. Technology will make it easy to use for most drivers.
2. Its parking is almost always shared, to support mixed uses.
3. It unbundles cost by charging and having earnings go to the parking beneficiaries.
4. Traditional groups, such as single-family home owners, employees, tenants, train riders, and students benefit from parking. The benefit is equal for drivers and non-drivers.
5. Baseline prices are computed primarily from the value of the parking and an agreed-upon rate of return. On-street parking is free until it is half full, at which time its base price often matches that of the closest off-street parking.
6. For all parking, price is dynamically increased to guarantee availability. Earnings are therefore only limited by what people are willing to pay.
7. Technology helps drivers find parking and decide if they want to drive or use transit.
8. Prepaid RFIDs provide service to those who have poor credit or don’t want to be billed.
9. Disabled and perhaps low-income drivers will have accounts that allow them to park at reduced prices and perhaps avoid congestion pricing. Specially designated spots might also be required for disabled drivers.
10. The system will provide reports showing where additional parking would be a good investment and where it would be wise to convert existing parking to some other use.

11. Privacy will be protected. Law enforcement officials would need a search warrant to see where someone’s car has been parked. The level of detail on billing would be selected by the car’s owner.

12. Implementations could begin in carefully selected locations and expand.

Global warming, air pollution, trade deficits, and fairness are some of the significant reasons that governments have a responsibility to implement Intelligent Parking.

ACKNOWLEDGEMENTS

The following people have offered encouragement, specific information, and/or special insights.

Dr. Dennis Martinek, Oceanside Planning Commissioner; Sandra Goldberg, California Deputy Attorney General; Jerry Kern, Oceanside, City Council; Amy Volzke, Principal Planner, City of Oceanside; Dr. Nilmimi Silva-Send, Senior Policy Analyst of the Energy Policy Initiative Center; Diane Nygaard, Director of Preserve Calaveras and founder of Nelson Nygaard, Consulting Associates; Lisa Rodman, Trustee, Carlsbad Unified School District; Dr. Michael McQuary, President, La Jolla Democratic Club; Joan Bullock; Judy Jones, San Diego County Central Committee, California Democratic Party; Patrick Siegman, Principal and Shareholder, Nelson Nygaard; Andy Hamilton, San Diego Air Pollution Control District; Renee Owens, Conservation Chair, San Diego Sierra Club; Caroline Chase, Executive Committee Chair, San Diego Sierra Club; Ed Mainland, Co-Chair, Energy-Climate Committee, Sierra Club California; Bern Grush, Chief Scientist, Skymeter Corporation; and the following San Diego Area Government (SANDAG) employees: Susan Baldwin, Senior Regional Planner; Bob Leiter, former Director of Land Use and Transportation Planning; Coleen Clementson, Principle Planner; and Stephan Vance, Senior Regional Planner.

REFERENCES

1 Siegman, P. How to Get Paid to Bike to Work: A Guide to Low-traffic, High-profit Development; Pro Bike Pro Walk Resource Book; from the Ninth International Conference on Bicycle & Pedestrian Programs; Sept. 3-6, 1996, Portland, Maine; Bicycle Federation of America Pedestrian Federation of America; pp 171-175.


KEYWORDS

A&WMA, Parking, Unbundled, Shared, TDM, cash-out, pricing, beneficiary, greenhouse gas, GHG, GPS, RFID
Deriving a Climate-Stabilizing Solution Set of Fleet-Efficiency and Driving-Level Requirements, for Light-Duty Vehicles in California

Paper #796315

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ABSTRACT

An Introduction is provided, including the importance of light-duty vehicles (LDVs: cars and light-duty trucks) and the top-level LDV requirements to limit their carbon dioxide (“CO2”) emissions. Climate crisis fundamentals are presented, including its cause, its potential for harm, California mandates, and a greenhouse gas (GHG) reduction road map to avoid disaster.

A 2030 climate-stabilizing GHG reduction target value is calculated, using statements by climate experts. The formula for GHG emissions, as a function of per-capita driving, population, fleet CO2 emissions per mile, and the applicable low-carbon fuel standard is given. The ratio of the 2015 value of car-emission-per-mile to the 2005 value of car-emission-per-mile is obtained.

Internal Combustion Engine (ICE) mileage values from 2000 to 2030 are identified, as either mandates or new requirements. A table is presented that estimates 2015 LDV fleet mileage.

Zero Emission Vehicle (ZEV) parameters are given. Methods are derived to compute equivalent 2030 mileage. Four cases are defined and overall equivalent mileage is computed for each. Those equivalent fleet mileage values are used to compute their corresponding required per-capita driving reductions, with respect to 2005. Measures to achieve the most reasonable per-capita driving reduction are described, with reductions allocated to each measure.

A conclusion is presented.

INTRODUCTION

Humanity’s top-level requirement is to stabilize our climate at a livable level. This top-level requirement must flow down to cars and light-duty trucks, also known as Light-Duty Vehicles (LDVs), due to the significant size of their emissions. As an example, LDVs emit 41% of the GHG in San Diego County\(^1\).

From a systems engineering perspective, the needed top-level LDV requirements are an upper bound on greenhouse gas (GHG) emissions per mile driven, applicable to all of the vehicles on the road, in the year of interest, and an upper bound on per-capita driving, given population growth. These two upper bounds must achieve the climate-stabilizing GHG emission target level. This paper will do a calculation of required driving levels, based on calculations of how clean our cars and fuels could be, predicted population growth, and the latest, science-based, climate-
stabilizing target, or requirement. All three categories of LDV emission-reduction strategies will be used: cleaner cars, cleaner fuels, and less driving. Four cases will be considered.

BACKGROUND: OUR CLIMATE PREDICAMENT

Basic Cause

Our climate crisis exists primarily because of these two facts: First, our combustion of fossil fuels puts “great quantities” of CO$_2$ into our atmosphere; second, atmospheric CO$_2$ traps heat.

California’s Primary CO2_e Emission-Reduction Mandates

California’s Governor’s Executive Order S-3-05 is based on the greenhouse gas (GHG) reduction limits that were recommended by climate scientists, for industrialized nations, in 2005. In 2005, climate scientists believed that if the industrialized nations of the world achieved the reduction-targets of S-3-05 (and other nations did something less), the Earth’s climate could be stabilized at a livable level, with a reasonably high level of certainty. More specifically, this executive order aims for an average, over-the-year, atmospheric, temperature rise of “only” 2 degree Celsius, above the preindustrial temperature. It attempts to do this by limiting atmospheric CO$_2$ _e to 450 PPM by 2050 and then reducing emissions further, so that atmospheric levels would come down to more tolerable levels in subsequent years. The S-3-05 emission targets are the 2000 emission level by 2010, the 1990 level by 2020, and 80% below the 1990 level by 2050.

It was thought that if the industrialized world achieved S-3-05 (and the non-industrialized world achieved an easier task), there would be a 50% chance that the maximum temperature rise will be less than 2 degrees Celsius, thus leaving a 50% chance that it would be larger than 2 degrees Celsius. A 2 degree increase would put over a billion people on the planet into a position described as “water stress” and it would mean a loss of 97% of our coral reefs.

There would also be a 30% chance that the temperature increase would be greater than 3 degrees Celsius. A temperature change of 3 degree Celsius is described in Reference 3 as being “exponentially worse” than a 2 degree Celsius increase.

The second California climate mandate is AB 32, the Global Warming Solutions Act of 2006. It includes provisions for a cap and trade program, to ensure meeting S-3-05’s 2020 target, which is to be emitting at no more than the 1990 level of emissions. AB 32 was to continue after 2020. AB 32 required CARB to always implement measures that achieved the maximum technologically feasible and cost-effective (words taken from AB 32) greenhouse-gas-emission reductions.

In 2015 Governor Brown signed B-30-15. This Executive Order established a mandate for 40% below 2020 emissions by 2030, as can be seen by a Google search. If S-3-05 is interpreted as a straight line between its 2020 and its 2050 targets, then the B-30-15 target of 2030 is the same as the S-3-05 implied target of 2035, because 2035 is halfway between 2020 and 2050 and 40% is halfway to 80%. More recently, California adopted SB 32, which made achieving B-30-15 legally binding. Finally, in 2018, the Governors Executive Order B-55-18 established a mandate of zero net emissions by the year 2045.
California achieved the second GHG emission target of S-3-05 (to emit at the 1990 level by 2020) in 2018, which is two years early. However, the world emission levels have, for most years, been increasing, contrary to the S-3-05 trajectory. Because the world has been consistently failing to follow S-3-05’s 2010-to-2020 trajectory, if California, still wants to lead the way to human survival, it must do far better than S-3-05, going forward, as will be shown.

**Failing to Achieve these Climate Mandates**

What could happen if we fail to achieve S-3-05, AB 32, and B-30-15 or if we achieve them but they turn out to be too little too late and other states and countries follow our example or do less?

It has been written⁴ that, “A recent string of reports from impeccable mainstream institutions - the International Energy Agency, the World Bank, the accounting firm of PricewaterhouseCoopers - have warned that the Earth is on a trajectory to warm by at least 4 Degrees Celsius and this would be incompatible with continued human survival.”

It has also been written⁵ that, “Lags in the replacement of fossil-fuel use by clean energy use have put the world on a pace for 6 degree Celsius by the end of this century. Such a large temperature rise occurred 250 million years ago and extinguished 90 percent of the life on Earth. The current rise is of the same magnitude but is occurring faster.”

**Pictures That Are Worth a Thousand Words**

Figure 1 shows (1) atmospheric CO₂ (in blue) and (2) averaged-over-a-year-then-averaged-over-the surface-of-the-earth, atmospheric temperature (in red). This temperature is with respect to a recent preindustrial revolution value. The data starts 800,000 years ago. It shows that the current value of atmospheric CO₂, which is over 410 PPM, far exceeds the values of the last 800,000 years. It also shows that we might expect the corresponding temperature to eventually be over 12 degrees above preindustrial temperatures. This would bring about a human disaster³, ⁴, ⁵.

Figure 2 shows the average yearly temperature (in blue) with respect to the 1960-to-1990 baseline temperature. It also shows atmospheric levels of CO₂ (in red). The CO₂ spike of Figure 1 is seen on Figure 2 to be an accelerating ramp up, starting at the time of our industrial revolution. The S-3-05 goal of 450 PPM is literally “off the chart”, in Figure 2. Figure 2 shows that, as expected, temperatures are starting to rise along with the rising levels of CO₂. The large variations in temperature that are observed are primarily due to the random nature of the amount of solar energy being received by the earth.

**FURTHER BACKGROUND: CALIFORNIA’S SB 375 AND AN IMPORTANT DATA SET**

As shown in the Introduction, LDVs emit significant amounts of CO₂. The question arises: will driving need to be reduced or can cleaner cars and cleaner fuels arrive in time to avoid such behavioral change? Steve Winkelman, of the Center for Clean Air Policy (CCAP), worked on this problem and his results probably inspired California’s SB 375.
SB 375, the Sustainable Communities and Climate Protection Act of 2008

Under SB 375, the California Air Resources Board (CARB) has given each Metropolitan Planning Organization (MPO) in California driving-reduction targets, for the years 2020 and 2035. “Driving” means yearly, per capita, vehicle miles travelled (VMT), by LDVs, with respect to 2005. The CARB-provided values are shown at this Wikipedia link, http://en.wikipedia.org/wiki/SB_375. It is important to note that although this link and many other sources show the targets to be “GHG” and not “VMT”, SB 375 clearly states that the reductions are to be the result of the MPO’s Regional Transportation Plan (RTP), or, more specifically, the Sustainable Communities Strategy (SCS) portion of the RTP. Nothing in the SCS will improve average mileage. That will be done by the state and federal governments by their Corporate Average Fleet Efficiency (CAFÉ) standards and any other laws or regulations that they might adopt. The SCS can only reduce GHG by reducing VMT.

Figure 1  Atmospheric CO₂ and Mean Temperature from 800,000 Years Ago

Figure 2  Atmospheric CO₂ and Mean Temperature, Over the Last 1,000 Years
Under SB 375, every Regional Transportation Plan (RTP) must include a section called a Sustainable Communities Strategy (SCS). The SCS must include driving reduction predictions corresponding to the CARB targets. Each SCS must include only feasible transportation, land use, and transportation-related policy data. If the SCS driving-reduction predictions fail to meet the CARB-provided targets, the MPO must prepare an Alternative Planning Strategy (APS). An APS uses infeasible transportation, land use, and transportation-related policy assumptions. The total reductions, resulting from both the SCS and the APS, must at least meet the CARB-provided targets.

**Useful Factors from Steve Winkelman’s Data**

Figure 3 shows 5 variables as a percent of their 2005 value and also the 1990 emission value (turquoise) related to the 2005 CO2 emission value (the blue line). All of the variables are for LDVs. The year 2005 is the baseline year of SB 375. The red line is the Caltrans prediction of VMT. The purple line is California’s current mandate for a Low Carbon Fuel Standard (LCFS). The LCFS also can be used to get the equivalent mileage from the actual mileage by dividing the actual mileage by the LCFS. The LCFS can be used to get the equivalent CO2 per mile driven by multiplying the actual CO2 per mile driven by the LCFS. As shown, by 2020, fuel in California must emit 10% less per gallon than in 2005. As written above, the turquoise line is the 1990 GHG emission in California. As shown, it is 12% below the 2005 level. This is important because S-3-05 specifies that in 2020, state GHG emission levels must be at the 1990 level. The green line is the CO2 emitted per mile, as specified by AB 1493, also known as “Pavley 1 and 2” named after Senator Fran Pavley. The values shown do not account for the LCFS. The yellow (or gold) line is the S-3-05 mandate, referenced to 2005 emission levels. The blue line is the product of the red (miles), the green (CO2 per mile), and the purple line (LCFS, which reduces emission per mile) and is the percentage of GHG emissions compared to 2005. Since VMT is not being adequately controlled, the blue line is not achieving the S-3-05 line. Figure 3 shows that driving must be reduced. For this reason, Steve Winkelman can be thought of as the true father of SB 375.
Figure 3 provides inspiration for a road map to climate success for LDVs. Climate-stabilization targets must be identified (from the climate scientists) and achieved by a set of requirements that will increase fleet efficiency and another set that will reduce per-capita driving.

**THE DERIVATION OF CALIFORNIA’S TOP-LEVEL LDV REQUIREMENTS TO SUPPORT CLIMATE STABILIZATION**

It is clear that more efficient (less CO2 emitted per mile) LDVs will be needed and this can be achieved with appropriate requirements. Significant improvements in efficiency will be needed if driving reductions are going to remain within what many people would consider politically achievable. Mileage and equivalent mileage will need to be specified. A significant fleet-fraction of Zero-Emission Vehicles (ZEVs, either Battery-Electric LDVs or Hydrogen Fuel Cell LDVs) will be needed. Since mileage and equivalent mileage are more heuristic than CO2 emissions per mile, they will be used in the derivations. CO2 per mile driven will not appear in the final equations.

Since the SB-375 work used 2005 as the reference year, that convention will be used. It will be assumed that cars last 15 years.

**GHG Emission Target to Support Climate Stabilization**

The primary problem with S-3-05 is that California’s resolve and actions have been largely ignored by other states, our federal government, and many countries. Therefore, rather than achieving 2000 levels by 2010 (the first target of S-3-05) and 1990 levels by 2020 (the 2nd target of S-3-05), world emission has been increasing for nearly all of the years since 2010. (California, on the other hand achieved its 1990 emission level in 2018. This is two years sooner than the 2nd target of the S-3-05 requirement.) Reference 7 states on Page 14 that the required rate of reduction, if commenced in 2020, would be 15%. That rate means that the factor of 0.85 must be achieved, year after year. If this were done for 10 years, the factor would be \((0.85)^{10} = 0.2\), by 2030. This reduction of 80% down from the 2020 value matches the 2050 target requirement of S-3-5, which is 80% below the 1990 value. According to S-3-05, the 2020 emission value should be the same as the 1990 emission value. As noted above, the S-3-05 emission of 2050 was designed to support capping atmospheric CO2 at \(450 \text{ PPM}^3\). “Capping” means that the sum of all emissions (anthropogenic and natural) equals the sum of all sequestration (mostly photosynthesis.) Therefore, the author of the Reference 7 statement wanted the world to achieve the third target of S-3-05 to get the atmospheric CO2 to stop going up 20 years sooner than what S-3-05 was written to achieve. This shows the urgent nature of our climate crisis. Therefore, if California wants to do its part by setting an example for the world, the correct requirement for California is to achieve emissions that are reduced to 80% below California’s 1990 value by 2030. The world’s reduction rate is not anywhere near the needed 15% as we move towards the end of 2020. Therefore, the target, of 80% below 1990 levels by 2030 is considered to be correct for California. Reference 7 also calls into question the advisability of aiming for a 2 degree Celsius increase, given the possibilities of positive feedbacks that would increase warming. This concern for positive feedbacks is another reason that this paper will work towards identifying LDV requirement sets that will support LDVs achieving 80% below the 1990 value by 2030.
Thinking that LDVs can, for some reason, fail to achieve this target is dangerous thinking. As stated above, LDVs emit, by far, the most CO2 of all categories.

**Notes on Methods**

The base year is 2005. An intermediate year of 2015 is used. The car efficiency factor of 2015 with respect to 2005 is taken directly from Figure 3. The car efficiency factor of 2030 with respect to 2015 is derived herein, resulting in a set of car-efficiency requirements.

It is assumed that cars last 15 years. This is equivalent to assuming that the effect of the cars that last more than 15 years, thus increasing emissions, will be offset by the effect of the older cars that don’t last as long as 15 years, thus reducing old-car emissions. As will be seen, there will also have to be some sort of an additional action to remove many of the older Internal Combustion Engine cars that are 15, through just 8 years old. Natural attrition will take care of some of this since as cars get older the probability that they will be taken out of service increases. However, some sort of “cash for gas guzzlers” program will be needed. How this is done is not covered in this paper. This is not unique. As another example, the car manufacturers will have to figure out how to produce the needed cars and batteries.

**Primary Variables Used**

Table 1 defines the primary variables that are used.

**Fundamental Equations**

The emissions are equal to the CO2 per mile driven multiplied by the per-capita driving multiplied by the population, since per-capita driving multiplied by the population is total driving. This is true for any given year.

Future Year \( k \):
\[
e_k = c_k \cdot d_k \cdot p_k
\]  
(Eq. 1)

Base Year \( i \):
\[
e_i = c_i \cdot d_i \cdot p_i
\]  
(Eq. 2)

Dividing both sides of Equation 1 by equal values results in an equality. The terms on the right side of the equation can be associated as shown here:
\[
\frac{e_k}{e_i} = \frac{c_k}{c_i} \cdot \frac{d_k}{d_i} \cdot \frac{p_k}{p_i}
\]  
(Eq. 3)

**Table 1 Variable Definitions**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>( e_k )</td>
<td>LDV Emitted CO2, in Year “k”</td>
</tr>
<tr>
<td>( L_k )</td>
<td>Low Carbon Fuel Standard (LCFS) Factor that reduces the Per-Gallon CO2 emissions, in Year “k”</td>
</tr>
<tr>
<td>( C_k )</td>
<td>LDV CO2 emitted per mile driven, average, in Year “k”, not accounting for the Low Carbon Fuel Standard (LCFS) Factor</td>
</tr>
<tr>
<td>( c_k )</td>
<td>LDV CO2 emitted per mile driven, average, in Year “k”, accounting for the Low Carbon Fuel Standard (LCFS) Factor</td>
</tr>
<tr>
<td>( p_k )</td>
<td>Population, in Year “k”</td>
</tr>
<tr>
<td>( d_k )</td>
<td>Per-capita LDV driving, in Year “k”</td>
</tr>
<tr>
<td>( D_k )</td>
<td>LDV Driving, in Year “k”</td>
</tr>
<tr>
<td>( M_k )</td>
<td>LDV Mileage, miles per gallon, in Year “k”</td>
</tr>
<tr>
<td>( m_k )</td>
<td>LDV Equivalent Mileage, miles per gallon, in Year “k” accounting for Low Carbon Fuel Standard (LCFS) Factor, so this is ( M_k/L_k )</td>
</tr>
<tr>
<td>( N )</td>
<td>Number of pounds of CO2 per gallon of fuel but not accounting for the Low Carbon Fuel Standard (LCFS) Factor</td>
</tr>
</tbody>
</table>

Since CO2 per mile (“c”) is a constant (use “A”, noting that it is equal to about 20 pounds per gallon) multiplied by the number of Gallons (“G”) and since number of gallons is distance (use “D”) divided by mileage (use “m”), then \( c = A*D/m \). This shows that the ratio of the “c” values in different years is going to be equal to the reciprocal of the “m” values in those different years because the other variables will cancel out. Therefore:

To work with mileage:

\[
\frac{m_i}{m_k} = \frac{c_k}{c_i} \quad \text{(Eq. 4)}
\]

Putting Equation 4 into Equation 5 results in the following equation:

\[
\frac{e_k}{e_i} = \frac{m_i}{m_k} \times \frac{d_k}{d_i} \times \frac{p_k}{p_i} \quad \text{(Eq. 5)}
\]

Showing the base year of 2005, the future year of 2030, introducing the intermediate year of 2015 and the year of 1990 (since emissions in 2030 are with respect to the 1990 value) results in Equation 6.

\[
\frac{e_{2030}}{e_{1990}} \times \frac{e_{1990}}{e_{2005}} = \frac{c_{2030}}{c_{2015}} \times \frac{c_{2015}}{c_{2005}} \times \frac{d_{2030}}{d_{2005}} \times \frac{p_{2030}}{p_{2005}} \quad \text{(Eq. 6)}
\]

The ratio on the far left is the climate-stabilizing target, which is the factor of the 2030 emission to the 1990 emission. It has been shown that this is 0.20 or 80% less. The next ratio is the emission of 1990 compared to 2005. It is the turquoise line of Figure 3, which is 0.87. The first ratio on the right side of the equation is the fleet emission per mile in 2030 compared to the value in 2015. This ratio will be derived in this report and it will result in a set of car-efficiency requirements. Moving to the right, the next ratio is the car efficiency in 2015 compared to 2005. It can obtained by multiplying the purple line 2015 value times the green line 2015 value, which is 0.90 * 0.93. The next term, still going from right to left, is the independent variable. It is the per-capita driving reduction required, with respect to the 2005 level of driving. The final term on the far right is the ratio of the population in 2030 to the population in 2005. Reference 8 shows that California’s population in 2005 was 35,985,582. Reference 9 shows that California’s population in 2030 is predicted to be 42,263,654. Therefore,

\[
\frac{p_{2030}}{p_{2005}} = \frac{42263654}{35985582} = 1.17446076 \quad \text{(Eq. 7)}
\]

Putting in the known values results in Equation 8:
\[ 0.20 \times 0.87 = \frac{c_{2030}}{c_{2015}} \times 0.90 \times 0.93 \times \frac{d_{2030}}{d_{2005}} \times 1.17446076 \quad \text{(Eq. 8)} \]

Combining the values, solving for the independent variable (the per-capita driving ratio), and changing from emission-per-mile to equivalent-miles-per-gallon results in the following:

\[ \frac{d_{2030}}{d_{2005}} = 0.177004896 \times \frac{m_{2030}}{m_{2015}} \quad \text{(Eq. 9)} \]

With the coefficient being so small, it is doubtful that we can get the equivalent mileage in 2030 to be high enough to keep the driving ratio from falling below one. The mileage of the 2015 fleet will be based on the best data we can get and by assuming cars last 15 years. The equivalent mileage in 2030 will need to be as high as possible to keep the driving-reduction factor from going too far below 1, because it is difficult to reduce driving too much. The equivalent mileage will be dependent on the fleet-efficiency requirements in the near future and going out to 2030. Those requirements are among the primary results of this report.

**Internal Combustion Engine (ICE) Mileage, from Year 2000 to Year 2030**

The years from 2000 to 2011 are taken from a plot produced by the PEW Environment Group, [http://www.pewenvironment.org/uploadedFiles/PEG/Publications/Fact_Sheet/History%20of%20Fuel%20Economy%20Clean%20Energy%20Factsheet.pdf](http://www.pewenvironment.org/uploadedFiles/PEG/Publications/Fact_Sheet/History%20of%20Fuel%20Economy%20Clean%20Energy%20Factsheet.pdf)

The plot is shown here as Figure 6. The “Both” values are used.

**Figure 4** Mileage Values From the PEW Environment Group

The values from 2012 to 2025 are taken from the US Energy Information Agency (EIA) as shown on their website, [http://www.c2es.org/federal/executive/vehicle-standards#ldv_2012_to_2025](http://www.c2es.org/federal/executive/vehicle-standards#ldv_2012_to_2025). They are the LDV Corporate Average Fleet Efficiency (CAFÉ) values enacted into law in the first term of President Obama. From 2025 to 2030, it is assumed that the yearly ICE improvement in CAFÉ will be 2.5 MPG.
Overall Mileage of California’s LDV Fleet in 2015

Table 2 uses these values of the Internal Combustion Engine (ICE) LDV mileage to compute the mileage of the LDV fleet in 2015. It assumes that the fraction of ZEVs being used over these years is small enough to be ignored. The 100 miles driven, nominally, by each set of cars, is an arbitrary value and inconsequential in the final calculation, because it will divide out. It is never-the-less used, so that it is possible to compare the gallons of fuel used for the different years. The “f” factor could be used to account for a set of cars being driven less. It was decided to not use this option by setting all of the values to 1. The Low Carbon Fuel Standard (LCFS) values are taken from Figure 3. The gallons of fuel are computed as shown in Equation 10, using the definition for \( L_k \) that is shown in Table 2.

\[
\text{Gallons Used per } f \times 100 \text{ miles} = \frac{fx100}{(\text{CAFE MPG})/L_k} \quad (\text{Eq. 10})
\]

As shown in Table 2, using the definitions in Eq. 9:

\[ m_{2015} = 27.63 \]

If it is deemed acceptable to have per-capita driving in 2030 be reduced 32% with respect to 2005 driving, then the left side of Eq. 9 becomes 0.68 and it is possible to use Eq. 9 to solve for the 2030 mileage as:

\[ m_{2030} = (27.63) \times 0.68 \times \left(\frac{1}{0.177004896}\right) = 106.1462 \quad (\text{Eq. 11}) \]

Likewise if it is decided that the per-capita driving in 2030 should equal the per-capita driving in 2005 then:

\[ m_{2030} = (27.63) \times 1.00 \times \left(\frac{1}{0.177004896}\right) = 156.0974 \quad (\text{Eq. 12}) \]

These values will provide the targets for the tables that compute the mileage values for 2030.

How ICE Mileage Values Will Be Used with ZEV Equivalent Mileage Values

To have LDVs achieve our climate-stabilizing target, after 2015, the net (computed using both ICE and ZEV vehicles) mileage values for each year will need to greatly improve by having a significant fraction of ZEVs. The ICE CAFÉ standards are used in this report as just the ICE contribution to fleet MPG. The ICE MPG values are inadequate by themselves and will therefore need to become less important; the ZEVs sales will need to overtake the ICE sales.

Federal requirements will need to change significantly. Currently, federally-mandated corporate average fuel efficiency (CAFE) standards have been implemented, from 2000 to 2025. These standards require that each corporation produce and sell their fleet of cars and light-duty trucks in the needed proportions, so that the combined mileage of all of the cars they sell (total miles driven in all cars sold in the year of interest divided by the total gallons used by all those cars, for any arbitrary distance) at least meets the specified mileage.
Table 2 Calculation of the Fleet MPG for 2015

<table>
<thead>
<tr>
<th>LDV Set</th>
<th>Years Old</th>
<th>Model Year</th>
<th>CAFE MPG</th>
<th>LCFS Factor L&lt;sub&gt;Year&lt;/sub&gt;</th>
<th>Factor Driven f</th>
<th>Gallons Used Per 100 Miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>14-15</td>
<td>2001</td>
<td>24.0</td>
<td>1.0</td>
<td>1.0</td>
<td>4.17</td>
</tr>
<tr>
<td>2</td>
<td>13-14</td>
<td>2002</td>
<td>24.0</td>
<td>1.0</td>
<td>1.0</td>
<td>4.17</td>
</tr>
<tr>
<td>3</td>
<td>12-13</td>
<td>2003</td>
<td>24.0</td>
<td>1.0</td>
<td>1.0</td>
<td>4.17</td>
</tr>
<tr>
<td>4</td>
<td>11-12</td>
<td>2004</td>
<td>24.0</td>
<td>1.0</td>
<td>1.0</td>
<td>4.17</td>
</tr>
<tr>
<td>5</td>
<td>10-11</td>
<td>2005</td>
<td>25.0</td>
<td>1.0</td>
<td>1.0</td>
<td>4.00</td>
</tr>
<tr>
<td>6</td>
<td>9-10</td>
<td>2006</td>
<td>25.7</td>
<td>.9933</td>
<td>1.0</td>
<td>3.87</td>
</tr>
<tr>
<td>7</td>
<td>8-9</td>
<td>2007</td>
<td>26.3</td>
<td>.9867</td>
<td>1.0</td>
<td>3.75</td>
</tr>
<tr>
<td>8</td>
<td>7-8</td>
<td>2008</td>
<td>27.0</td>
<td>.9800</td>
<td>1.0</td>
<td>3.63</td>
</tr>
<tr>
<td>9</td>
<td>6-7</td>
<td>2009</td>
<td>28.0</td>
<td>.9733</td>
<td>1.0</td>
<td>3.48</td>
</tr>
<tr>
<td>10</td>
<td>5-6</td>
<td>2010</td>
<td>28.0</td>
<td>.9667</td>
<td>1.0</td>
<td>3.45</td>
</tr>
<tr>
<td>11</td>
<td>4-5</td>
<td>2011</td>
<td>29.1</td>
<td>.9600</td>
<td>1.0</td>
<td>3.30</td>
</tr>
<tr>
<td>12</td>
<td>3-4</td>
<td>2012</td>
<td>29.8</td>
<td>.9533</td>
<td>1.0</td>
<td>3.20</td>
</tr>
<tr>
<td>13</td>
<td>2-3</td>
<td>2013</td>
<td>30.6</td>
<td>.9467</td>
<td>1.0</td>
<td>3.09</td>
</tr>
<tr>
<td>14</td>
<td>1-2</td>
<td>2014</td>
<td>31.4</td>
<td>.9400</td>
<td>1.0</td>
<td>2.99</td>
</tr>
<tr>
<td>15</td>
<td>0-1</td>
<td>2015</td>
<td>32.6</td>
<td>.9333</td>
<td>1.0</td>
<td>2.86</td>
</tr>
</tbody>
</table>

Sum of Gallons: 54.29
Miles = 100*\(\text{Sum}(f)\): 1500

\[
\text{MPG} = \frac{\text{Miles}}{\text{Sum of Gallons}} = \frac{1500}{54.29} = 27.63
\]

The car companies want to maximize their profits while achieving the required CAFÉ standard. In California, the car companies are already be required to sell a specified number of electric vehicles, which have a particularly-high, equivalent-value of miles-per-gallon. If the laws are not changed, this situation will allow companies to take advantage of their ZEV vehicles to sell more low-mileage, high-profit cars and light-duty trucks, and still achieve the federal CAFÉ standard.

It will be better to apply the CAFÉ standards to only the ICEs and then require, in addition to the CAFÉ standards, that the fleet of LDVs sold achieve some mandated fraction of ZEVs. The ZEVs will get ever-improving equivalent mileage, as our electrical grid is powered by a larger percent of renewable energy. In other words, their equivalent mileage is not fixed, but will improve over the years. Requirements developed here are for 2030. Therefore a high percentage of all the electricity generated in the state, including both the “in front of the meter” (known as the “Renewable Portfólio Standard” or “RPS”) portion and the “behind the meter” portion is assumed to come from sources that do not emit CO2. The values of 85% and 90% are assumed. The values become one of the important fleet-efficiency requirements for cases that are considered. Hopefully these assumptions are reasonable. San Diego’s Climate Action Plan (CAP) was the first to specify 100% renewable energy by 2035. Many other cities have followed San Diego’s lead in this regard.
How to Compute the ZEV Equivalent Mileage Values

To calculate the equivalent mileage of the 2030 fleet of LDVs, it is necessary to derive a formula to compute the equivalent mileage of ZEVs, as a function of the percent of electricity that is generated without emitting CO2 (the mixed case), the equivalent ZEV mileage if the electricity is from 100% fossil fuel (the “West Virginia” case), and the equivalent ZEV mileage if the electricity is from 100% renewable sources (the ideal case), which is not infinity because it is assumed that the manufacturing of the car emits CO2. The variable definitions in Table 3 are used.

Table 3 Variables Used in the Calculation of ZEV Equivalent Mileage

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>$m_z$</td>
<td>ZEV Equivalent mileage</td>
</tr>
<tr>
<td>$m_{zr}$</td>
<td>ZEV Equivalent mileage if the electricity is from renewables</td>
</tr>
<tr>
<td>$m_{zf}$</td>
<td>ZEV Equivalent mileage if the electricity is from fossil fuels</td>
</tr>
<tr>
<td>$r$</td>
<td>fraction of electricity generated from renewable sources</td>
</tr>
<tr>
<td>$G$</td>
<td>Gallons of equivalent fuel used</td>
</tr>
<tr>
<td>$D$</td>
<td>Arbitrary distance travelled</td>
</tr>
<tr>
<td>$Num$</td>
<td>$m_{zr} * m_{zf}$</td>
</tr>
<tr>
<td>$Den$</td>
<td>$r * m_{zf} + (1 - r) * m_{zr}$</td>
</tr>
</tbody>
</table>

The derivation of the equation for equivalent ZEV mileage is based on the notion that the ZEV can be imagined to travel “r” fraction of the time on electricity generated from renewables and “(1-r)” fraction of the time on fossil fuel. If the vehicle travels “D” miles, then, using the definitions shown in Table 4, the following equation can be written.

\[ G = \frac{r*D}{m_{zr}} + \frac{(1-r)*D}{m_{zf}} \]  \hspace{1cm} (Eq. 13)

\[ m_z = D/G = D/\left(\frac{r*D}{m_{zr}} + \frac{(1-r)*D}{m_{zf}}\right) \]  \hspace{1cm} (Eq. 14)

Dividing the numerator and the denominator by D and multiplying the numerator and the denominator by the product of the two equivalent mileage values ($m_{zr}$ and $m_{zf}$) results in Equations 31.

\[ m_z = m_{zr} * m_{zf} / \left( r * m_{zf} + (1 - r) * m_{zr} \right) \]  \hspace{1cm} (Eq. 15)

Using the definitions in Table 3:

\[ m_z = Num / (Den) \]  \hspace{1cm} (Eq. 16)
Table 4 shows 3 assignments of assumed values in which the fraction of electricity generated from renewables is varied and the results, using Equations 15 and 16, results in the three values of ZEV equivalent mileage. This shows the urgent need to move towards cleaner electricity.

**Table 4** Variable Assignment and the Resulting ZEV Mileages

<table>
<thead>
<tr>
<th>$m_{zr}$</th>
<th>$m_{zf}$</th>
<th>$r$</th>
<th>$1-r$</th>
<th>Num</th>
<th>Den</th>
<th>$m_z$</th>
</tr>
</thead>
<tbody>
<tr>
<td>5000</td>
<td>70</td>
<td>0.80</td>
<td>0.20</td>
<td>350000.00</td>
<td>1056.00</td>
<td>331.44</td>
</tr>
<tr>
<td>5000</td>
<td>70</td>
<td>0.85</td>
<td>0.15</td>
<td>350000.00</td>
<td>809.50</td>
<td>432.37</td>
</tr>
<tr>
<td>5000</td>
<td>70</td>
<td>0.90</td>
<td>0.10</td>
<td>350000.00</td>
<td>563.00</td>
<td>621.67</td>
</tr>
</tbody>
</table>

Additional Variables Needed to Compute the Overall Equivalent Mileage in 2030, Taking Into Account Both ICEs and ZEVs

Table 5 shows the additional definitions that will be used in the calculation of 2030 overall mileage.

**Table 5** Additional Variables Used in the Calculation of 2030 LDV Mileage

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>$D_i$</td>
<td>Distance travelled by ICE vehicles</td>
</tr>
<tr>
<td>$D_z$</td>
<td>Distance travelled by ZEV vehicles</td>
</tr>
<tr>
<td>$G_i$</td>
<td>Gallons of equivalent fuel used by ICE vehicles</td>
</tr>
<tr>
<td>$G_z$</td>
<td>Gallons of equivalent fuel used by ZEVs</td>
</tr>
</tbody>
</table>

Computing an LDV Overall Equivalent Fleet Mileage, for the **Balanced_1** Case

Table 6 shows the calculation for the overall equivalent mileage for all the cars on the road, in the year of 2030, for the **Balanced_1** case.

The name, **Balanced_1**, comes from the attempt to balance the difficulty of achieving the fleet efficiency-related requirements with the difficulty of achieving the driving-reduction related requirements. The **Balanced_1** case assumes that electricity is 85% renewable, which is also difficult.

There will also be a **Balanced_2** case that assumes that electricity is 90% renewable. Both the **Balanced_1** and the **Balanced_2** cases assume that it is reasonable to have per-capita driving in 2030 reduced 32%, with respect to 2005 per-capita driving. That assumption, along with the 85% renewable electricity assumption, was used to select the $z$ values of Table 6 to result in the Equation 11 value of overall 2030 mileage, which is 106.1263 Miles Per Gallon (MPG). From Table 4, 85% renewable electricity results in a ZEV equivalent mileage of 432.37 MPG. That value of equivalent ZEV mileage in 2030, when electricity is 85% renewable, is used for all of the ZEV model years, for
this case. Note that this is overlooking the fact that not all BEVs are equally efficient. In order to simplify this analysis, the Table 4 values of \( m_{zf} \) and \( m_{zr} \) are considered to be applicable to all the ZEV models. Therefore, the 432.37 MPG value can be divided into each \( D_z \) value to compute the corresponding \( G_z \) value, in all of the model years being considered.

To reduce the miles driven in poor-mileage ICE’s, the “f” factor is used. For example, if “f” is set to 0.30, as it is in 2016, then the miles driven is reduced by 70%. Achieving the required “f” values may require some type of “cash-for-gas-guzzlers” program. However, it could also be noted that when older cars are second or third cars in multi-car families in which family members have the luxury of choosing which car to drive, family members will usually choose the car that is cheaper to operate, thus making the “f” factors easier to achieve. Finally, the Low Carbon Fuel Standard (LCFS) is assumed to continue to improve from the currently mandated value of 0.9 by the end of 2019. This is another method of reducing the CO2 emissions of the ICE vehicles.

For the ICE vehicles, the \( G_i \) values are computed as the \( D_i \) value divided by the equivalent MPG value. The equivalent MPG is the CAFÉ MPG divided by the LCFS factor.

It is arbitrarily assumed that the cars, for each year being considered (the models for that year, both ZEVs and ICES), go a total of 100 miles. Although this is an extremely small fraction of the actual miles that will be driven, it doesn’t change the result because the number of gallons of equivalent gasoline is always proportional to miles. The fraction of cars that are ZEVs (\( z \)) is used to divide up this value of 100 Miles. However, the factor “f” reduces the miles driven by the ICE vehicles and this brings down the total miles driven for the years in which the “f” term is less than 1. For each year, the total miles per gallon (MPG) is computed as the total miles driven divided by the total gallons used. However, this value is not used in the calculation of the entire fleet equivalent mileage. The overall equivalent mileage is computed as the total miles driven divided by the total gallons used, where these quantities are summed over all of the 15 categories (years) of LDVs.

The following formulas are used to compute the overall equivalent mileage in 2030, of all of the LDVs on the road.

For the ICE calculations, for 2016, where

- “\( L_k \)” is defined in Table 1 (LCFS factor for year “\( k \)” and is the value in the “LCFS” column of Table 6 and
- “\( z \)” is from the “\( z \)” column and is the fraction of cars sold in the year that are ZEVs and
- “\( m_i \)” is the value from the CAFÉ MPG column:

\[
D_i = 100 \times f \times (1 - z) \quad \text{(Eq. 17)}
\]
\[
G_i = D_i / (m_i / L_{2016}) \quad \text{(Eq. 18)}
\]

For the ZEV calculations:

\[
D_z = 100 \times z \quad \text{(Eq. 17)}
\]
\[
G_z = D_z / (432.37) \quad \text{(Eq. 18)}
\]

In updating this report from its 2015 version, the fleet fraction of ZEVs (“\( z \)”), from 2015 to 2019, had to be reduced to approximate the low values that actually occurred from 2015 to 2019. However,
in 2020, it is assumed that the fraction will be at least as large as 8%, which is not such a trivial value. If it is actually larger than 8%, then there will be some margin built into the requirements derived in this report.

### Table 6 Calculation of 2030 LDV Mileage Assuming the Balanced_1 Case

<table>
<thead>
<tr>
<th>Year</th>
<th>ICE Parameters and Calculations</th>
<th>ZEVs</th>
<th>Yearly Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CAFE MPG</td>
<td>LCFS</td>
<td>Eq. MPG</td>
</tr>
<tr>
<td>2016</td>
<td>34.3</td>
<td>.9267</td>
<td>37.01</td>
</tr>
<tr>
<td>2017</td>
<td>35.1</td>
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</tr>
<tr>
<td>2030</td>
<td>61.2</td>
<td>.8000</td>
<td>76.50</td>
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</tbody>
</table>

Sum of Miles and then Gallons of Equivalent Fuel: 1235.60, 11.64
Equivalent MPG of LDV Fleet in 2030: 106.17
Sum of ZEV Miles = 795. Fraction of Miles Driven by ZEVs = 64.3%
There is probably some margin from the 2016 to 2019 values as well. The difficult values are for 2022, 2023, and 2024, with 2024 requiring that ZEV sales are 80% of all the cars purchased in California. The purple color of the $z$ values denotes difficulty. This shows that the government will need to require that the car companies achieve the $z$ values or buy credits from a company such as Tesla, which sells 100% ZEVs.

The Table 6 $z$ values were put into an EXCEL spread sheet that looks like Table 6. It produced the values shown in Table 6. The values were selected to try to get to the 106.1462 value that was computed in Eq. 11.

Using the result of 106.17 MPG into Equation 9, gives the following result:

$$\frac{d_{2030}}{d_{2005}} = 0.17700 \times \frac{m_{2030}}{m_{2015}} = 0.17700 \times \frac{106.17}{27.63} = 0.68016 \quad \text{(Eq. 19)}$$

This is the 32% reduction desired. It will be difficult to achieve. However, the required schedule of ZEV adoption is also difficult. The values of $z$ from the years 2021 to 2025 will be at least as difficult as achieving the 32% reduction. This situation motivates the next case. If electricity could be made cleaner sooner, the years from 2021 to 2025 could be less difficult.

**Computing an LDV Overall Equivalent Fleet Mileage, for the Balanced_2 Case**

The Balanced_2 case is shown in Table 7.

The Balanced_2 case is the same as the Balanced_1 case except it includes an assumption that electricity is 90% renewable in 2030 instead of 85%. Table 7 shows the results using that assumption, which becomes a requirement for this case. For the Balanced_2 case, the values of $z$ are once again assigned to achieve the desired driving-reduction value of 32%.

From the second line of Table 4, this means that the equivalent mileage of the ZEV vehicles is 621.67 MPG.

Eq. 18 becomes:

$$G_z = D_z/(621.67) \quad \text{(Eq. 20)}$$

This is used to compute the gallons of equivalent fuel from the distance, for the ZEV vehicles in Table 7.

The Table 7 $z$ values were put into an EXCEL spread sheet that looks like Table 7. It produced the values shown in Table 7. The $z$ values were selected to try to get to the 106.1462 value that was computed in Eq. 11.

Using the Table 7 result of 106.22 MPG into Equation 9, gives the following result:
\[
\frac{d_{2030}}{d_{2055}} = 0.17700 \times \frac{m_{2030}}{m_{2015}} = 0.17700 \times \frac{106.22}{27.63} = 0.68045 
\]  
(Eq. 21)

Table 7  
Calculation of 2030 LDV Mileage Assuming the Balanced_2 Case

<table>
<thead>
<tr>
<th>Year</th>
<th>ICE Parameters and Calculations</th>
<th>ZEVs</th>
<th>Yearly Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CAFÉ MPG</td>
<td>LCFS</td>
<td>Eq. MPG</td>
</tr>
<tr>
<td>2016</td>
<td>34.3</td>
<td>.927</td>
<td>37.01</td>
</tr>
<tr>
<td>2017</td>
<td>35.1</td>
<td>.920</td>
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<tr>
<td>2018</td>
<td>36.1</td>
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</tr>
<tr>
<td>2023</td>
<td>44.3</td>
<td>.800</td>
<td>55.38</td>
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<tr>
<td>2030</td>
<td>61.2</td>
<td>.800</td>
<td>76.50</td>
</tr>
</tbody>
</table>

Sum of Miles and then Gallons of Equivalent Fuel: 1233.60 11.61

Equivalent MPG of LDV Fleet in 2030: 106.22

Sum of ZEV Miles = 761. Fraction of Miles Driven by ZEVs = 61.7%
This is the 32% reduction desired. It will be difficult to achieve. However, the required schedule of ZEV adoption is also difficult. The values of $z$ from the years 2021 to 2025 will be at least as difficult as achieving the 32% reduction. However, they are easier to achieve than the values needed in the Balanced_1 Case. This quantifies the benefit of increasing the renewable fraction of electricity from 85% to 90%.

**Computing an LDV Overall Equivalent Fleet Mileage, for the 2005_Driving Case**

When climate change and transportation policies are discussed, the opinion that we should simply electrify our fleet as soon as possible is often expressed. The idea is that the per-capita driving level does not have to be reduced, if we electrify our fleet fast enough. The relationships developed in this paper enable an analysis to see how this would work. This gives rise to the 2005_Driving Case. For this case, it is assumed that electricity is 90% renewable.

From the third line of Table 4, this means that the equivalent mileage of the ZEV vehicles is 621.67 MPG. Therefore, the relationship shown in Eq. 20 is used.

The 2005_Driving case is shown in Table 8.

For the 2005_Driving case, the values of $z$ are assigned to achieve the overall equivalent mileage (MPG) value computed in Eq. 12, which is 156.0974, because that value was computed for there being no change in the per-capita driving from the 2005 value.

Using the result of 155.99 MPG into Equation 9, gives the following result:

$$\frac{d_{2030}}{d_{2005}} = 0.17700 \times \frac{m_{2030}}{m_{2015}} = 0.17700 \times \frac{155.99}{27.63} = 0.99930 \quad (\text{Eq. 22})$$

This is the 0% reduction desired. However, the required schedule of ZEV adoption is not possible. Jumping from 8% in 2020 to 82% in 2021 defies reason. It appears that our best bet, to do our part to avoid human extinction, is to proceed with the assumption (and thus requirement) that we are going to have to reduce per-capita driving, as shown in either the Balanced_1 or the Balance_2 case.

**Computing an LDV Overall Equivalent Fleet Mileage, for the Mary_Nichols Case**

Mary Nichols was first appointed to the California Air Resource Board (CARB) in 1975 and became Chair in 1979. After leaving CARB, she founded the Los Angeles Chapter of the Natural Resources Defense Council (NRDC) in 1989. She was reappointed to the position of Chair of
CARB in 2007 by Governor Arnold Schwarzenegger and she is still serving in that position today.

The following quote\textsuperscript{13} inspires the \textit{Mary_Nichols} Case:

\begin{table}[h]
\centering
\begin{tabular}{|c|c|c|c|c|c|c|c|c|c|c|}
\hline
\textbf{Year} & \textbf{ICE Parameters and Calculations} & \textbf{ZEVs} & \textbf{Yearly Totals} \\
& \textbf{CAFÉ MPG} & \textbf{LCFS} & \textbf{Eq. MPG} & \textbf{f} & \textbf{$D_i$} & \textbf{$G_i$} & \textbf{$z$} & \textbf{$D_z$} & \textbf{$G_z$} & \textbf{Total Miles} & \textbf{Total Gallons} & \textbf{2030 MPG} \\
\hline
2016 & 34.3 & .9267 & 37.01 & .3 & 29.4 & .7943 & .02 & 2.0 & .003 & 31.40 & 0.7975 & 39.37 \\
2017 & 35.1 & .9200 & 38.15 & .4 & 39.2 & 1.0275 & .02 & 2.0 & .003 & 41.20 & 1.0307 & 39.97 \\
2018 & 36.1 & .9133 & 39.53 & .5 & 48.5 & 1.2271 & .03 & 3.0 & .005 & 51.50 & 1.2319 & 41.81 \\
2019 & 37.1 & .9067 & 40.92 & .6 & 57.6 & 1.4077 & .04 & 4.0 & .006 & 61.60 & 1.4141 & 43.56 \\
2020 & 38.3 & .9000 & 42.56 & .7 & 64.4 & 1.5133 & .08 & 8.0 & .013 & 72.40 & 1.5262 & 47.44 \\
2021 & 40.3 & .8500 & 47.41 & .8 & 14.4 & .3037 & .82 & 82.0 & .132 & 96.40 & 0.4356 & 221.29 \\
2022 & 42.3 & .8000 & 52.88 & .9 & 2.7 & .0511 & .97 & 97.0 & .156 & 99.70 & 0.2071 & 481.42 \\
2023 & 44.3 & .8000 & 55.38 & 1.0 & 1.0 & .0181 & .99 & 99.0 & .159 & 100.00 & 0.1773 & 563.99 \\
2024 & 46.5 & .8000 & 58.13 & 1.0 & 1.0 & .0172 & .99 & 99.0 & .159 & 100.00 & 0.1765 & 566.72 \\
2025 & 48.7 & .8000 & 60.88 & 1.0 & 1.0 & .0164 & .99 & 99.0 & .159 & 100.00 & 0.1757 & 569.23 \\
2026 & 51.2 & .8000 & 64.00 & 1.0 & 1.0 & .0156 & .99 & 99.0 & .159 & 100.00 & 0.1749 & 571.84 \\
2027 & 53.7 & .8000 & 67.13 & 1.0 & 1.0 & .0149 & .99 & 99.0 & .159 & 100.00 & 0.1741 & 574.23 \\
2028 & 56.2 & .8000 & 70.25 & 1.0 & 1.0 & .0142 & .99 & 99.0 & .159 & 100.00 & 0.1735 & 576.42 \\
2029 & 58.7 & .8000 & 73.38 & 1.0 & 1.0 & .0136 & .99 & 99.0 & .159 & 100.00 & 0.1729 & 578.45 \\
2030 & 61.2 & .8000 & 76.50 & 1.0 & 1.0 & .0131 & .99 & 99.0 & .159 & 100.00 & 0.1723 & 580.31 \\
\hline
\end{tabular}
\caption{Calculation of 2030 LDV Mileage Assuming the 2005\textit{Driving} Case}
\end{table}

The sum of miles and then gallons of equivalent fuel: \textit{1254.20 | 8.04}

The equivalent MPG of LDV fleet in 2030: \textit{155.99}

Sum of ZEV Miles = \textcolor{red}{990.0} Fraction of Miles Driven by ZEVs = \textcolor{red}{78.9\%}
Regulations on the books in California, set in 2012, require that 2.7 percent of new cars sold in the state this year be, in the regulatory jargon, ZEVs. These are defined as battery-only or fuel-cell cars, and plug-in hybrids. The quota rises every year starting in 2018 and reaches 22 percent in 2025. Nichols wants 100 percent of the new vehicles sold to be zero- or almost-zero-emissions by 2030.

The mathematical relationships developed in this paper make it possible to determine the driving reduction that would be required if it is desired to stabilize the climate at a livable level, assuming the schedule of fleet electrification implied by the above quote. Electricity is required to be 90% renewable. The results of the Mary Nichols Case are shown in Table 9. The corresponding driving reduction is computed using Eq. 9.

\[
\frac{d_{2030}}{d_{2005}} = 0.177005 \times \frac{m_{2030}}{m_{2015}} = 0.177055 \times \frac{77.24}{27.63} = 0.495 \quad \text{(Eq. 14)}
\]

This means that the per-capita driving will need to be about 50% less in 2030 than in year 2005. It is not known if CARB understands this.

The official policy of the California Democratic Party (CDP) is expressed in its Platform. A statement that applies to this report and to CARB can be viewed by looking at the California Democratic Party (CDP) website, then select “About Us”, “Standing Committees”, “Platform Committee”, “2020 Platform”, and finally “Energy and Environment Plank”. In that Plank, the following statement is found:

- **Demand a state plan specifying how cars and light-duty trucks can meet climate-stabilizing targets by defining enforceable measures to achieve necessary fleet efficiency and per-capita driving limits;**

However, your author’s efforts to get CARB to do such a “state plan”, or to convince a state legislator to write legislation to direct CARB to do such a plan, have not been successful.

If CARB would do such a plan or would consider the results of this report, they would perhaps decide to push for a more ambitious fleet electrification schedule and would also push for state legislation and regulation to enact measures to reduce VMT.

**Preliminary Conclusions Drawn from the Results of the Four Cases Run**

Table 10 is a summary showing the most important results of the four cases considered. The purple-colored entries denote difficult requirements; red denotes nearly impossible.

Considering the Balance_1 and the Balanced_2 cases and the fleet electrification schedules for each, it is first concluded that California needs to work to get its electricity to be at least 85% renewable by 2030 and furthermore that getting it to be 90% from renewables by 2030 would make the electrification schedule much easier.
Table 9: Calculation of 2030 LDV Mileage Assuming the Mary_Nichols Case

<table>
<thead>
<tr>
<th>Year</th>
<th>ICE Parameters and Calculations</th>
<th>ZEVs</th>
<th>Yearly Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CAFÉ MPG</td>
<td>LCFS</td>
<td>Eq. MPG</td>
</tr>
<tr>
<td>2016</td>
<td>34.3</td>
<td>.9267</td>
<td>37.01</td>
</tr>
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<td>2017</td>
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<tr>
<td>2030</td>
<td>61.2</td>
<td>.8000</td>
<td>76.50</td>
</tr>
</tbody>
</table>

Sum of Miles and then Gallons of Equivalent Fuel: 1236.00 | 16.00

Equivalent MPG of LDV Fleet in 2030: 77.24

Sum of ZEV Miles = 457.9. Fraction of Miles Driven by ZEVs = 37.0%
## Table 10
Four-Case Summary of Requirements

<table>
<thead>
<tr>
<th>Case Designations</th>
<th>Balanced_1</th>
<th>Balanced_2</th>
<th>2005 Driving</th>
<th>Mary Nichols</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Renewable Electricity</td>
<td>85.0%</td>
<td>90.0%</td>
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<tr>
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<td>% ZEVs, Year 2017</td>
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<td>8.0%</td>
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<td>35.0%</td>
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<td><strong>97.0%</strong></td>
<td>14.76%</td>
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<td>19.59%</td>
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<td>% ZEVs, Year 2025</td>
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<td>95.0%</td>
<td>99.0%</td>
<td>22.00%</td>
</tr>
<tr>
<td>% ZEVs, Year 2026</td>
<td>97.0%</td>
<td>97.0%</td>
<td>99.0%</td>
<td>37.60%</td>
</tr>
<tr>
<td>% ZEVs, Year 2027</td>
<td>98.0%</td>
<td>98.0%</td>
<td>99.0%</td>
<td>53.20%</td>
</tr>
<tr>
<td>% ZEVs, Year 2028</td>
<td>99.0%</td>
<td>99.0%</td>
<td>99.0%</td>
<td>68.80%</td>
</tr>
<tr>
<td>% ZEVs, Year 2029</td>
<td>99.0%</td>
<td>99.0%</td>
<td>99.0%</td>
<td>84.40%</td>
</tr>
<tr>
<td>% ZEVs, Year 2030</td>
<td>99.0%</td>
<td>99.0%</td>
<td>99.0%</td>
<td>100.00%</td>
</tr>
<tr>
<td>% Reduction in Per-Capita Driving With Respect to Year 2005</td>
<td><strong>32.0%</strong></td>
<td><strong>32.0%</strong></td>
<td><strong>0%</strong></td>
<td><strong>50.5%</strong></td>
</tr>
</tbody>
</table>
Besides that, it should be recognized that California alone cannot stabilize our earth’s climate. California’s best hope is to set an example for other states and other countries. Taking too many of the world’s production of electric vehicles will not work. For a more specific example, lithium batteries may be in short supply and so it may be counterproductive for California to have more than its fair share, thus preventing other states and countries from electrifying their fleet at the required rate. The rates of electrification shown for the Balanced_1 and the Balanced_2 cases are aggressive enough, as shown by the purple-colored entries.

California needs to adopt a set of requirements to achieve the 32% reduction. If CARB wants to work to have California legislate requirements to achieve the Mary Nichol’s case of a 50% reduction in driving, that would also work and allow more electric cars to go to other states and countries. However the 50% reduction in per-capita driving might be politically impossible at this time. Since the 32% reduction seems prudent, it begs the question as to what this means in terms of roadway congestion.

The net (as opposed to the per-capita) driving change, going from 2005 to 2030 can be computed by multiplying the per-capita driving factor corresponding to the 32% reduction, which is 0.68, by the population factor of 1.1744, computed in Equation 7. The product of these two values is 0.7986. This means that, even with the 17% increase in California’s population, the net driving will have to drop by the factor of about 0.80, or by 20%. If this LDV-driving-reduction requirement (of 0.68) is selected, all of California’s transportation money can be used to improve transit, improve active transportation (mainly walking and biking), and maintain, but not expand, roads. There can be little or no congestion because California highway capacity now is larger than it was in 2005 while the state’s net driving must drop by 20%.

ACHIEVING THE REQUIRED DRIVING REDUCTION OF THE BALANCED_1 AND THE BALANCED_2 CASES

As shown in Equation 19, for the Balanced_1 case, and in Equation 21 for the Balanced_2 Case, in 2030, the per-capita driving will need to be 32% below the 2005 value. As shown in this link, https://en.wikipedia.org/wiki/Sustainable_Communities_and_Climate_Protection_Act_of_2008, California’s Metropolitan Planning Organizations (MPOs) are adopting Region Transportation Plans (RTPs) that will achieve reductions in year 2020 and 2035. The convention adopted in this report for these reductions, specifically the per-capita driving reduction with respect to the per-capita driving in 2005, matches the SB 375 convention. As shown in the link, the targets, for year 2035, range from 0% for the Shasta MPO to 16% for Sacramento Area Council of Governments. However, it may be true that some of the 2035 requirements have been revised upwards, to be as large as 19% for some MPOs. Since the climate stabilization target year here is 2030 instead of 2035, and to be reasonably conservative, it is assumed here that the state (this is for all MPOs) will achieve a 12% reduction in per-capita driving, in 2030, compared to 2005. This leaves approximately 20% to be achieved by new requirements.

The title of each of the following subsections contains the estimated per-capita driving reduction each strategy will achieve, by 2030.
Reallocate Funds Earmarked for Highway Expansion to Transit and Consider Transit-Design Upgrades (2%)

San Diego County has a sales tax measure called “TransNet”, which allocates approximately one-third for highway expansion, one-third for transit, and one-third for road maintenance. It has a provision that allows for a reallocation of funds, if supported by at least two-thirds of SANDAG Board members, including a so-called weighted vote, where governments are given a portion of 100 votes, proportional to their population. This requirement would be to reallocate the TransNet amount, earmarked for highway expansion, to transit and to do similar reallocations throughout California.

This money could be used to fund additional transit systems; improve transit operations; and/or fund the redesign and implementation of the redesign of existing transit systems. The redesign could include electrification and automation (including automation of fare collection and such features as screening passengers to prevent them from boarding if they have a fever or are in a “test positive” database) or even upgrading to a different transit technology.

A Comprehensive Road-Use Charge (RUC) Pricing and Payout System to Unbundle the Cost of Operating Roads (10%)

*Comprehensive* means that pricing would be set to cover all costs (including road maintenance and externalities such as harm to the environment and health); that privacy and the interests of low-income drivers doing necessary driving would be protected; that the incentive to drive fuel-efficient cars would be at least as large as it is under the current fuels excise tax; and finally, as good technology becomes available, congestion pricing is used to protect critical driving from congestion.

The words *payout* and *unbundle* mean that some of the money collected would go to people that are losing money under the current system.

User fees (gas taxes and tolls) are not enough to cover road costs\(^\text{10}\) and California is not properly maintaining its roads. Reference 10 shows that in California user fees amount to only 24.1% of what is spent on roads. Besides this, the improved mileage of the ICEs and the large number of ZEVs mean that gas tax revenues will drop precipitously.

This RUC system could be used to help reduce the ICE LDV miles driven in 2016 to 2022, as shown in the “f” column of Tables 6 through 9. This system could probably be implemented in less than 2 years if the urgency of our climate crisis is recognized.

Unbundling the Cost of Car Parking (8%)

Unbundling the cost of car parking\(^\text{11}\) throughout California is conservatively estimated to decrease driving by 8%, based on Table 1 of Reference 11. That table shows driving reductions that occur in response to introducing a price, for 10 cases. Its average reduction in driving is 25% and its smallest reduction is 15%. However, these numbers are for individual cases whereas the 8% is the decrease in driving in California, due to introducing value pricing where there is a zero price today, or where the price is below its value price. These concepts are explained in Reference 11.

The first such systems should be installed by a (RFP is Request for Proposal) RFP-process-identified, third-party vendor, such as Google, Qualcomm, Uber, or Lime Bicycle, for municipal government employees, as part of the government’s Climate Action Plan. The system would be operated for the financial gain of the employees, with a hard requirement in the RFP that even
employees that continue to drive every day would at least break even. The winning third-party vendor would be skilled at monetizing parking whenever it is not being used by the employees and skilled at monetizing data. The parking system would be fully automated, like Uber, except with a more useful phone app that would find the best parking at the user-specified price and walk-distance. The parking would be available to all drivers driving a car registered in the system. Briefly stated, the system is value priced, shared, automated, and provides earnings to all the people that are effectively losing wages or paying higher costs because the parking is being provided. The vendor would also be good at expanding the system both geographically and over all types of uses, in an economically disruptive way; as Uber and Lyft did to the taxi cab industry. The system would be as easy to use as “free” parking, once the car is registered. It would utilize congestion pricing to protect the desired maximum-occupancy rate.

Good Bicycle Projects

The best criterion for spending money for bicycle transportation is the estimated reduction in driving per the amount spent. The following strategies may come close to maximizing this parameter.

Projects to Improve Bicycle Access (1%)

All of the smart-growth neighborhoods, central business districts, and other high-trip destinations or origins, both existing and planned, should be checked to see if bicycle access could be substantially improved with either a traffic calming project, a “complete streets” project, more shoulder width, or a project to overcome some natural or made-made obstacle. For example, in some cases, long stretches of freeways cut off bicycle passage on surface streets that are perpendicular to the freeway. In some of these cases, a bicycle bridge over the freeway would be cost effective.

League-of-American-Bicyclist-Certified (LCI) Instruction of “Traffic Skills 101” (1%)

Most serious injuries to bike riders occur in accidents that do not involve a motor vehicle\textsuperscript{12}. Most car-bike accidents are caused by wrong-way riding and errors in intersections; the clear-cut-hit-from-behind accident is rare\textsuperscript{12}.

After attending Traffic Skills 101, students that pass a rigorous written test and demonstrate proficiency in riding in traffic and other challenging conditions, in passing an on-road-riding test, would be paid for their time and effort.

As an example of what could be done in San Diego County, if the average class size was 3 riders per instructor and each rider passes both tests and earns $100 and if the instructor, with overhead, costs $500 dollars, for a total of $800 for each 3 students, that would mean that $160M could teach $160M/$800 = 200,000 classes of 3 students, for a total of 600,000 students. The population of San Diego County is around 3 million.

Eliminate or Greatly Increase the Maximum Height and Density Limits Close to Transit Stops that Meet Appropriate Service Standards (2%)

As sprawl is reduced, more compact, transit-oriented development (TOD) will need to be built. This strategy will incentivize a consideration of what level of transit service will be needed, how it can be achieved, and what levels of maximum height and density are appropriate. Having no limits at all is reasonable if models show that the development can function without harming the existing adjacent
neighborhoods, given the level of transit service and other supporting transportation policies (such as car parking that unbundles the cost and supports the full sharing of parking\textsuperscript{12}) that can be assumed.

**Complete Streets (Streets designed for all users), “Road Diets”, and “Traffic Calming”, Such as Replacing Signalized Intersections with Roundabouts (1%)**

These projects will encourage active transportation, such as bicycling and walking. These projects also fit well with the addition of TOD and increasing density. They will reduce speeds and therefore reduce noise. The noise reduction and increased safety will encourage people to want to live on and around the redesigned arterials where they would not want to have lived before. People will also be more inclined to shop and to work in such surroundings.

**Net Driving Reduction from All Identified Strategies**

By 2030, the sum of these strategies should be realized as shown in Table 11.

**CONCLUSION**

The urgency of our climate crisis dictates that California should develop plans such as the cases considered in this paper for a climate-stabilizing target year of 2030. The state needs to select a case and move forward with legislation and implementation. The cases considered in this paper indicate that California should achieve electricity that is at least 85% from renewable sources and a per-capita driving reduction of at least 32% with respect to 2005 driving levels. The eight driving-reducing requirements described in this paper are an example of how this could be done.
Table 11  Requirements to Achieve a 32% Reduction in 2030 Per-Capita Driving, with Respect to 2005

<table>
<thead>
<tr>
<th>Driving Reduction Requirements</th>
<th>Percent Reduction</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legislated (SB 375) Plans to Reduce Driving</td>
<td>12%</td>
<td>0.88</td>
</tr>
<tr>
<td>Value-Priced Road Use Charge (RUC)</td>
<td>10%</td>
<td>0.90</td>
</tr>
<tr>
<td>Value-Priced Parking (Unbundling the Cost)</td>
<td>8%</td>
<td>0.92</td>
</tr>
<tr>
<td>Transfer Highway Expansion Funds to Transit</td>
<td>2%</td>
<td>0.98</td>
</tr>
<tr>
<td>Increase Height &amp; Density by Transit Stations</td>
<td>2%</td>
<td>0.98</td>
</tr>
<tr>
<td>&quot;Complete Streets&quot;, &quot;Road Diet&quot; (walk/bike)</td>
<td>1%</td>
<td>0.99</td>
</tr>
<tr>
<td><strong>Pay-to-Graduate</strong> Bicycle Traffic-Skills Class</td>
<td>1%</td>
<td>0.99</td>
</tr>
<tr>
<td>Bicycle Projects to Improve Access</td>
<td>1%</td>
<td>0.99</td>
</tr>
</tbody>
</table>

**Product of Factors** 0.68

**% Reduction** 32%

ABREVIATIONS AND ACRONYMS

| AB 1493 California’s Assembly Bill 1493                             | ICE Internal Combustion Engine LDV |
| AB 32 California’s Assembly Bill 32                                 | kW-h Kilo Watt-hour                |
| APS Alternative Planning Strategy                                   | LCFS Low Carbon Fuel Standard      |
| CAFE Corporate Average Fleet Efficiency                             | LDV Light-Duty Vehicle             |
| CARB California Air Resources Board                                 | MPO Metropolitan Planning Organization |
| CBD Center for Biological Diversity                                 | Pavley Senator Pavley’s AB 1493    |
| CEQA California Environmental Quality Act                          | PPM Parts per Million              |
| CCAP Center for Clean Air Policy                                    | RPS Renewable Portfolio Standard   |
| CNFF Cleveland National Forest Foundation                           | RTP Regional Transportation Plan   |
| SB 375 California’s Senate Bill 375                                 | S-3-05 Governor’s Executive Order S-3-05 |
| CO₂ Carbon Dioxide                                                  | SANDAG San Diego Association of Governments |
| CO₂_e Carbon Dioxide Equivalent GHG                                 |                                 |
| EHM “Extra Heroic Measures” LDV Case                                | SCS Sustainable Community Strategy |
| GEO Governor’s Executive Order                                      | TransNet San Diego County sales tax |
ACKNOWLEDGEMENTS

Darrell Clarke, Lead Volunteer for the Sierra Club’s “Beyond Oil Campaign”; Dr. Dennis Martinek, Oceanside Planning Commissioner; Sandra Goldberg, formerly California Deputy Attorney General; Dr. Nilmini Silva-Send, Senior Policy Analyst of the Energy Policy Initiative Center; Diane Nygaard, Director of Preserve Calavera and founder of Nelson Nygaard Consulting Associates; Jack Shu, CNFF President; Joan Bullock; San Diego Sierra Club Executive Committee Chairs: Caroline Chase, John Stump, and (former Assembly Member) Lori Saldaña; Malinda Dickenson, Law Offices of Malinda R. Dickenson; Conservation Committee Chair Mollie Biggers; Ed Mainland and Jim Stewart, Co-Chairs, Energy-Climate Committee, Sierra Club California; Bern Grush, Chief Scientist, Skymeter Corporation; and SANDAG Staff: Susan Baldwin, Senior Regional Planner; Charles Stoll, Director of Land Use and Transportation Planning; and Stephan Vance, Senior Regional Planner.

REFERENCES

4. Hertsgaard, M; Latino Climate Solution, the Nation, Dec. 24/31, 2012.
5. Whitney E.; How to Meet the Climate Crisis, UU World, Volume XXVI No. 4, Winter 2012.
9. State of California Department of Finance, from http://www.dof.ca.gov/Forecasting/Demographics/Projections/ then select the EXCEL file from “Total Population by County”


**KEYWORDS**

Driving, climate, mandates, S-3-05, SB 375, RTP, CEQA, Unbundled, GHG, CAFÉ, ZEVs
Good morning Chairman and all board members.

My name is Toshi Ishihara. I am a volunteer with San Diego 350.

First, Executive Director Hassan and hard working SANDAG employees, thanks for bringing to us the bold new RTP that can transform the San Diego region’s transportation systems to meet our mobility needs and climate challenges.

There are differences between the short needs and the long term challenges. San Diego has short term issues such as unemployment, housing, and other problems, and the COVID-19 has exacerbated many of them. Those short term issues need your immediate attention. At the same time, this region has many challenges that require a long term vision and careful planning. However, I think that some people are confused about the short term and long term needs of this region. Please don’t mix them up.

Next, I would like to remind that the transit-based transportation system is more easily scalable than the freeway and road-based transportation system. Climate change will likely cause domestic and global migration of people, and San Diego may face possible large population increases due to the migration. The well planned transit system will be able to readily handle population increases, but the freeway cannot meet that challenge without constructing more lanes. Which is the smarter solution? Please ask yourself this question.

Thank you.
To whom it may concern,
Recent campaign contribution disclosures from San Diego County Supervisor District 3 candidate Terra Lawson-Remer reveal that San Diego Association of Governments (SANDAG) Executive Director Hosam Ikhrata contributed to the campaign of Ms. Lawson-Remer. Not only did he contribute, Mr. Ikhrata gave the maximum legal amount of $850. While such a contribution may not be illegal, it raises significant ethical and political concerns regarding Mr. Ikhrata's role within SANDAG.

There is an evident and pervasive conflict of interest when a nonpartisan officeholder, especially one with the power and influence of Mr. Ikhrata, financially severs himself from even a pretense of nonpartisanship. This is especially problematic given that Mr. Ikhrata contributed to a candidate who is currently running against a member of the SANDAG Board, County Supervisor Kristin Gaspar. The precedent being set by Mr. Ikhrata is dangerous on several levels, and creates a stifling environment where Board members may feel that advocating for their constituents—particularly when that manifests in disagreement with the Executive Director—threatens not just their position on the Board, but their elected office.

Furthermore, concerns with respect to the efficacy of SANDAG are increasingly salient among residents of San Diego County. And while those concerns may or may not be legitimate depending on the perspective of the respondent, these campaign contribution disclosures certainly do not serve to quell the very real apprehension expressed by San Diegans.

Mr. Ikhrata’s position as the Executive Director of SANDAG places him in a different position than most of the Board of Directors. Many of the Board representatives serve in elected office in their respective cities, which creates an asymmetrical standard as far as what constitutes ethical behavior. In other words, SANDAG Board members who are elected and a part of a political party do not have the same expectation of nonpartisanship that Mr. Ikhrata does. Nor does their representation on the Board preclude them from taking ostensibly partisan stances on issues that inevitably affect their constituents.

Mr. Ikhrata does not represent a city or a political party; however he is elected within SANDAG to serve as a nonpartisan executive with various powers and responsibilities that correspond with such a position. This letter is not concerned with the policies forwarded and enacted by Mr. Ikhrata or anyone on the SANDAG Board of Directors. Instead, it seeks to illuminate a very serious ethical violation that threatens the credibility and legitimacy of SANDAG as an institution.

The purpose and functions of SANDAG are far too important to allow for such appalling and unbecoming behavior to go unnoticed. Trust in our local institutions is vital—perhaps now more than ever. The responsibility falls on the rest of SANDAG to ensure that such actions are condemned in the strongest terms and handled accordingly. It is an obligation not just to the rest of the SANDAG Board of Directors, but to the residents of San Diego County whom they represent.

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 Allegations of corruption and self-serving within SANDAG span many years, and internal accountability is long overdue. The determination of what form of retribution should be implemented is up to the SANDAG Board of Directors. Whether that is censure, sanction, resignation, or some other disciplinary method, it is clear that Mr. Ikhrata’s actions warrant consequences of some kind. Failure to address this explicitly unethical behavior may render the Board complicit in the eyes of San Diegans, and such complicity is not good for SANDAG, its members, or those they serve.

The purpose and functions of SANDAG are far too important to allow for such appalling and unbecoming behavior to go unnoticed. Trust in our local institutions is vital—perhaps now more than ever. The responsibility falls on you and the rest of the SANDAG Board of Directors to ensure that such actions are condemned in the strongest terms and handled accordingly. It is an obligation not just to the rest of the Board, but to the residents of San Diego County whom you represent.
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Mary & Don Hale
Dear Board Members,

As you hear this item, please consider the following:

1) The SANDAG Regional Housing Needs Assessment (RHNA) Plan approved in July begins with the sentence "The San Diego region is in the midst of a housing crisis." No one will disagree with this. The RHNA housing allocations are focused in transit based areas that provide the best combination of Housing + Transportation (H+T) affordability. The RTP Vision must support the RHNA housing goals.

2) The RTP Vision draft states: "The Transit Leap will create a complete network of high-speed, high-capacity, and high-frequency transit services that connect major residential areas with employment centers and attractions throughout the San Diego region." We support this vision whole-heartedly with the condition that realizing this vision will require timing deadlines and prioritizing critical areas as the system builds out to best support the RHNA housing goals.

3) The 2015 RTP reported that the region is forecast to fall far short of achieving California's 2050 greenhouse gas targets. The combination of the Transit Leap and meeting the RHNA targets will make a substantial step towards achieving the 2050 climate targets and making up for lost time.

4) Until the transit system is built out, the region needs to forego spending more money on freeway expansion. Money spent on freeway expansion: 1) undermines achieving the housing goals, 2) diverts money from what is needed to build the transit system, and 3) undermines achieving the climate goals.

Please find attached, a simple one-page illustration of the above mentioned items.

Best Regards,

Duncan McFetridge, Cleveland National Forest Foundation, Save Our Forest & Ranchlands
Rick Bates, Cleveland National Forest Foundation
The San Diego region is in the midst of a housing crisis. Housing prices and rents have steadily increased during the last decade, outpacing inflation, putting home ownership out of reach for many residents and affecting the quality of life in the region. High housing costs cause significant challenges for low-income residents, retired residents on a fixed income, and young San Diegans who wish to stay in the region.

City of San Diego has mapped the locations for 175,000 potential infill housing units that could be constructed between now and 2029—mostly along transit corridors.

Meeting the Challenges

- 40% reduction in GHG below 1990 by 2030 (Governor Brown)
- 80% reduction in GHG below 1990 by 2050 (California AB 32)
- 50% transit, walk and bike mode share for commuters within a ¼ mile of a major transit stop in City of San Diego by 2035 (Climate Action Plan, City of San Diego)
- 150% increase in transit mode share (SANDAG’s Urban Area Transit Study)
- Adequately plan to meet the housing needs of everyone in the community (California)

For more information download Cleveland National Forest Foundation’s letter to SANDAG: [link]
SANDAG Chair Vaus and Board Members:

I am submitting these comments on behalf of the Southwest Wetlands Interpretive Association (SWIA) in SUPPORT of the proposals for preparing the 2012 RTP that will be presented to the Board at the August 14, 2020 meeting. Please include them in the official public record for this project.

Based on our years of participating in SANDAG transportation planning efforts and other related regional efforts including the Multiple Species Conservation Program and regional water quality plans, we believe the 2021 Regional Transportation Plan (San Diego Forward) is the most understandable, objective, and pragmatic approach to improve this region's transportation system that SANDAG has produced. Within the 5 Big Moves framework, this new approach utilizes the most relevant and updated transportation data and assessment methods to identify what are the most pressing future transportation problems and opportunities. It acknowledges the need for a regionally integrated infrastructure system that incorporates individual differences among the cities and county residents. It also formally integrates sustainable communities strategies (including efficient and affordable housing) and social equity needs into the proposed system. This allows all of the local jurisdictions to plan for and implement requirements for building more efficiently, and provide for more affordable housing that is directly linked to a variety of transit options.

It is clear that past transportation plans have not produced the kinds of transit access and options that must be part of San Diego's future. While the 5 Big Moves may be viewed by some as "radical" (and therefore unacceptable), the region has no option but to plan and construct a new transportation infrastructure and operating system. The 2021 RTP proposes to use a logical sequence of analytical steps for defining and planning this system, and proposes a realistic path forward that would create a world-class transportation system for ALL. There remains a great amount of work to transform this into a fully functioning and affordable and equitable transportation infrastructure system and we look forward to working with SANDAG to achieve that outcome.

We urge the SANDAG Board to accept and move forward on this essential and pragmatic approach to address San Diego's transportation woes.

Respectfully,

Bill Tippets (SWIA Board Member)
CAUTION: This email originated from outside of SANDAG. Do not click links or open attachments unless you are expecting the content.

Tackling the huge topic of our transportation future would be impossible for me. But as a daily MTS rider with no car --and a former Bay Area and Los Angeles transit rider--- I'd like to share a few observations:

1. In cities like New York, Chicago and the Bay Area, job centers and residential centers developed around the layout of early passenger transit. In Washington DC and Los Angeles, they did not. A big question is whether San Diego's development is still in its "childhood", and we should put major transit where we want development to go, or whether San Diego is "mature" and major transit needs to chase existing population centers. A decision about this topples many other decision dominos.

2. Rapid Ride corridors are far more flexible, and in fact pleasant, than rail lines for many serious users. What's a serious user? Someone who's not just out for a fun ride on the train. For example, the 225 Rapid Ride is much more pleasant than the Blue Line trolley. No kooks with carts of hoarded trash, no drunks stumbling into you. The openness of a rail car generates human behavior problems. Besides, non-rail transit can be added and relocated in a nimble and cost-effective way.

3. You will never know how many potential mass transit riders exist here until you control the trolley stations with fencing and human gatekeepers to restrict the platforms to passengers-only. Women are particularly repelled by the chaos and danger of these stations. This change is long overdue. Literally as I write these words, a mentally ill man wearing a football helmet and a knife with a ten-inch blade has stumbled into the H Street trolley station to dig through the trash. He is now pestering two women who are waiting for their train. This should not be happening, ever.

4. A world that puts people on the moon and explores the surface of Mars can certainly solve the mystery of the clean, safe transit-user bathroom. Using the incredible brain power at SANDAG, plus that of similar agencies worldwide, just figure it out. No more excuses for closing and eliminating restrooms. Even though your 30 year old male engineer who only needs the toilet every four hours says it's OK, believe me, it isn't OK.

-Joan Rincon, National City
Dear SANDAG Board,

My name is Regan Patterson. Thank you for the opportunity to provide comment on the Vision for the 2021 Regional Plan, which will shape our region for decades to come.

Every San Diegan deserves access to high-quality transportation and economic mobility, and today, that does not exist. COVID-19 and the economic crisis have only further revealed the unacceptable inequalities that have plagued our communities for far too long.

I urge SANDAG to adopt a Regional Transportation Plan (RTP) that:

- provides a world-class transit system for all San Diegans
- promotes racial and economic justice
- cleans our air and decreases vehicle miles driven
- reduces greenhouse gas emissions towards a Zero Carbon future
- stops the climate crisis!

Despite the sudden and tragic consequences of the coronavirus crisis, I urge you: move forward with an RTP that reduces emissions and stops climate change. This is your opportunity to finally take bold action to build a greener, healthier, prosperous, and more just future in San Diego. Thank you.

Best,

Regan

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Regan F. Patterson, Ph.D.
E: rpatts90@gmail.com | LinkedIn
CAUTION: This email originated from outside of SANDAG. Do not click links or open attachments unless you are expecting the content.

Good afternoon Board Members, Mayors and staff,

SanDiego350 members support San Diego’s 5 Big Moves! The Regional Transportation Plan is a long term plan. Transit will recover.

FY 2020 BUILD Transportation grants are for planning and capital investments in surface transportation infrastructure and are to be awarded on a competitive basis for projects that will have a significant local or regional impact. BUILD funding can support roads, bridges, transit, rail, ports or intermodal transportation.

Projects for BUILD will be evaluated based on merit criteria that include safety, economic competitiveness, quality of life, environmental sustainability, state of good repair, innovation, and partnership.

**Investment in transit now, will be leveraged to earn money many years into the future!**

**MTS:** We are continuing to advocate for environmental justice and equity in our relationship with MTS. Any future MTS efforts to create a ballot measure will prompt us to make sure that our priorities are taken into consideration.

**SANDAG:** We expect SANDAG to place a measure on the 2022 ballot, and again, we will work to advance the goals of lowering GHG emissions and prioritizing equity in the ballot language.

**Active Transportation:** We want the City to improve its active transportation infrastructure to provide a safer and complete network for pedestrians and cyclists.

**Electrification of Vehicles:** Due to the slow process of changing out gas fueled cars and trucks, this is not the fastest way to reduce GHG emissions, but we encourage consumers to buy electric ASAP.

Electrification does not reduce congestion, but due to the current need for some cars and trucks, if all new vehicles are electric, at least the carbon footprint will be lower.

**Equity:** Disadvantaged communities have suffered for generations from environmental degradation and lack of access to opportunity. These conditions must be addressed in all transportation decisions.

The transition to Zero-Emission Buses (ZEBs) needs to be accelerated. To address Environmental Justice, service routes must prioritize ZEBs for lower-income communities of color.

Youth Opportunity Passes for citizens 24 years and younger are needed for access to schools and jobs.
SANDAG’s next Regional Transportation Plan must address societal inequities. Capital projects in our infrastructure should be prioritized to serve communities that are transit-dependent and whose members are employed as essential workers.

Due to the essential nature of riders and drivers on public transportation, they must have the highest level of protection against the corona virus in order to stay healthy and productive. Recent research in NYC transit proved that there were no clusters of corona virus infection resulting from transit ridership.

Best regards,

Rita Clement
SanDiego350
Phone 619-675-1925
ritalclement@gmail.com
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Despite the sudden and tragic consequences of the coronavirus crisis, I urge you: move forward with an RTP that reduces emissions and stops climate change. This is your opportunity to finally take bold action to build a greener, healthier, prosperous, and more just future in San Diego.

Thank you,

Steve Hansen
4560 Ladera Street
San Diego, CA 92107

Stephen O. Hansen, PCC
Cliffhouse Consulting, Inc.
We do support the Regional Transportation Plan. It is critical that we reduce GHG from transportation.

Specifically, for Fallbrook to benefit from the regional plan we need to better connect to the system.

1. We need the Commuter bus that goes from Temecula to Escondido stop at the Park and Ride on the 1-15 and 76 so Fallbrook commuters can get to Escondido without driving.

2. Shuttle buses on the 76 from the I-15 Park and Ride to the Oceanside Transit Center.

3. Lengthen the 306 bus route from downtown Fallbrook to the I-15 Park and Ride.

These 3 improvements would greatly facilitate the ease of Fallbrook residents, many of whom are elderly and or/low income to travel without cars. Also I wonder if the new OS will be bilingual.

Joy Frew
Fallbrook Climate Action Team
425 830 7569
To whom it may concern,

Recent campaign contributions to the candidate Terra Lawson-Remer, Executive Director of SANDAG, raised questions about the legality of Mr. Ikhrata's contributions. It may not be illegal for Mr. Ikhrata to contribute to a candidate who is also a County Supervisor, but his role within SANDAG raises concerns of a pretense of nonpartisanship, even if he is not directly involved.

Mr. Ikhrata's role within SANDAG, especially with the power and influence he wields, raises concerns of a conflict of interest or even a pretense of nonpartisanship. His contributions to candidates who are also his constituents, such as Neil Kwak and Kristin Gaspar, raises ethical concerns.

Furthermore, his role as President of the Board of Directors threatens to undermine the integrity of SANDAG and its mission. A candidate who serves on the board of directors is expected to represent the public's interest, not their personal political interests.

Additionally, Mr. Ikhrata's influence on the board of directors should not be underestimated. His position on the board is not only powerful but also ethical behavior. In other words, political party do not have the same allowances as corporate or governmental institutions.

Mr. Ikhrata does not represent a nonpartisan board of directors; his contributions to candidates who are also his constituents, such as Neil Kwak and Kristin Gaspar, raises ethical concerns.

The purpose and functions of SANDAG, which includes representing the public's interests, are compromised when personal political interests take precedence. The responsibility of representing the public's interest should not be compromised.

Kathie Parish
Coronado, CA 92118
To whom it may concern,
Recent campaign contribution disclosures from San Diego County Supervisor District 3 candidate Terra Lawson-Remer reveal that San Diego Association of Governments (SANDAG) Executive Director Hasan Ikhrama contributed to the campaign of Ms. Lawson-Remer. Not only did he contribute, Mr. Ikhrama gave the maximum legal amount of $500. While such a contribution may not be illegal, it raises significant ethical and political concerns regarding Mr. Ikhrama's role within SANDAG.

There is an evident and pervasive conflict of interest when a nonpartisan officeholder, especially one with the power and influence of Mr. Ikhrama, financially severs himself from even a pretense of nonpartisanship. This is especially problematic given that Mr. Ikhrama contributed to a candidate who is currently running against a member of the SANDAG Board, County Supervisor Kristin Gaspar. The precedent being set by Mr. Ikhrama is dangerous on several levels, and creates a stifling environment where Board members may feel that advocating for their constituents—particularly when that manifests in disagreement with the Executive Director—threatens not just their position on the Board, but their elected office. Furthermore, concerns with respect to the efficacy of SANDAG are increasingly salient among residents of San Diego County. And while these concerns may or may not be legitimate depending on the perspective of the respondent, these campaign contribution disclosures certainly do not serve to quell the very real apprehension expressed by San Diegans.

Mr. Ikhrama's position as the Executive Director of SANDAG places him in a different position than most of the Board of Directors. Many of the Board representatives serve in elected office in their respective cities, which creates an asymmetrical standard as far as what constitutes ethical behavior. In other words, SANDAG Board members who are elected and a part of a political party do not have the same expectation of nonpartisanship that Mr. Ikhrama does. Nor does their representation on the Board preclude them from taking ostensibly partisan stances on issues that inevitably affect their constituents.

Mr. Ikhrama does not represent a city or a political party, however he is elected within SANDAG to serve as a nonpartisan executive with various powers and responsibilities that correspond with such a position. This letter is not concerned with the policies forwarded and enacted by Mr. Ikhrama or anyone on the SANDAG Board of Directors. Instead, it seeks to illuminate a very serious ethical violation that threatens the credibility and legitimacy of SANDAG as an institution.

The purpose and functions of SANDAG are far too important to allow for such appalling and unbecoming behavior to go unnoticed. Trust in our local institutions is vital—perhaps now more than ever. The responsibility falls on the rest of SANDAG to ensure that such actions are condemned in the strongest terms and handled accordingly. It is an obligation not just to the rest of the SANDAG Board of Directors, but to the residents of San Diego County whom they represent.

Kathie Parish
Coronado, CA
To whom it may concern,

Recent campaign contribution disclosures from San Diego County Supervisor District 2 candidate Terri Lawson-Remer reveal that San Diego Association of Governments (SANDAG) Executive Director Hisan Ikhrata contributed to the campaign of Ms. Lawson-Remer. Not only did he contribute, Mr. Ikhrata gave the maximum legal amount of $350. While such a contribution may not be illegal, it raises significant ethical and political concerns regarding Mr. Ikhrata’s role within SANDAG.

There is an evident and pervasive conflict of interest when a nonpartisan officeholder, especially one with the power and influence of Mr. Ikhrata, financially separates himself from even a pretense of nonpartisanship. This is especially problematic given that Mr. Ikhrata contributed to a candidate who is currently running against a member of the SANDAG Board, County Supervisor Kristin Gaspar. The precedent being set by Mr. Ikhrata is dangerous on several levels, and creates a stifling environment where Board members may feel that advocating for their constituents—particularly when that manifests in disagreement with the Executive Director—threatens not just their position on the Board, but their elected office.

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