STATE OF CALIFORNIA
AIR RESOURCES BOARD

PUBLIC HEARING TO CONSIDER THE ADOPTION OF A PROPOSED REGULATION FOR IN-USE OFF-ROAD DIESEL VEHICLES	))))))	Agenda Item: 07-5-6

SUPPLEMENTAL COMMENTS OF THE ASSOCIATED GENERAL CONTRACTORS OF AMERICA

January 8, 2008

On behalf of—
Associated General Contractors of America

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GLOSSARY

AGC ....Associated General Contractors of America

APA................California Administrative Procedure Act

ARB ....California Air Resources Board

CEQA.............California Environmental Quality Act

CO_2 ....Carbon Dioxide

EIR ....Environmental Impact Report

NAAQS ....National Ambient Air Quality Standard

NO_x................Oxides of Nitrogen

ORD ....In-Use Off-Road Diesel Rule

PM..................Particulate Matter

INTRODUCTION

The Associated General Contractors of America ("AGC") respectfully submits these supplemental comments to the California Air Resources Board ("ARB") on its proposed in-use off-road diesel ("ORD") rule. AGC respectfully submits that the ORD rule would fundamentally change the regulation of construction equipment and, far more importantly, that ARB has adequately analyzed neither the environmental nor the economic consequences of its changes.

AGC previously submitted comments dated May 23, 2007, and July 25, 2007, which AGC incorporates by reference. To summarize its interest in this rulemaking, AGC is the largest and most diverse trade association in the construction industry, with more than 32,000 members and 96 state and local chapters throughout the United States. Among AGC's members are more than 7,000 of the nation's leading general construction contractors and approximately 25,000 specialty contractors and other firms engaged in the construction of highways, bridges, tunnels, airport runways and terminals, buildings, factories, warehouses, shopping centers, and both water and wastewater treatment facilities.

While AGC is a nationwide organization, with a national presence and perspective, AGC developed these comments in close cooperation with its California chapters and members, and with the considerable assistance and support of the California Industry Air Quality Coalition ("CIAQC"). AGC is particularly grateful for the experience and insights that the coalition's superior staff and experts contributed to AGC's analysis of the key issues that the ORD rule raises.

I. ARB INADEQUATELY CONSIDERED ORD RULE'S ENVIRONMENTAL EFFECTS

Under the California Environmental Quality Act ("CEQA"), whether a rule has a significant, non-mitigable and adverse effect on the environment goes to whether the lead agency must prepare an Environmental Impact Report ("EIR"), or may simply make a negative declaration. *See, e.g., Pocket Protectors v. City of Sacramento*, 124 Cal.App.4th 903, 927 (2004). With all due respect, AGC maintains that ARB cannot justify its suggestion that the ORD rule will not have such an effect. In addition, because ARB's Initial and Final Statements of Reason under the California Administrative Procedure Act ("APA") also serve as its environmental documents under CEQA, *see* 14 Cal. Code Regs. §15251(d), the distinction between an EIR and a negative declaration is less relevant here: ARB must still prepare its APA-required documents for its certified regulatory program, whether or not there is a significant, non-mitigable, and adverse effect on the environment. As the following three sections explain, the ORD rule will have a significant and adverse impact on the environment even if, in the aggregate, it also has benefits for certain locations or certain pollutants.[1]

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[1] CEQA categorically exempts actions taken by regulatory agencies pursuant to state law for the maintenance, restoration, enhancement, or protection of the environment. 14 Cal. Code Regs. §15308. ARB's ORD rule does not qualify for that exemption because the exemption does not apply where the regulatory action involves a significant adverse effect on the environment.

A. Indirect Emission Impacts from Construction-Industry Burdens

As explained in prior AGC and other industry comments, the ORD rule will constrict the sizes and thus capabilities of individual California construction companies' fleets. For example, when existing used equipment loses some of its resale value and the ORD rule requires companies to purchase newer equipment, those twin factors will compel many companies to downsize their fleets. Downsized fleets, in turn, either cannot bid on projects or will take longer to complete the same project with less equipment. Individual projects that take longer will thus cause more automobile idling, more congestion, and more related worker trips to the area. Further, shrinking a company's fleet (*e.g.*, going from two scrapers to one scraper) will create discrete project delays, thereby increasing the time to complete essential infrastructure and other important projects (*e.g.*, restoring and repairing highways and bridges to relieve transportation congestion).

A study conducted by the American Highway Users Alliance of the nation's most severely congested highways showed that implementation of modest improvements to traffic flow at the most severe bottlenecks would reduce carbon dioxide emissions by as much as 77% and conserve more than 40 billion gallons of fuel over a 20-year period, as well as reduce traffic fatalities and emissions of criteria pollutants. American Highway Users Alliance, *Unclogging America's Arteries—Effective Relief for Highway Bottlenecks 1999-2004*, at 1, 24, 42, 44-45, 60 (February 2004) (Attach. 1). Similarly, the 2007 Urban Mobility Report conducted by Texas A&M University's Texas Transportation Institute said that Americans spend a total of 4.2 billion hours stuck in traffic and waste 2.9 billion gallons of fuel. David Schrank & Tim Lomax, *The 2007 Urban Mobility Report*, at 1, 8, 11 (Sept. 2007) (Attach. 2).

Based on these recent studies, the nation's road system is not keeping up with growth in system usage and is resulting in an ever-growing congestion problem. In California alone, congestion in urban areas has increased by approximately 30% during the period from 1982 and 2002. *See* Federal Highway Administration, *Transportation and Air Quality: Selected Facts and Figures*, at 8 (updated March 2006) (Attach. 3).

Recognizing that the most significant cause of traffic congestion is roadway bottlenecks, the ORD rule will lead to increased levels of transportation-related pollutants such as oxides of nitrogen ("NOx"), particulate matter ("PM"), and volatile organic compounds because vehicles caught in stop-and-go traffic emit far more of these pollutants than they do operating without frequent braking and acceleration.

What is more, in its Technical Support Document's discussion of traffic impacts that the ORD rule will cause, ARB aggregates the traffic impact statewide, without considering the localized effects that the ORD rule will cause. Specifically, ARB reasons that if the ORD rule's assumed

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See International Longshoremen's & Warehousemen's Union v. Board of Supervisors, 116 Cal. App. 3d 265, 276-77 (1981); *Wildlife Alive v. Chickering*, 18 Cal.3d 190, 206 (1976).

0.3% increase in construction costs would cause 0.3% fewer lane-miles of construction in California and thus 0.3% more idling statewide, then that increase would not offset the ORD rule's emission reductions. Technical Support Document, at 142. ARB's analysis of environmental impacts is inadequate: CEQA does not allow project sponsors to trivialize significant local environmental effects by aggregating them statewide.

The construction industry's economic interest in the ORD rule does not disqualify its raising environmental concerns under CEQA. *Meridian Ocean Systems, Inc. v. California State Lands Comm'n*, 222 Cal.App.3d 153, 170-71 (1990). Indeed, the ORD rule's economic debilitation of the construction industry is precisely what will cause a significant adverse environmental impact: "Where a physical change is caused by economic or social effects of a project, the physical change may be regarded as a significant effect *in the same manner as any other physical change* resulting from the project." 14 Cal. Code Regs. §15064(e) (emphasis added); *Citizens for Sensible Development v. County of Inyo*, 172 Cal.App.3d 151, 170-71 (1985). Under the circumstances, CEQA compels responsible stewardship of both economic and environmental resources.

B. Direct Emission Impacts from Life-Cycle Regulation

In its environmental analysis, ARB assumes that the emissions avoided by the ORD rule's idling restriction will offset the carbon dioxide ("CO2") increase from the ORD rule's fuel penalty. *See* Technical Support Document, at 133, 147, 164-65 & App. I-1 to -2. In its analysis, however, ARB does not consider the life-cycle emissions from the manufacture, delivery, installation, use, and servicing of the controls that the ORD rule will impose. If ARB properly considered the life-cycle emissions, it would find that CO2 emissions increase significantly. *See* Naylor Affidavit, ¶11 (finding increase of 393,430 metric tons per year in 2020) (Attach. 4). For CO2 and global warming, moreover, emissions outside California have precisely the same environmental effect on California as emissions within California. Accordingly, ARB should consider the full life cycle of global-warming emissions that its ORD rule will cause, including not only the operation of ORD-required equipment in California but also the manufacturing, delivery, and service of that equipment.

C. NOx Reductions Inefficient and Even Counter-Productive

Although virtually ignored by ARB, credible data suggest that reducing NOx does not appreciably reduce ambient ozone concentrations and may even increase ambient ozone concentrations. As reported in the August 29, 2007, edition of *Inside EPA,* Dr. Douglas Lawson of the U.S. Department of Energy's National Renewable Energy Laboratory summarized the findings of his recent research as follows:

> I am not opposed to reducing NOx but I am opposed to doing stupid things. We've spent billions to reduce ozone, and it is either not reducing or increasing in many parts of the country….

> Emission control regimes on the books… place more emphasis on NOx cuts than on hydrocarbons and that means ozone may get worse. It has increased in Denver and Dallas and has been flat [in Los Angeles].

According to recent research by Dr. Lawson and earlier research from 2003,[2] lower weekend traffic and congestion make weekend NOx levels lower than weekday NOx levels. Today's weekend levels are comparable to the weekday levels that we will achieve after implementation of currently planned and adopted future NOx controls, such as the ORD rule. Perhaps counter-intuitively, lower weekend NOx levels do not lead to decreased weekend ozone levels, but instead to ozone levels that are actually higher than during the week. *See* Affidavit of Joseph "Jeb" Stuart, ¶¶3-6 (Attach. 5). As Jeb Stuart explains it, "at four air monitoring stations across the [South Coast air] basin in 1999 and 2000 the average hourly ozone level on Saturdays was 28% higher than on midweek days and 50% higher on Sundays even though ozone forming emissions were much lower on weekends than weekdays." *Id.* at ¶5. These and related papers by eminent scholars support the contention that NOx reductions will result in higher ozone levels in California's urban areas. *Id.* at ¶11; *see also id.*, at ¶8 (citing reports), ¶6 (citing ARB website hosting several such reports, http://www.arb.ca.gov/aqd/weekendeffect/weekendeffect.htm). Quite simply, it is counterproductive for ARB to consider this unprecedented rule without certainty that it will benefit air quality in California. Even if the ORD rule does not increase ozone concentrations in California, ARB's environmental documents must consider the weekend-weekday phenomenon's lesser suggestion that NOx controls will not reduce ozone levels as much as predicted in the absence of that phenomenon.

II. ARB FAILED TO COMPLY WITH PROCEDURAL REQUIREMENTS

As a certified regulatory program under CEQA, ARB's rulemaking must meet the procedural requirements of both CEQA and the California Administrative Procedure Act ("APA"). Pub. Resources Code §21080.5; 14 Cal. Code Regs. §15251(d). Moreover, although certified-program status exempts ARB from Chapters 3 and 4 of CEQA and from Public Resources Code §21167, ARB must comply with the non-exempted portions of CEQA, *Sierra Club v. State Bd. of Forestry*, 7 Cal.4th 1215, 1231 (1994), and "must demonstrate strict compliance with its certified regulatory program." *Mountain Lion Foundation v. Fish & Game Comm'n*, 16 Cal.4th 105, 132

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[2] Dr. Lawson also serves on the Colorado Air Quality Control Commission. His paper on the "weekend-weekday" NOx effect is undergoing peer review for publication in the *Journal of the Air & Waste Management Association.* Dr. Lawson also has published a summary of the earlier, related studies on the weekend-weekday effect in California. *See* Douglas R. Lawson, "The Weekend Ozone Effect—The Weekly Ambient Emissions Control Experiment," *Air & Waste Management Association EM Forum*, 17 (July 2003) (Attach. 6).

(1997). As explained in the following four sections, ARB's rulemaking falls short of APA and CEQA requirements.

On page 14 of the Notice of this new comment period, ARB states that "Only comments relating to the modifications to the text of the regulation made available by the notice shall be considered by the Executive Officer." Before addressing the procedural irregularities of ARB's rulemaking, AGC disputes ARB's authority to limit public comment to the modified regulatory text. Although the APA arguably authorizes ARB to limit public comment to the revised regulatory text in a "15-day notice" proceeding such as this, Gov't Code §11346.8(c), CEQA does not. *See* Pub. Resources Code §21092.1 (agency must re-notice EIR when significant new information added to EIR prior to certification); Gov't Code §§11346.5, 11346.8(c) (requiring public notice of proposed regulatory language as part of the "EIR" for ARB's certified regulatory program); *see also Citizens of Goleta Valley v. Board of Supervisors,* 52 Cal.3d 553, 567-68 (1990) (lead agency must consider entire administrative record on environmental effects).[3] Here, ARB's revisions to the regulatory text, as well as its addition to the administrative record, clearly constitute significant new information.

As indicated above, in a "15-day notice" proceeding such as this, the APA appears to authorize (without requiring) ARB to limit public comment to the revised regulatory text. *See* Gov't Code §11346.8(c). Given the interrelationship between the revised regulatory text and ARB's supporting technical and economic analyses, however, most of AGC's comments relate at least indirectly to ARB's revised regulatory text. For example, bifurcating the NOx and PM standards makes it easier and more attractive for other states to opt into their desired portion of the ORD rule (*e.g.,* the NOx requirements for ozone nonattainment areas) under Clean Air Act §209(e)(2)(B). By opting into the ORD rule, other states will increase the number of buyers of later-tier used equipment and decrease the number of sellers of such equipment, thereby driving up the cost of the ORD rule, impairing its feasibility for the California construction industry, and decreasing the ORD rule's cost effectiveness. *See* Technical Support Document, at 177-78; Initial Statement of Reasons, at 52-53 (relying on market in later-tier used equipment to lower the then-joint NOx-PM ORD rule's anticipated cost). Even under the APA, therefore, ARB must accept and respond to comments on issues raised by ARB's initial proposal.

Finally, a representative of ARB's Ombudsman's Office advised a construction-industry coalition member that ARB would accept comments on the entire package:

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[3] Under specified circumstances, CEQA requires various post-EIR documents such as subsequent EIRs, supplemental EIRs, and addenda. *See* Pub. Resources Code §21166; 14 Cal. Code Regs. §15164. Because ARB has not yet certified its EIR-equivalent, however, these CEQA requirements for post-EIR developments do not apply. Instead, for CEQA purposes, the "15-day notice" procedure reopens the comment period on the proposed project.

> There will be a 15 day public comment period for these changes. You may also submit comments for the entire package during this 15 day period.

Affidavit of Lawrence J. Joseph, at ¶3(a) (Attach. 7). Industry has relied on ARB's representation that it would consider comments on the entire rulemaking during the 15-day process, *id.*, and nothing in the APA prevents ARB from honoring it. Indeed, as indicated above, CEQA requires it.

A. Inadequate Notice and Consultation

Public Resources Code §21091(a) requires a minimum of 30 days public notice of a draft EIR and 45 days' notice if the agency submits the draft EIR to the State Clearinghouse within the Office of Planning and Research. *See also* Pub. Resources Code §21091(b) (20 days minimum notice for negative declarations, with 30 days minimum required if submitted to the State Clearinghouse). Moreover, to enable other state agencies to review and comment on proposed projects, Public Resources Code §21082.1(c)(4) requires state agencies like ARB to submit their draft environmental documents to the State Clearinghouse. *See* Pub. Resources Code §21082.1(c)(4)(A)(i). The state-agency review period begins on "the date that the State Clearinghouse distributes the document to state agencies," Pub. Resources Code §21091(c)(2), which has not yet occurred. Joseph Affidavit, at ¶8. Significantly, ARB's shortened notice period has significantly prejudiced AGC's ability to respond to ARB's proposal. *Id.*, at ¶9.

Further, CEQA requires ARB to consult with federal, state, regional, and local public agencies (including transportation planning agencies) before adopting regulations that (a) affect California's transportation infrastructure, (b) regulate offroad equipment leased, owned, or contracted for by California state and local agencies, including trustee agencies, and (c) regulate federally preempted vehicles. *See* 14 Cal. Code Regs. §15086(a)(2)-(3), (5); Pub Resources Code §§21080.3(a); 21080.4, 21092.4(a). Moreover, "informal[] contact" does not constitute "required consultation." Pub Resources Code §21080.3(a). Instead of meeting its required consultation obligations, ARB has created a regulation with unprecedented financial, economic, transportation, and environmental implications in an area (namely, the construction industry) in which ARB staff have little experience.

Under the circumstances, ARB staff certainly would have benefited from consultation. Particularly for the NOx provisions added late in the rule-development cycle, ARB staff acted without significant stakeholder consultation. Although not subject to judicial review, the pre-rulemaking public participation provisions of APA §11346.45 would have improved the quality of the eventual ORD proposal. Gov't Code §11346.45(a), (d). The Board should direct ARB staff to implement the public process envisioned by Section 11346.45(a).

B. Incomplete Administrative Record

The APA requires ARB to maintain (and make public) an administrative record that includes, among other things, "All data and other factual information, technical, theoretical, and empirical studies or reports, if any, on which the agency is relying in the adoption, amendment, or repeal of a regulation, including any cost impact estimates as required by Section 11346.3." Gov't Code §11347.3(b)(7). The APA further requires agencies to designate a representative and designated backup for the public to contact with inquiries about the proposed administrative action. Gov't Code §11346.5(a)(14), (b).

In its economic-impact analysis, ARB staff cites data ostensibly analyzed on February 24, 2007, from two construction-equipment websites (Ritchie Brothers and Machinery Trader). *See* Technical Support Document, at 126-27, 129, 130, 178, 187; Initial Statement of Reasons, at 52-53, 64. The ARB staffperson so designated advised an AGC consultant that ARB does not have any of the specific data from those two sources and instead provided several summary-data spreadsheets and a 440-page series of output from the MachineryTrader.com website from 2006 (i.e., not from February 24, 2007). *See* Joseph Affidavit, ¶¶3(b)-(c). For the reasons discussed in Section III.B.2, *infra,* the ARB data are insufficient to support the ARB staff analysis. In addition, ARB's failure to maintain the data that support its empirical study violates the foregoing requirements regarding the maintenance of an administrative record.

> It is not consonant with the purpose of a rule-making proceeding to promulgate rules… on data that [to a] critical degree, is known only to the agency.

Washington Trollers Ass'n v. Kreps, 645 F.2d 684, 686 (9th Cir. 1981) (*quoting Portland Cement Ass'n v. Ruckelshaus,* 486 F.2d 375, 393 (D.C. Cir. 1973)). Before ARB can rely on its analysis to support a regulation of this magnitude, ARB's data must be publicly available. Gov't Code §11347.3(b)(7); *Building Code Action v. Energy Resources Conservation & Development Commission,* 88 Cal.App.3d 913, 917 (1979). Otherwise, the record will not contain substantial evidence to support ARB's actions. *American Canyon Community United for Responsible Growth v. City of American Canyon,* 145 Cal.App.4th 1062, 1079-81 (2006). ARB cannot support a rulemaking of this (or any) magnitude by "[r]eference to a report of unknown content, which the [agency] refuses to divulge." *EPIC v. Johnson,* 170 Cal.App.3d 604, 628 (1985).

In summary, ARB reached incorrect conclusions (Section III.B.2, *infra*) based on data it cannot provide (this Section). Under the circumstances, ARB should re-assess the market in used equipment, particularly in light of the decision to bifurcate the NOx and PM requirements. As explained in Section III.B.2, *infra*, bifurcation makes it likely that other states will adopt components of the ORD rule, thereby weakening the market in used equipment that ARB incorrectly assessed. Because economic and technical issues are integral to the legal findings that ARB must make, *see, e.g.*, Gov't Code §11346.2(b)(3)(B); Health & Safety Code §43013(a)-(b), ARB must ensure that the public can understand and comment intelligently on whether ARB's proposal adequately considers alternatives and small-business impacts and adequately demonstrates economic and technical feasibility.

C. Irregular Resolution and Improper Delegation

The resolution included with the 15-day mail-out package suggests that the Board approved that resolution at the hearing on July 26, 2007, *see* Resolution 07-19, but that is not the case. As of July 31, 2007, ARB's Legal Division had not finalized resolution. *See* Joseph Affidavit, at ¶3(d). Moreover, up until December 3, 2007, ARB staff had advised CIAQC that ARB would release the current 15-day package with the SOON program included. Therefore, unless the Board approved it after December 3, 2007, Resolution 07-19 appears inaccurate. Nothing in the record suggests that the Board revisited the ORD since the July hearing.

In Resolution 07-19, the Board appears to have delegated the final revisions and Final Statement of Reasons to ARB's Executive Officer, with directions to return to the Board only if circumstances (such as the public comments) appeared "warranted" to the Executive Officer:

> [T]he Board directs the Executive Officer to incorporate into the proposed regulations the modifications approved herein, with such other conforming modifications as may be appropriate, and then to adopt the new regulations, after making the modified regulatory language available for public comment for a period of 15 days, provided that the Executive Officer shall consider such written comments regarding the modifications as may be submitted during this period, shall make further modifications as may be appropriate in light of the comments received, and shall present the regulations to the Board for further consideration if the Executive Officer determines that this is warranted.

Resolution 07-19, at 9. The APA does not provide administrative agencies the authority to delegate statutory approval authority to staff. *See, e.g.*, Gov't Code §11343(f), 11343.5, 11344.2 (APA expressly allows delegation of lesser functions). With exceptions not here relevant, however, ARB's enabling legislation authorizes the Board to "delegate any duty to the executive officer that the state board deems appropriate." Health & Safety Code §39515(a). Nonetheless, as the caveat at the end of the above-quoted Resolution indicates, the Board did not intend the Executive Director and ARB staff to amend the ORD rule wholesale. The Board is the proper decisionmaker for deciding important policy issues.[4]

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[4] Although the Legislature plainly may delegate this function to ARB, and assuming *arguendo* that the Legislature may delegate to ARB the authority to delegate rulemaking authority to the Executive Officer, the Board's delegation to the Executive Officer in this

Under CEQA, by contrast, the lead agency must certify that "[t]he final EIR was presented to the decision-making body of the lead agency, and that the decision-making body reviewed and considered the information contained in the final EIR prior to approving the project." 14 Cal. Code Regs. §15090(a)(2) (emphasis added). Because CEQA requires that the Board act on ARB's EIR-equivalent, the staff-prepared revisions do not meet CEQA's requirements. Significantly, Board approval is not an empty procedural formality. The ARB staff has omitted several key issues from their analysis, which warrant the Board's attention:

- ARB's staff-prepared health analysis relied on an analysis by C. Arden Pope III and colleagues (*see* Technical Support Document, App. C, pp. at 1, 3) without reporting on a critical review of Dr. Pope's analyses published in the *Journal of the Air & Waste Management Association* in October 2006. *Compare id. and* C. Arden Pope III & Douglas W. Dockery, "Health Effects of Fine Particulate Air Pollution: Lines that Connect," *Journal of the Air & Waste Management Ass'n*, 56:709-742 (June 2006) *with* Judith C. Chow, *et al*, "Health Effects of Fine Particulate Air Pollution: Lines that Connect--Critical Review Discussion," *Journal of the Air & Waste Management Ass'n*, 56:1368-1380 (Oct. 2006). Even if ARB lawfully could select from among two expert analyses or find the pair mutually inconclusive, it is arbitrary simply to ignore dissenting expert opinion.

- ARB's staff-prepared health analysis assumes that diesel exhaust has no safe threshold concentration. *See* Technical Support Document, at 199 ("Diesel PM is a carcinogen, and – as such – has no safe threshold below which there is no risk"). As explained in AGC's initial comments, however, the data are inconclusive on that issue, with rat data suggesting a threshold but also suggesting (without establishing) that that data may not bridge to humans. *See* Air Resources Board & Office of Environmental Health Hazard Assessment, "Proposed Identification of Diesel Exhaust as a Toxic Air Contaminant," at ES-27 (Scientific Review Panel Apr. 22, 1998) ("It has been suggested that information based on the rat data suggested the presence of a threshold. However, the same data suggests that the rat data may not be relevant to humans.") (emphasis added). Before ARB directs the public to spend what even ARB acknowledges as billions of dollars, ARB should conduct – or allow industry, other government, or non-governmental organizations the opportunity to conduct – testing to establish whether diesel exhaust indeed has a threshold below which exposure does not cause cancer.

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instance violates the nondelegation doctrine by lacking a *legislative* delegation to a specified agency, *unbound* by an intelligible principle. *Samples v. Brown,* 146 Cal.App.4th 787, 227-29 (2007): "it is 'constitutionally sufficient if [the Legislature] clearly delineates the general policy, the public agency which is to apply it, and the boundaries of this delegated authority." Id. at 229 (*quoting American Power & Light Co. v. Securities & Exchange Comm'n,* 329 U.S. 90, 105 (1946)). Here, the Board (not the Legislature) delegated the power, with no binding principle.

- The SOON program under consideration by ARB staff differs greatly from the SOON program discussed by the Board at the public hearing in July on issues as fundamental as the voluntary versus mandatory nature of the program and its full funding versus partial funding. To ensure that staff implements the Board's vision and to allow the public an opportunity to comment on the SOON program at a public hearing, the Board must put this proposed regulation back on its public-hearing docket. As it now stands in draft form, the SOON program in no way qualifies as so "sufficiently related to the original text that the public was adequately placed on notice that the change could result from the originally proposed regulatory action." *See* Gov't Code §11346.8(c)(2). Without that relationship to ARB's originally proposed ORD rule, the SOON program is ineligible for adoption via the 15-day process envisioned in ARB's notice of this 15-day comment period.

In light of these significant issues, the Board should hold a further public hearing on the ORD rule and then direct the ARB staff to reformulate a proposed rule and any other required studies, based on the Board's independent findings and questions about the ORD rule's economic and technical feasibility, the uncertainty over health effects and environmental effects, and the appropriate range of alternative regulations for consideration.

D. Inadequate Consideration of Alternatives and Impacts

When proceeding under its certified program, ARB must respond in its final statement of reasons ("FSOR") to all significant environmental issues raised by the public. As part of its CEQA compliance, ARB must consider the following:

- Reasonably foreseeable environmental impacts of the project;
- Reasonably foreseeable feasible mitigation measures; and
- Reasonably foreseeable alternatives to the project.

Pub. Resources Code §21159(a); 14 Cal. Code Regs. §§15252, 15187(c). Significantly, under both CEQA and the APA, the procedural requirement to consider alternatives blends into a substantive requirement to avoid or mitigate environmental impacts and to avoid unnecessary or unauthorized economic burdens. Under CEQA, an alternative is "feasible" if it is "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors." *Sierra Club v. County of Napa,* 121 Cal.App.4th 1490, 1507 (2004) (citations omitted).

Ironically, given the significant economic and social dislocations that the ORD rule will cause, ARB should not even have considered the proposed ORD rule as a feasible alternative, much less selected it as the regulation to adopt.

The following three sections discuss varieties of regulatory alternatives that ARB must consider before adopting its final regulation.

1. Regionally Varied and Limited Regulations

As currently drafted, the proposed ORD rule already contemplates geographic variations in its legal requirements. For example, proposed §2449.1(a) and §2449(c)(6) exempt "Captive Attainment Area Fleets" from NOx requirements. To avoid having its regulations lag behind areas' attaining (or falling out of attainment with) applicable ambient air quality standards, ARB should use a performance standard (rather than an enumeration of counties) in its definition of "Captive Attainment Area Fleet." For example, the definition could exempt any county having attained national ambient air quality standard ("NAAQS") for ozone. Given the limited availability of higher-tier new and used vehicles (*see* Section III.B.2, *infra*) and the limited statewide resources for repowering and retrofitting (*see* Section III.A, *infra*), ARB should consider limiting the scope of the ORD rule to those geographic areas that will not attain the NAAQS by the applicable attainment deadline without the emission reductions from the ORD rule (*e.g.,* the South Coast and San Joaquin air basins). Although it has not yet adopted a geographically limited vehicular standard, ARB considered adopting the South Coast Air Quality Management District ("SCAQMD") fleet rules as SCAQMD-specific ARB standards in the aftermath of the Supreme Court's decision in *Engine Mfrs. Ass'n v. SCAQMD*, 541 U.S. 246, 252-55 (2004). As it concluded then, ARB has the authority to adopt geographically limited vehicular standards. *See also* 13 Cal. Code Regs. §2610 (pilot program in South Coast air basin).

As signaled above, geographic limitations would have several advantages over statewide regulations:

- Geographic limitations would target the emission benefits to the areas that most need them to accomplish the limited purpose for which Congress has authorized ARB to act outside of federal preemption (namely, attainment of the NAAQS);

- Moreover, by focusing and directing the limited higher-tier vehicles, retrofit/repower capacity, and public and private financing to those areas, ARB would avoid the massive strain that statewide regulations otherwise would place on the foregoing limited resources. Thus, those resources not only would <u>go where most needed</u>, but also would <u>go there more easily</u> than if those areas faced statewide competition for limited resources.

- Finally, by avoiding the adverse financial, social, and environmental impacts of the ORD rule in areas that do not need the ORD rule to attain the NAAQS (or other applicable threshold(s) that ARB selects), a geographically focused ORD rule would meet ARB's obligation to minimize adverse economic impacts and ensure feasible standards.

Thus, even if ARB was not obligated to consider alternatives that eliminate adverse economic and environmental impacts, ARB nonetheless should consider a geographically limited and focused ORD rule to ensure that the South Coast and San Joaquin air basins attain the NAAQS.

2. NOx-PM Bifurcation

By bifurcating the NOx and PM components of the ORD rule, ARB has facilitated other states' adopting only the component that concerns them (*e.g.*, a federal ozone nonattainment area could adopt only the NOx requirements). Significantly, ARB's decision to facilitate other states' opting into the California standards will negatively affect the ORD rule's costs and thus its cost effectiveness. Specifically, other opt-in states such as New York or Texas will go from suppliers (*i.e.*, sellers) to demanders (*i.e.*, buyers) of higher-tier used equipment and the limited supply of new equipment needed to comply with the ORD rule's fleet-average requirements. Affidavit of Gary E. Rohman, at ¶¶22-23 (Attach. 8). By creating competitors for the purchase of the lower-emitting equipment that the ORD rule requires, ARB will drive up the cost of compliance. For that reason, ARB's adoption of the bifurcated NOx-PM alternative requires that ARB revisit its economic analysis. As explained in Section III.B.2, *infra*, moreover, ARB's existing economic analysis is deeply flawed, which increases the need for ARB to revisit that analysis.

Even within California, the ORD rule already contemplates some pollutant-specific bifurcation in §2449.1(a)'s exempting "Captive Attainment Area Fleets" from NOx requirements. AGC respectfully submits that ARB has the statutory obligation to consider the alternatives of exempting PM attainment areas from the ORD rule's PM component, just as well as exempting ozone attainment areas from the NOx component. Although federal law may allow ARB to adopt statewide standards to meet a geographically limited compelling and extraordinary condition (*e.g.*, the South Coast air basin), state law requires ARB to consider alternatives, which clearly include geographically limited, basin-specific standards. Limiting NOx or PM requirements makes sense where those requirements are not necessary to address NAAQS nonattainment, which is the only legal basis that ARB has to seek a waiver of Clean Air Act §209(e)'s preemption. As indicated in the prior section, any geographic or pollutant-specific limitation on the ORD rule would help focus limited resources such as manufacturing, retrofitting, and repowering capacity and public financing to areas that most need those resources.

3. Treatment of Post-2007 "Flex Engines"

As indicated in the prior section, the NOx-PM bifurcation will increase the geographic scope of the ORD rule through other states' opting into their desired portion (PM or NOx) of the ORD rule. That will exacerbate an already significant inequity in the ORD rule: the treatment of "post-2007 flexibility engines" in fleet averaging. Specifically, under the proposed ORD rule, ARB would average such engines as having the emission levels to which they were certified, as opposed to the tier of emission levels to which they were "flexed." *See* proposed §2449(c)(41).

By assigning them a higher emissions rating than otherwise statutorily required, the ORD rule would make these engines more of a burden on purchasers and thus less marketable and less valuable. The feasibility of the Tier 4 standards relied on the manufacturing flexibility and California-federal uniformity that the proposed ORD rule would undo. Both the ORD rule itself and other states' adoption of it would disrupt an orderly implementation of the Tier 4 nonroad engine standards and create a lack of uniformity between the federal and ARB nonroad engine standards and enforcement programs. As an alternative to the proposed treatment of post-2007 flexibility engines, therefore, ARB should honor its prior commitment and consider such engines at the tier at which they were "flexed."

Alternatively, if ARB is not willing to give owners credit for flex engines, ARB should, at a minimum, allow fleets the option of omitting their flex engine from fleet averaging calculations (*i.e.*, do not include them at the tier of emissions to which they were flexed or at the emission rates to which they were certified). Under this alternative, the ORD rule would take a neutral stance with respect to flexed engines (*i.e.*, they would neither raise nor lower a fleet's average emissions). Absent either of these proposed alternatives, the ORD rule would have a preempted lack of uniformity with federal standards and enforcement.

III. ORD RULE DOES NOT MEET SUBSTANTIVE REQUIREMENTS OF CALIFORNIA LAW

The following four sections summarize additional reasons that the proposed ORD rule exceeds ARB's substantive statutory authority.

A. Technical and Economic Infeasibility within Leadtime

To determine what is technically and economically feasible for the construction industry, ARB first must recognize that construction companies have a significant portion of their total capital tied up in their equipment, which they rely upon both to expand their fleet with new purchases and to perform their work (*e.g.*, using equipment's value to support bonding). *See, e.g.*, Rohman Affidavit, at ¶5; *cf.* "*Sierra Club v. County of Napa*, 121 Cal.App.4th at 1507 (CEQA feasibility means "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors"). Both technologically and economically, the ORD rule is infeasible for California construction companies to implement under the current timelines.

New Tier 4 vehicles will not become available soon enough to help fleets meet the ORD rule's fleet requirements. Current demand exceeds (and future demand will continue to exceed) the limited supply of later-tier vehicles. Rohman Affidavit, at ¶¶22-23. Similarly, in the pre-ORD rule era, when the construction industry repowered a thousand or so vehicles, that effort stretched statewide repowering capacity (*e.g.*, dealerships, consultants, mechanics, and suppliers) to its limits. Rohman Affidavit, at ¶14. That statewide capacity is simply inadequate to address the hundredfold increase in demand from the statewide construction fleet. Rohman Affidavit, at ¶¶8, 14.

Significantly, these upgrades to existing equipment are complicated processes that require third-parties such as dealers (*i.e.*, fleet owners cannot implement themselves). Instead, every step from availability of the hardware, to assessing compatibility, to installing the retrofit or repowering the engine, to supporting the product, can involve significant delay and equipment downtime. Rohman Affidavit, at ¶¶8, 10. The year or more of equipment downtime required for repowers is debilitating for the construction industry, which must have its fleets in the field to remain profitable. Rohman Affidavit, at ¶¶5, 11-12.

Further, feasibility necessarily includes the cumulative effect of other efforts that the regulated entity has taken or must take. For example, ARB must consider the cumulative impact of the regulatory costs imposed by ARB's portable-equipment and on-road diesel efforts. Significantly, ARB also should consider the financial outlays by California companies made in good-faith reliance on the then-applicable regulations, and particularly on their pre-ORD rule efforts at environmental stewardship. For example, one company spent more than $62 millions to upgrade vehicles from Tier 0 to Tier 1. Rohman Affidavit, at ¶¶7, 26. Because the ORD rule as currently drafted would render those good-faith and responsible efforts virtually worthless, ARB cannot expect companies in similar positions to spend (or to have) a similar amount of capital to devote under the ORD rule.

B. Cost Effectiveness

As indicated above under the consideration of alternatives (Section II.D.1, *supra*), having accepted regulatory differences between air districts based on attainment status, ARB must consider more cost-effective approaches to regulation by targeting the newer, cleaner equipment and funding to air districts that actually need the reductions to attain air quality standards.

1. <u>Inadequate Cost-Effectiveness Modeling</u>

ARB based its cost estimates on the Statewide Off-road Regulatory Cost/Benefit Model ("ORM") prepared by its staff. More than a month after proposing the ORD rule, ARB added its ORM to the administrative record. Based on its further review of the ORM, M.Cubed prepared a technical supplement to its previously filed report entitled *Estimating the Construction Industry Compliance Costs for CARB's Off-Road Diesel Vehicle Rule* ("M.Cubed Supplement") (Attach. 9).

If they meet threshold criteria for reliability, models have a place in the rulemaking process. *See, e.g.*, *Coalition for Reasonable Regulation of Naturally Occurring Substances v. California Air Resources Board*, 122 Cal.App.4th 1249, 1257-58, 1263 (2004) (deferring to unchallenged data from publicly available EPA and ARB models); *Sherwin-Williams Co. v. SCAQMD*, 86 Cal.App.4th 1258, 1273 (Massachusetts Institute of Technology independently assessed and validated the agency's methodology in assessing the socioeconomic impacts of the amendments). By contrast, although ARB belatedly made its ORM model publicly available, ARB has not had that model independently assessed. Indeed, the ORM is not really a model, but simply a Visual Basic module that runs within Microsoft Access (*i.e.*, a glorified spreadsheet).

More significantly, ARB's ORM model differs from ARB's OFFROAD2007 model in several key assumptions. *See* M.Cubed Supplement, at 2-3. For example, the ORM's sample fleets included 49% Tier 0 equipment, whereas the OFFROAD2007 emission inventory model shows 39% Tier 0 vehicles in the vehicle population for 2008. M.Cubed Supplement, at 2. By assuming a higher number of Tier 0 vehicles in its ORM cost model, ARB estimated lower regulatory costs because a larger number of older vehicles lowers the apparent costs of replacement. *Id.* Similarly, M.Cubed's analysis of the OFFROAD2007 emission inventory model demonstrated an underlying (or natural) vehicle retirement rate of 6.2%, in the absence of the proposed regulation, but ARB assumed a natural retirement rate of 5.0%. *See id.* (*citing* Technical Support Document, at 177). Using a lower natural retirement rate overemphasizes the emission reductions from the proposed regulation, which artificially increases the proposal's cost effectiveness. In addition, ARB must specify whether its 7.0% discount rate is nominal or real (*i.e.*, including or excluding inflation) and, if real, what rate of inflation ARB assumes. If it used a nominal discount rate, ARB must correct for inflation (M.Cubed recommends the 2.5% rate based on the embedded forecast in 20-year U.S. Treasury bond yield rates), which would increase projected costs (and decrease cost effective) commensurately. *Id.* at 4 & n.4. As it stands, the discussion of discounting in ARB's modeling and reports is insufficient.

ARB cannot have it both ways, accepting the OFFROAD2007 model for some purposes and the ORM's conflicting data for other purposes. In any event, because ARB has not released its input into the ORM or the full output from it, the public has no basis on which to comment on the summary data that ARB staff report in ORM rule's supporting documents. ARB must make its full supporting economic and cost-effectiveness data available for public comment.

2. <u>Overstated Used-Equipment Market</u>

Industry and ARB widely differ – approximately $12 billion to $3 billion – on the ORD rule's cost of implementation. As explained in the M.Cubed economic analysis, those differences derive from divergent assumptions on relatively few parameters, including the extent to which California industry will find an adequate market in higher-tier used equipment. ARB bases its analysis on the assumption that the market in used "Tier 2 or better" equipment will grow with time, making it "likely that there will be a sufficient number of used vehicles available to meet the increased demand due to the regulation" and its analysis of two websites: Ritchie Brothers (rbauction.com) and Machinery Traders (machinerytrader.com). *See* Initial Statement of Reasons, at 52-53.

Specifically, in 2006, ARB collected a 440-page series of Machinery Trader output for approximately 3,000 vehicles in fifteen equipment categories (of approximately 50 discrete categories) and, in 2007, ARB prepared a spreadsheet that purports to represent the total numbers of equipment on the two websites on a single day (February 24, 2007). Other than the spreadsheets, ARB has no supporting data for its 2007 claims. Joseph Affidavit, ¶3(b)-(c). Further, and with no supporting data, ARB claims that 30,000 of the 80,000 vehicles (*i.e.*, approximately 37.5%) for sale on February 24, 2007, were model year 2003 or newer. From these data, ARB claims that a developed market already exists in post-2002 vehicles, which ARB deems "likely Tier 2 or better."

In attempting to analyze these data, AGC first ran up against the problem that (without any supporting data) the spreadsheets do not support ARB's claims about February 24, 2007. In their only reference to model year (as opposed to aggregate totals that do not break down by model year), the spreadsheets provide model-year breakdowns for total Dozers, total Excavators, and for Caterpillar D7, D8, D9, and D10 from an unspecified source. *See* Joseph Affidavit, Ex. 1. While the total dozer-excavator categories aggregate to 36.7% post-2002, the larger Caterpillar units aggregate to 16.9% post-2002.

Because AGC and its construction-industry members found ARB's methodology and results extremely suspect, AGC attempted to obtain historical data from Machinery Traders and Ritchie Brothers and analyzed the data currently available online from those two websites. In summary, AGC found the following:

- ARB's 80,000-vehicle figure appears to represent ARB's Machinery Trader's worldwide total (71,932) plus ARB's Ritchie Brothers' total (10,564), although ARB's Machinery Trader's U.S.-based vehicle total (55,370) likely would be more realistic. *See* Joseph Affidavit, Ex. 1. At the time, however, the Machinery Trader website included all Ritchie Brothers equipment, Joseph Affidavit, at ¶4, meaning that ARB double-counted the Ritchie Brothers units.

- Although it denominated its Machinery Trader spreadsheet in manufacturers, ARB denominated its Ritchie Brothers spreadsheet in equipment type. From an analysis of the Ritchie Brothers data, ARB's survey breaks down as follows: 54.1% equipment subject to the ORD rule; 27.8% equipment <u>not</u> subject to the ORD rule; and 18.1% that may or may not be subject to the ORD rule. *See* Joseph Affidavit, at ¶6 & Ex. 4. The Machinery Traders data certainly include equipment <u>not</u> subject to the ORD rule, but they are impossible to quantify. Joseph Affidavit, at ¶7.

- Working through industry contacts who are customers of Machinery Traders and Ritchie Brothers, AGC asked both companies to provide their data as it existed on February 24, 2007, to enable our confirming and elaborating on ARB's analysis of the used-equipment market. Machinery Trader declined to provide any data, and Ritchie Brothers indicated that it was impossible for their database to report the items available for sale on a specific date in the past. Joseph Affidavit, at ¶4.

- We did obtain data from Ritchie Brothers that enabled us to compare sales between two period (February 1-March 15, 2007 and November 1-December 15, 2007), broken down by exemplars of large-equipment and small-equipment categories. Based on our analysis of that data, the February snapshot showed 23.20% post-2002 for the small equipment and 9.38% post-2002 for the large equipment. By contrast, the current snapshot showed 28.94% post-2002 for the small equipment and 5.39% post-2002 for the large equipment. *See* Joseph Affidavit, at ¶5 & Ex. 2.

- We further obtained from Ritchie Brothers nationwide and California calendar 2007 sales figures for specific examples of large equipment (Caterpillar D8 and D9 dozers, 637 and 657 Scrapers, 988 Wheel Loaders, 140 Graders, and 773 Rock Trucks), which demonstrate that 6.58% of nationwide sales in post-2002 model years. *See* Joseph Affidavit, Ex. 3. Significantly, 191 of such pre-2003 vehicles sold in California, while only 64 such post-2002 vehicles sold nationwide. *Id.* Assuming that California sales represent decreased capacity (and thus demand for new capacity) in the California construction industry, the nationwide market in post-2002 equipment is insufficient to cover California demand.

In summary, disregarding the double-counted equipment (10,564) and looking only at regulated equipment (54.1%) reduces ARB's 80,000-vehicle market to approximately 30,000 relevant vehicles (29,955), and even less if one uses U.S.-based sales. Moreover, ARB should disregard the higher-tier availability ratio (36.7% post-2002) for small-scale equipment that industry would replace regularly without an ORD rule. Because industry would replace them in the absence of a regulation, these small equipment categories are irrelevant to the cost analysis and certainly irrelevant to the availability of the higher-horsepower, workhorse equipment that the California construction industry needs to perform its vital infrastructure work. Using the calendar 2007 higher-tier availability ratio for larger equipment (6.58% post-2002) reduces the implicit rate of higher-tier equipment from more than fivefold, from 37.5% (30,000/80,000) to 6.58%.[5]

As signaled by note 5, AGC is concerned that the ARB not only overstated the market in relevant, later-tier equipment in its economic analysis but also misconstrued the trend over time. Specifically, rather than seeing an increased market in relevant, later-tier used equipment, the market appears to be contracting, as companies both in California and nationwide hoard their later-tier used equipment to ensure compliance with the ORD rule in California and in states likely to opt into the ORD rule. *See, e.g.*, Rohman Affidavit, at ¶16 (fleet retains later-tier

[5] The Ritchie Brothers annual ratio of post-2002 vehicles (6.58%) is between the February figure (9.38%) and the current figure (5.39%).

equipment it might have sold in absence of ORD rule). Because ARB bifurcated the NOx component from the PM component, moreover, other states are more likely to opt into at least a component of the ORD rule. State opt-ins will contract the market in later-tier used equipment by converting erstwhile sellers of such equipment into competing buyers for such equipment, thereby both increasing price and decreasing supply.

In short, the later-tier market in relevant used equipment appears to be weakening, not strengthening. ARB must revise its cost and feasibility analysis accordingly, particularly given its bifurcation of the NOx and PM components to facilitate other states' opting into the ORD rule.

IV. ARB'S RULE DOES NOT MEET CRITERIA FOR WAIVER OF PREEMPTION

Consistent with EPA regulations and a decision of the U.S. Court of Appeals for the District of Columbia Circuit, ARB must seek and obtain a waiver of federal preemption before ARB can enforce an off-road engine emission standard. *Engine Mfrs. Ass'n. v. EPA*, 88 F.3d 1075, 1094-95 (D.C. Cir. 1996). In the *Pacific Merchant Shipping Association* litigation now in the U.S. Court of Appeals for the Ninth Circuit, ARB apparently argues that Clean Air Act §209(e)(2)(A) allows state and local standards for in-use nonroad equipment, without a waiver of preemption.

Even if ARB's position holds sway in the Ninth Circuit for vehicles covered by §209(e)(2), it would not resolve federal preemption for the locomotives, farm equipment, and construction equipment covered in §209(e)(1). Accordingly, ARB will need a waiver of preemption for the ORD rule even if ARB prevails in the *Pacific Merchant Shipping Association* litigation. If the Ninth Circuit holds that – contrary to EPA regulations – state and local governments remain free to regulate non-new §209(e)(1) vehicles, then EPA's regulatory definition of new as "showroom new" (*i.e.*, new until removed from the showroom floor) also must fall. Instead, at a minimum, §209(e)(1) would preempt all state and local regulation of qualifying locomotives, farm equipment, and construction equipment during their useful lives. Otherwise, that interpretation would rob §209(e)(1) of all meaning.

Even if ARB prevails in the *Pacific Merchant Shipping Association* litigation, the federal Clean Air Act will preempt the ORD rule to the extent that it applies to §209(e)(1) vehicles during their useful life. In addition to that protection of equipment less than 175 horsepower, §209(e)(2)(A)(i) requires that California regulation of equipment over that threshold be consistent with Clean Air Act §202(a), *see* 59 Fed. Reg. 36,969, 36,982-83 (July 20, 1994), which includes not only lead-time requirements but also stability in the standards applicable to heavy-duty engines. 42 U.S.C. §7521(a)(2), (3)(c). Specifically, §202(a)(3)(C) requires that a standard applicable to a heavy-duty vehicle must apply for a minimum of three model years, to begin no less than four model years after its promulgation. The ORD does not meet that requirement.

As a practical matter of timing, the ORD rule appears likely to take effect prior to the date by which ARB legitimately can expect to receive a waiver of federal preemption. To avoid burdening California industry with requirements that may never become enforceable, ARB should set the ORD rule's effective date to begin a reasonable time after the federal Environmental Protection Agency grants ARB a waiver of federal preemption for the ORD rule. If ARB does not make its ORD rule prospective from a reasonable time after the granting of a federal waiver, ARB risks adopting a rule for which EPA cannot grant a waiver. *See Georgetown University Hospital v. Bowen,* 821 F.2d 750, 758-60, (D.C. Cir. 1987), aff'd, 488 U.S. 204, 215-16 (1988) (federal agencies cannot adopt retroactive regulation); 42 U.SC. §§7521(a)(2), 7543(e)(2)(A)(iii) (to receive a waiver of preemption, standards must provide adequate leadtime). Even if it did not jeopardize ARB's legal ability to obtain an eventual waiver, ARB should not impose or threaten a novel, retroactive, and extremely burdensome requirement that may never take effect.

CONCLUSION

For all the foregoing reasons, the Board should revisit its current regulatory proposal, starting with consultation with affected public agencies and stakeholders and opening its consideration of alternatives to include region-specific regulation tied to federal nonattainment status and funding targeted to the federal nonattainment areas.

Respectfully submitted,
On behalf of—
Associated General Contractors of America

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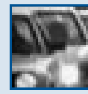
Attachment 1

Unclogging America's Arteries

Effective Relief for Highway Bottlenecks



1999 - 2004

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UNCLOGGING AMERICA'S ARTERIES

Effective Relief for Highway Bottlenecks

1999-2004

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About the American Highway Users Alliance

The American Highway Users Alliance is a nonprofit advocacy organization serving as the united voice of the transportation community promoting safe, congestion-free highways and enhanced freedom of mobility. Known as the Highway Users, the group has worked for sound transportation policy in the United States since 1932.

The Highway Users represents motorists, truckers, bus companies and a broad cross-section of businesses that depend on safe and efficient highways to transport their families, customers, employees and products. Our members pay the taxes that finance the federal highway program and advocate public policies that dedicate those taxes to improved highway safety and mobility.

The Highway Users regularly publishes studies on transportation trends and developments, as well as reports on other pertinent issues that affect highway safety and mobility. For more information, visit our web site at www.highways.org.

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Prepared for the American Highway Users Alliance
by Cambridge Systematics, Inc.

Member Price: $25
Nonmember Price: $75

EXECUTIVE SUMMARY

The American Highway Users Alliance in 1999 released a first-of-its-kind study examining a significant cause of traffic congestion – the country's worst highway bottlenecks. In the five years that have passed, two trends have become unmistakably clear.

Congestion Has Grown Across the U.S. . . .

In 1999, we identified 167 major highway bottlenecks located in 30 states plus the District of Columbia. Using the same methodology and delay criteria, the number of severe traffic chokepoints in the U.S. where drivers experience at least 700,000 hours of delay annually has now increased to a total of 233 bottlenecks in 33 states plus the District, a 40 percent increase.

. . . . But Improvements Are Possible

Seven of the top 18 bottlenecks we identified five years ago – including hot spots in Houston, Albuquerque, Denver, Boston, Chicago, Los Angeles and Washington, DC – no longer appear on our ranking of the country's worst chokepoints because major reconstruction projects are either completed or underway to improve traffic flow at these sites. In Albuquerque alone, motorists have regained more than 15 million hours each year that would have otherwise been wasted sitting in traffic at the I-40/I-25 interchange, also know at the "Big I."

Similar improvements are possible nationwide. Over the 20-year life of the projects, modest improvements to improve traffic flow at the 233 severe bottlenecks we identify in this report would prevent more than 449,500 crashes (including some 1,750 fatalities and 220,500 injuries). Carbon dioxide emissions would drop by an impressive 77 percent at these bottlenecks and more than 40 billion gallons of fuel would be conserved. Emissions of smog-causing volatile organic compounds would drop by nearly 50 percent, while carbon monoxide would be reduced by 54 percent at those sites. Rush hour delays would decline by 74 percent, saving commuters who must negotiate these bottlenecks an average of more than 30 minutes each day.

The Benefits of Unclogging America's Arteries

This updated study attempts to quantify the benefits Americans can realize if major bottlenecks are eliminated, and conversely, the price to be paid if congestion is allowed to increase. The benefits of congestion relief include:

- ***Saving Lives.*** Traffic congestion causes highway crashes that can kill drivers, their passengers and others. As highway crowding increases and motorists jockey for position at exits and entryways, the potential for crashes increases. Improving bottlenecks saves lives and averts injuries.
- ***Improving the Environment.*** Bottlenecks retard the nation's otherwise impressive progress in improving air quality. Vehicles caught in stop-and-go traffic emit far more pollutants – particularly carbon monoxide and volatile organic compounds – than they do when operating without frequent braking and acceleration. Improving bottlenecks reduces tailpipe pollutants.
- ***Reducing Greenhouse Gas Emissions.*** Vehicles emit carbon dioxide, a greenhouse gas, as fuel is consumed. Because congestion relief has a direct effect on fuel consumption, improvement projects will significantly reduce greenhouse gas emissions.
- ***Conserving Fuel.*** The longer vehicles are delayed in traffic, the more fuel they consume. Nationwide, 5.7 billion gallons of fuel are wasted annually because of congestion.
- ***Saving Time.*** Traffic congestion is a major source of frustration for American motorists, adding stress to our already busy lives. Reducing road delays eases that frustration and means more time for families, errands, work and play.

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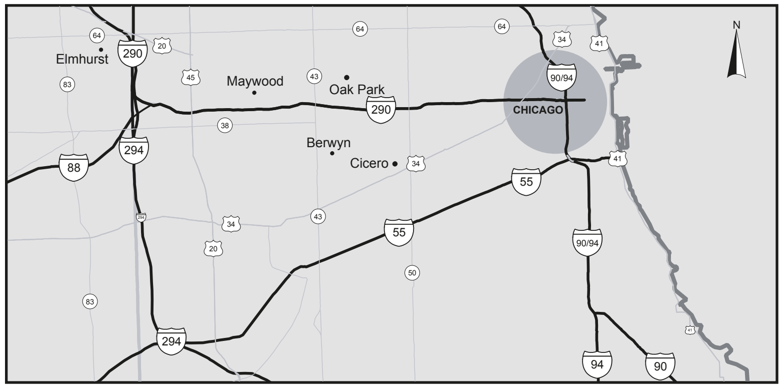
Chicago, Illinois

I-90/94 at the I-290 Interchange (the "Circle Interchange")

Summary

If needed improvements to the "Circle Interchange" were implemented, Chicago residents would realize significant gains in safety, air quality and overall quality of life. However, because no specific improvements to the interchange have been designed at this time, we analyzed the benefits to be gained if improvements were made to bring the interchange up to a minimum acceptable level of traffic flow (technically dubbed "level of service D" by traffic engineers) in the year 2007.



VITAL STATISTICS

I-90/94 at the I-290 Interchange

Annual Delay: 25,068,000 hours

	2002	2025 (estimated)
Vehicles Per Day	293,671	329,367
Peak Period Delay (minutes per vehicle per trip)	17.5	24.1 (without improvements)
Annual Traffic Growth	0.50%	

Level of service is a concept that traffic engineers have devised to describe how well highway facilities operate. Six levels of service categories are used: A, B, C, D, E and F. In layman's terms, they roughly correspond to the letter grades used in education. On freeways, level of service A is characterized by free-flow conditions with high vehicle speeds and wide spaces between vehicles. As level of service goes from B to D, speeds stay high, but vehicle spacing decreases. The physical capacity of the roadway is reached at level of service E; at this level the highest traffic flows are observed and speeds start to fall off sharply. Level of service F is stop-and-go traffic. Highway designers typically set a goal of level of service C or D for traffic in future years.

For the purposes of this analysis, we have not attempted to identify a specific combination of improvements that would ease congestion at the interchange. Such decisions are properly made at the state and local level, reflecting the wishes and concerns of the general public, budgetary priorities, and applicable legal and regulatory requirements. We have assumed that a combination of improvements could achieve level of service D operations, and we have analyzed the benefits to be gained from such improvements.

Over the 20-year life of the improvements, there would be 4,869 fewer crashes (including 19 fewer fatalities and 2,391 fewer injuries), a 51 percent decrease in smog-causing volatile organic compounds, and a 77 percent decrease in CO_2 emissions. In addition, motorists and truckers traveling through the interchange during morning or evening rush hours would

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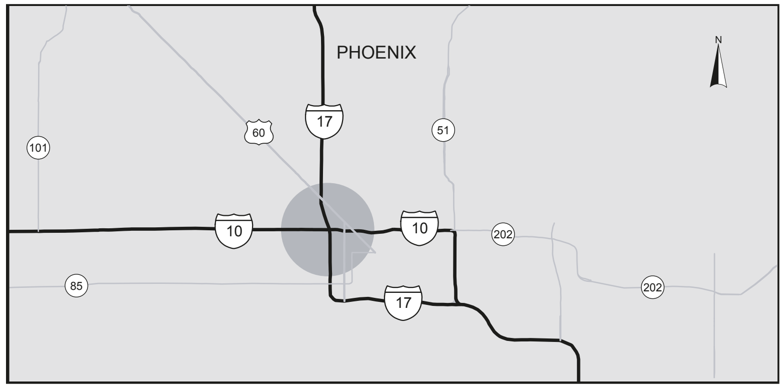
Phoenix, Arizona

I-17 (Black Canyon Fwy) from I-10 Interchange ("the Stack") to Cactus Rd.

Summary

If needed improvements to the Black Canyon Freeway (including the I-10) interchange ("the Stack") were implemented, Phoenix residents would realize significant gains in safety, air quality and overall quality of life. I-17 north of "the Stack" recently underwent a widening construction project (additional lanes were added.) There are also plans to add a viaduct along I-17, about 6 miles long north of the I-10 southern terminus, which will be decided by the Maricopa County voters in May 2004.



VITAL STATISTICS		
I-17 From I-10 to Cactus Road		
Annual Delay: 16,310,000 hours		
	2002	**2025** (estimated)
Vehicles Per Day	208,000	233,283
Peak Period Delay (minutes per vehicle per trip)	16.1	21.5 (without improvements)
Annual Traffic Growth	0.50%	

Because no specific improvements to the interchange have been designed at this time, however, we analyzed the benefits to be gained if improvements were made to bring the interchange up to a minimum acceptable level of traffic flow (technically dubbed "level of service D" by traffic engineers) in the year 2007.

Level of service is a concept that traffic engineers have devised to describe how well highway facilities operate. Six levels of service categories are used: A, B, C, D, E and F. In layman's terms, they roughly correspond to the letter grades used in education. On freeways, level of service A is characterized by free-flow conditions with high vehicle speeds and wide spaces between vehicles. As level of service goes from B to D, speeds stay high, but vehicle spacing decreases. The physical capacity of the roadway is reached at level of service E; at this level the highest traffic flows are observed and speeds start to fall off sharply. Level of service F is stop-and-go traffic. Highway designers typically set a goal of level of service C or D for traffic in future years.

For the purposes of this analysis, we have not attempted to identify a specific combination of improvements that would ease congestion at the interchange. Such decisions are properly made at the state and local level, reflecting the wishes and concerns of the general public, budgetary priorities, and applicable legal and regulatory requirements. We have assumed that a combination of improvements could achieve level of service D operations, and we have analyzed the benefits to be gained from such improvements.

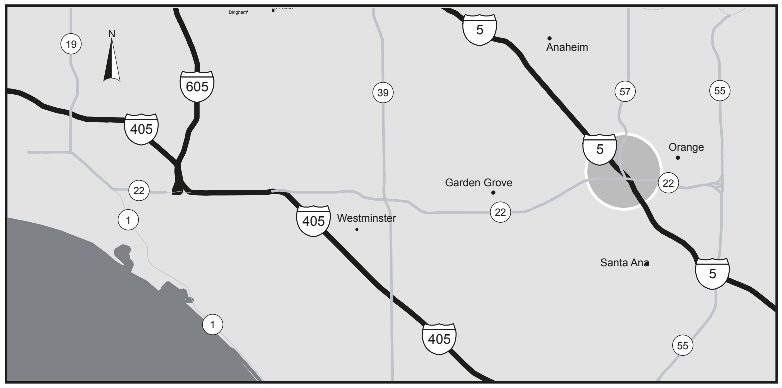
Over the 20-year life of the improvements, there would be 2,989 fewer crashes (including 12 fewer fatalities and 1,468 fewer injuries), a 49 percent decrease in smog-causing volatile organic compounds, and a 77 percent decrease in CO_2 emissions. In addition, motorists and truckers traveling through the interchange during morning or evening rush hours would shave 15 minutes off their driving time each trip. For commuters, who typically negotiate the interchange twice each day, nearly 30 minutes of commuting time would be saved daily. In addition, 63.8 gallons of fuel per commuter would be saved over the life of the project.

13 Los Angeles, California

I-5 (Santa Ana Fwy) at the SR-22/SR-57 Interchange ("Orange Crush")

Summary

If improvements to the "Orange Crush" interchange were completed, the people of Los Angeles would realize gains in safety, air quality and overall quality of life. The most recent federal Transportation Improvement Program in Southern California recognizes this interchange as a congestion area, but it does not identify specific improvements.



As with many freeways in Los Angeles, it is difficult to distinguish a dominating physical bottleneck. Long stretches of highway operate at similar levels of service (usually poor) during peak periods. For that reason, corridor- or area-wide strategies, including the addition of High Occupancy Vehicle (HOV) lanes, transit improvements, traffic lights on freeway entrance ramps, and real-time traveler information systems are employed to address congestion. Such strategies, combined with the reconfiguration of the "Orange Crush" interchange, may work to improve traffic flow at this site.

However, for this report, no specific improvements to the interchange are assumed. Instead we analyzed the benefits to be gained if improvements were made to bring the interchange up to a minimum acceptable level of traffic flow (technically dubbed "level of service D" by traffic engineers) in the year 2007.

Level of service is a concept that traffic engineers have devised to describe how well highway facilities operate. Six levels of service categories are used: A, B, C, D, E and F. In layman's terms, they roughly correspond to the letter grades used in education. On freeways, level of service A is characterized by free-flow conditions with high vehicle speeds and wide spaces between vehicles. As level of service goes from B to D, speeds stay high, but vehicle spacing decreases. The physical capacity of the roadway is reached at level of service E; at this level the highest traffic flows are observed and speeds start to fall off sharply. Level of service F is stop-and-go traffic. Highway designers typically set a goal of level of service C or D for traffic in future years.

For the purposes of this analysis, we have not attempted to identify a specific combination of improvements that would ease congestion at the interchange. Those decisions are properly made at the state and local level, reflecting the wishes and concerns of the general public, budgetary priorities, and applicable legal and regulatory requirements. We have assumed that a combination of improvements could achieve level of service D operations, and we have analyzed the benefits to be gained from such improvements.

VITAL STATISTICS

US-101 (Ventura Fwy) at I-405 Interchange

Annual Delay: 16,304,000 hours

	2002	2025 (estimated)
Vehicles Per Day	308,000	443,201
Peak Period Delay (minutes per vehicle per trip)	10.9	28.1 (without improvements)
Annual Traffic Growth	1.59%	

Over the 20-year life of the improvements, there would be 5,244 fewer crashes (including 21 fewer fatalities and 2,575 fewer injuries), a 49 percent decrease in smog-causing volatile organic compounds, and a 77 percent reduction in CO_2 emissions. In addition, motorists and truckers traveling through the interchange during morning or evening rush hours would shave 15 minutes off their driving time each trip. For commuters, who typically negotiate the interchange twice a day, 30 minutes of commuting time would be saved each day. In addition, 68.5 gallons of fuel will be saved per commuter of the life of the project.

These delay numbers include the effect of a three-year reconstruction phase during which it is assumed that available highway capacity is reduced by 20 percent every day. In reality, state transportation departments endeavor to keep all lanes open through reconstruction zones as much as possible.

Bottleneck Description

The "Orange Crush" is probably the most complex interchange in the U.S. It spans two cities (Orange and Santa Ana) and is 18 lanes at its peak. Despite its advanced design, the California Department of Transportation (Caltrans) estimates that congestion occurs for five continuous hours every weekday afternoon.

Benefits of Improvements

2004-2026

Allowing for a three-year construction period and a 20-year project life, bringing the I-5 (Santa Ana Fwy) at the SR-22/ SR-57 interchange ("Orange Crush") up to level of service D would significantly reduce congestion, thereby smoothing the flow of traffic and:

SAVING THE ENVIRONMENT

emissions (in tons)

	No Improvements	With Improvements	Percentage Change
Carbon Monoxide	546,767	254,957	-53.4
Volatile Organic Compounds	60,422	30,839	-49.0
Nitrogen Oxides	26,490	28,953	9.3*
Carbon Dioxide	5,329,633	1,226,496	-77.0

SAVING TIME

minutes per vehicle per trip (averaged over construction period and project life)

	No Improvements	With Improvements	Percentage Change
Peak Period Delay	20.2	5.1	-74.8

SAVING FUEL

Total Fuel Savings (gallons)	420,834,524
Percentage Reduction	77.0%
Savings Per Commuter (gallons over the life of the project)	68.5

SAVING LIVES

Fewer Total Crashes	5,244
Fewer Fatalities	21
Injury Reduction	2,575

* Emissions of carbon monoxide and volatile organic compounds decrease as speed increases up to 55 mph, and increase very slightly between 55 and 65 mph. Emissions of nitrogen oxides, however, decrease as speed increases up to approximately 20 mph, hold steady between 30 and 45 mph, and then increase sharply above 45 mph. Therefore, when a transportation improvement leads to increases in vehicle speeds, it is possible to decrease levels of carbon monoxide and volatile organic compounds while increasing emissions of nitrogen oxides. Transportation analysts have dubbed this phenomenon "The NOX Dilemma," and it is evident in the improvements studied in this report. The relationship between levels of nitrogen oxides and volatile organic compounds in the formation of ground-level ozone (also known as "smog") is complex. However, because the improvements studied also show dramatic decreases in volatile organic compounds, overall smog levels are expected to improve.

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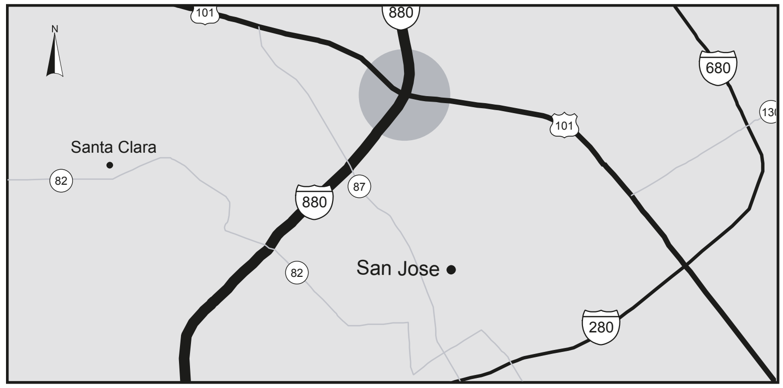
San Jose, California

US-101 at the I-880 Interchange

Summary

If needed improvements to the US-101/I-880 interchange were implemented, San Jose residents would realize significant gains in safety, air quality, and overall quality of life. No specific improvement has been identified for this interchange. However, corridor- or area-wide strategies, including the addition of High Occupancy Vehicle (HOV) lanes, transit improvements, traffic lights on freeway entrance ramps, and real-time traveler information systems could be employed to address congestion. Such strategies, combined with the reconfiguration of the US-101/I-880 interchange, may improve traffic flow at this site.



Because no specific improvements to the interchange have been designed at this time, however, we analyzed the benefits to be gained if improvements were made to bring the interchange up to a minimum acceptable level of traffic flow (technically dubbed "level of service D" by traffic engineers) in the year 2007.

Level of service is a concept that traffic engineers have devised to describe how well highway facilities operate. Six levels of service categories are used: A, B, C, D, E and F. In layman's terms, they roughly correspond to the letter grades used in education. On freeways, level of service A is characterized by free-flow conditions with high vehicle speeds and wide spaces between vehicles. As level of service goes from B to D, speeds stay high, but vehicle spacing decreases. The physical capacity of the roadway is reached at level of service E; at this level the highest traffic flows are observed and speeds start to fall off sharply. Level of service F is stop-and-go traffic. Highway designers typically set a goal of level of service C or D for traffic in future years.

VITAL STATISTICS

US-101 at I-880 Interchange

Annual Delay: 12,249,000 hours

	2002	2025 (estimated)
Vehicles Per Day	244,000	481,555
Peak Period Delay (minutes per vehicle per trip)	10.3	48.2 (without improvements)
Annual Traffic Growth	3.00%	

For the purposes of this analysis, we have not attempted to identify a specific combination of improvements that would ease congestion at the interchange. Such decisions are properly made at the state and local level, reflecting the wishes and concerns of the general public, budgetary priorities, and applicable legal and regulatory requirements. We have assumed that a combination of improvements could achieve level of service D operations, and we have analyzed the benefits to be gained from such improvements.

Over the 20-year life of the improvements, there would be 6,019 fewer crashes (including 24 fewer fatalities and 2,955 fewer injuries), a 55 percent decrease in smog-causing volatile organic compounds, and a 77 percent decrease in CO_2 emissions. In addition, motorists and truckers traveling through the interchange during morning or evening rush hours would shave 24 minutes

Attachment 2

THE 2007 URBAN MOBILITY REPORT

David Schrank
Associate Research Scientist

and

Tim Lomax
Research Engineer

Texas Transportation Institute
The Texas A&M University System
http://mobility.tamu.edu

September 2007

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Support for this research was provided in part by a grant from the U.S. Department of Transportation, University Transportation Centers Program to the University Transportation Center for Mobility (DTRT06-G-0044).

2007 Urban Mobility Report

Congestion is a problem in America's 437 urban areas and it is getting worse in regions of all sizes. Congestion caused urban Americans to travel 4.2 billion hours more and to purchase an extra 2.9 billion gallons of fuel for a congestion cost of $78 billion (Exhibit 1). This was an increase of 220 million hours, 140 million gallons and $5 billion from 2004. **THE** solution to this problem is really to consider implementing **ALL** the solutions. One lesson from more than 20 years of mobility studies is that congestion relief is not just a matter of highway and transit agencies building big projects. Those are important. But so are actions by businesses, shippers, manufacturers and employers, as well as commuters, shoppers, and travelers for all reasons. Agencies, Businesses, Commuters—as simple as A-B-C.

For the complete report and congestion data on your city, see: http://mobility.tamu.edu/ums

Many Problems, Many Solutions

There is no "wonder" technology or policy to solve the congestion problem because there is not A congestion problem. There are several problems and therefore several solutions. The *2007 Urban Mobility Report* points out that the supply of solutions is not being implemented at a rate anywhere near the rate of travel demand growth. This report and the website data describe the scope of the problem and some of the improvement strategies.

Exhibit 1. Major Findings for 2007 –
The Important Numbers for The 437 U.S. Urban Areas
(Note: Improved methodology and more urban areas than 2005 Report)

Measures of…	1982	1995	2004	2005
… Individual Traveler Congestion				
Annual delay per peak traveler (hours)	14	31	37	38
Travel Time Index	1.09	1.19	1.25	1.26
"Wasted" fuel per peak traveler (gallons)	9	21	25	26
Congestion Cost (constant 2005 dollars)	$260	$570	$680	$710
Urban areas with 40+ hours of delay per peak traveler	1	11	28	28
… The Nation's Congestion Problem				
Travel delay (billion hours)	0.8	2.5	4.0	4.2
"Wasted" fuel (billion gallons)	0.5	1.7	2.7	2.9
Congestion cost (billions of 2005 dollars)	$14.9	$45.4	$73.1	$78.2
… Travel Needs Served				
Daily travel on major roads (billion vehicle-miles)	1.67	2.79	3.62	3.73
Annual public transportation travel (billion person-miles)	35.0	36.4	44.7	45.1
… Expansion Needed to Keep Today's Congestion Level				
Lane-miles of freeways and major streets added every year	19,233	17,254	15,677	16,203
Daily public transportation riders added every year (million)	14.5	14.9	16.0	16.5
… The Effect of Some Solutions				
Travel delay saved by				
Operational treatments (million hours)	N/A	N/A	270	292
Public transportation (million hours)	255	396	543	541
Congestion costs saved by				
Operational treatments (billions of 2005 dollars)	N/A	N/A	$5.0	$5.4
Public transportation (billions of 2005 dollars)	$4.9	$7.4	$10.1	$10.2

N/A – No Estimate Available Pre-2000 data do not include effect of operational strategies.
Travel Time Index (TTI) – The ratio of travel time in the peak period to travel time at free-flow conditions. A Travel Time Index of 1.35 indicates a 20-minute free-flow trip takes 27 minutes in the peak.
Delay per Peak Traveler – The extra time spent traveling at congested speeds rather than free-flow speeds divided by the number of persons making a trip during the peak period.
Wasted Fuel – Extra fuel consumed during congested travel.
Vehicle-miles – Total of all vehicle travel (10 vehicles traveling 9 miles is 90 vehicle-miles).
Expansion Needed – Either lane-miles or daily riders to keep pace with travel growth (and maintain congestion).

The Congestion Problems

Travelers and shippers must plan around traffic jams for more of their trips, in more hours of the day and in more parts of town than in 1982. In some locations, this includes weekends and rural areas. Mobility problems have increased at a relatively consistent rate during the more than two decades studied.

Congestion wastes a lot of time, fuel and money. In 2005,

- 2.9 billion gallons of wasted fuel (enough to fill 58 supertankers)
- 4.2 billion hours of extra time (enough to fill 260 million iPod Shuffles™ with music)
- $78 billion of delay and fuel cost (enough to buy $78 billion of something)

The effect of uncertain or longer delivery times, missed meetings, business relocations and other congestion results are not included.

Congestion costs are increasing. The congestion "invoice" for the cost of extra time and fuel in 437 urban areas (all values in constant 2005 dollars),

- In 2005 – $78 billion
- In 2004 – $73 billion
- In 1982 – $15 billion

Congestion affects the people who typically make trips during the peak period.

- Yearly delay for the peak-period traveler was 38 hours in 2005—almost one week of vacation—an increase from 14 hours in 1982 (Exhibit 5).
- That traveler wasted 26 gallons of fuel in 2005—three weeks worth of gasoline for the average U.S. resident—up from 9 gallons in 1982 (Exhibit 6).
- Congestion effects were even larger in areas over one million persons—48 hours and 34 gallons in 2005.

The value for the delay and wasted fuel was $710 per traveler in 2005 compared to an inflation-adjusted $260 in 1982.

Exhibit 5. Hours of Travel Delay per Peak-Period Traveler

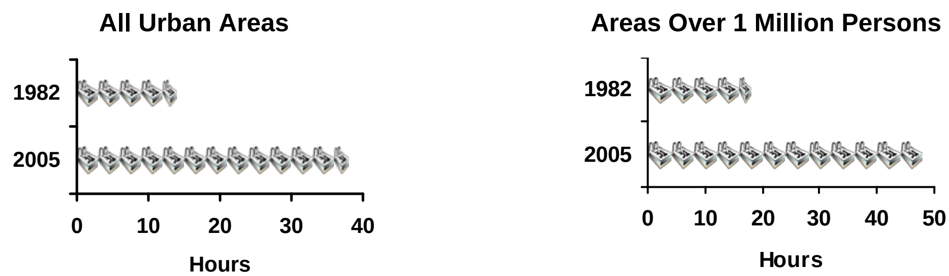
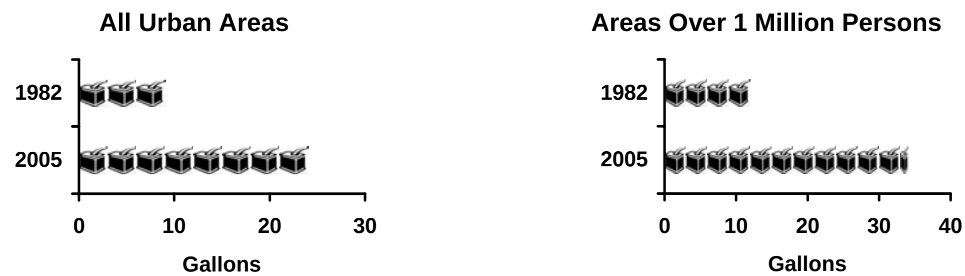


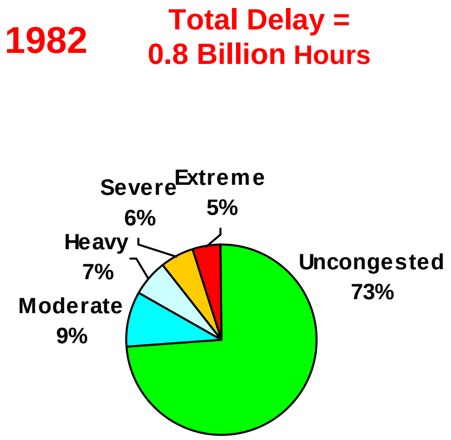
Exhibit 6. Gallons of Fuel Wasted per Peak-Period Traveler

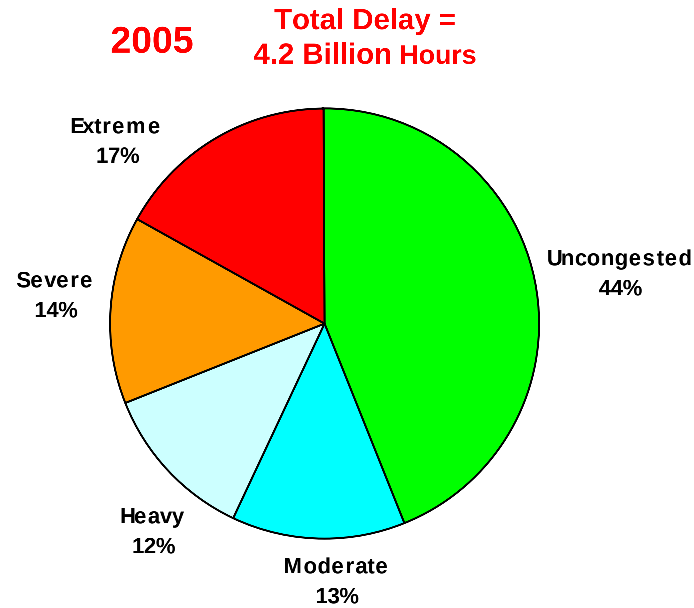


Travelers and shippers must plan around congestion more often.

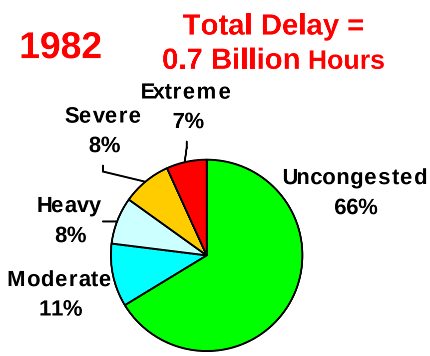
- In all 437 urban areas, the worst congestion levels affected (Exhibit 10) only 1 in 9 trips in 1982, but 1 in 3 trips in 2005.
- Free-flowing traffic is seen less than one-third of the time in urban areas over 1 million population.
- Delay is five times larger overall and is six times higher in regions with fewer than 1 million people.

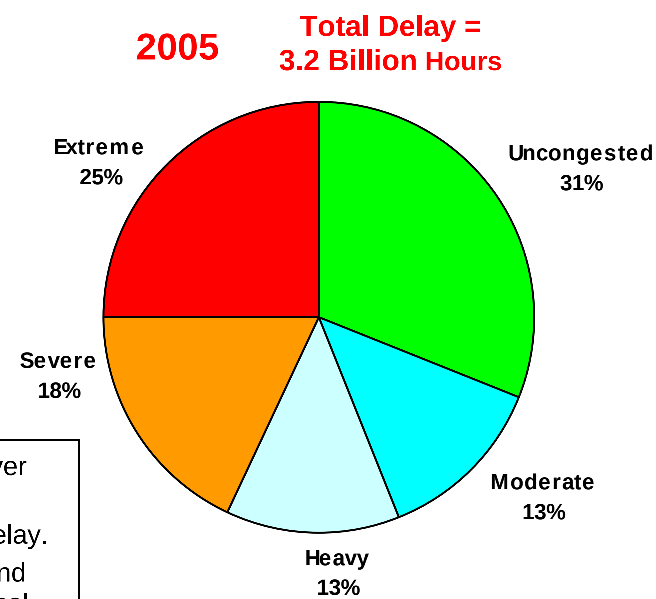
Exhibit 10. Congestion Growth – 1982 to 2005





Urban Areas Over 1 Million Population





But the problem could be even worse in the regions over 1 million population.

- Operational treatments save 259 million hours of delay.
- And if there were no public transportation service and travelers used their cars, there would be an additional 493 million hours of delay.

Attachment 3

Transportation AIR QUALITY

Selected Facts and Figures

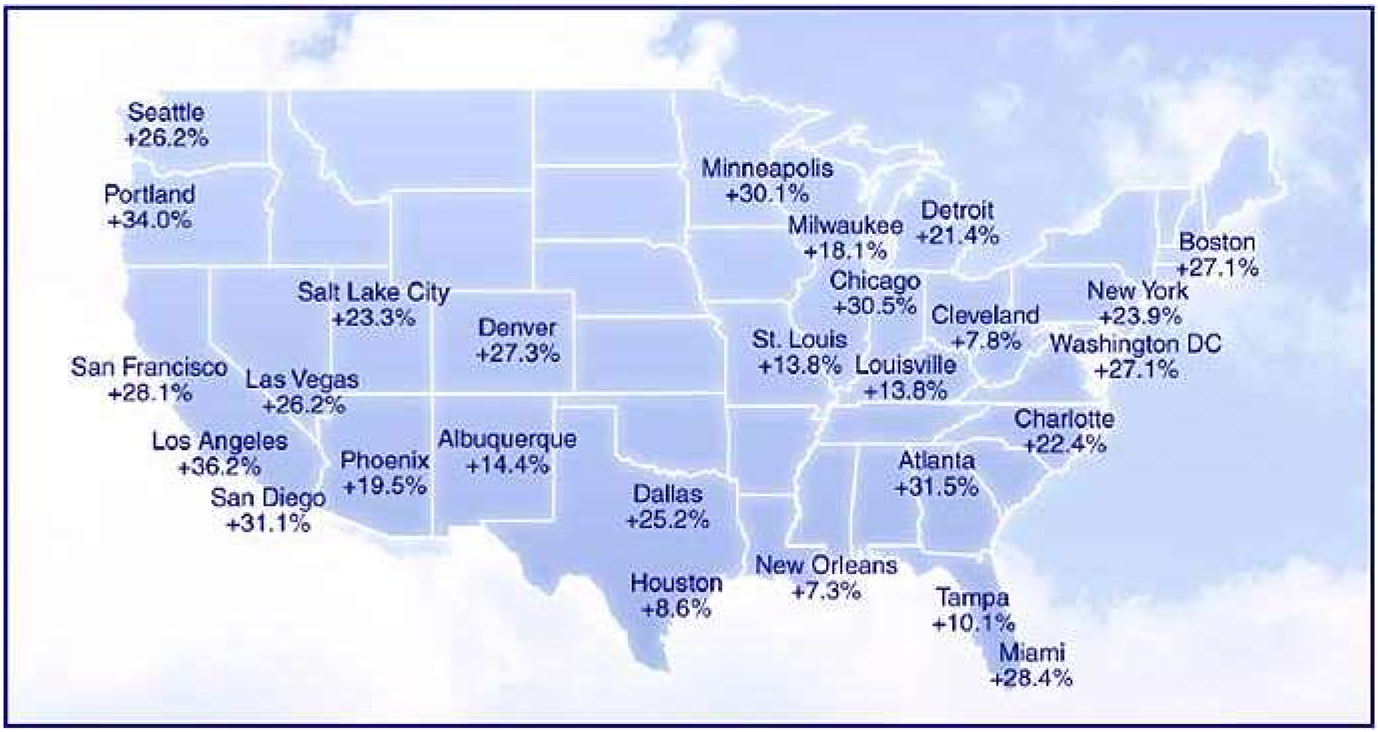
January 2006

U.S. Department of Transportation
Federal Highway Administration

Traffic Congestion

Percent Change in Urban Congestion

1982-2002

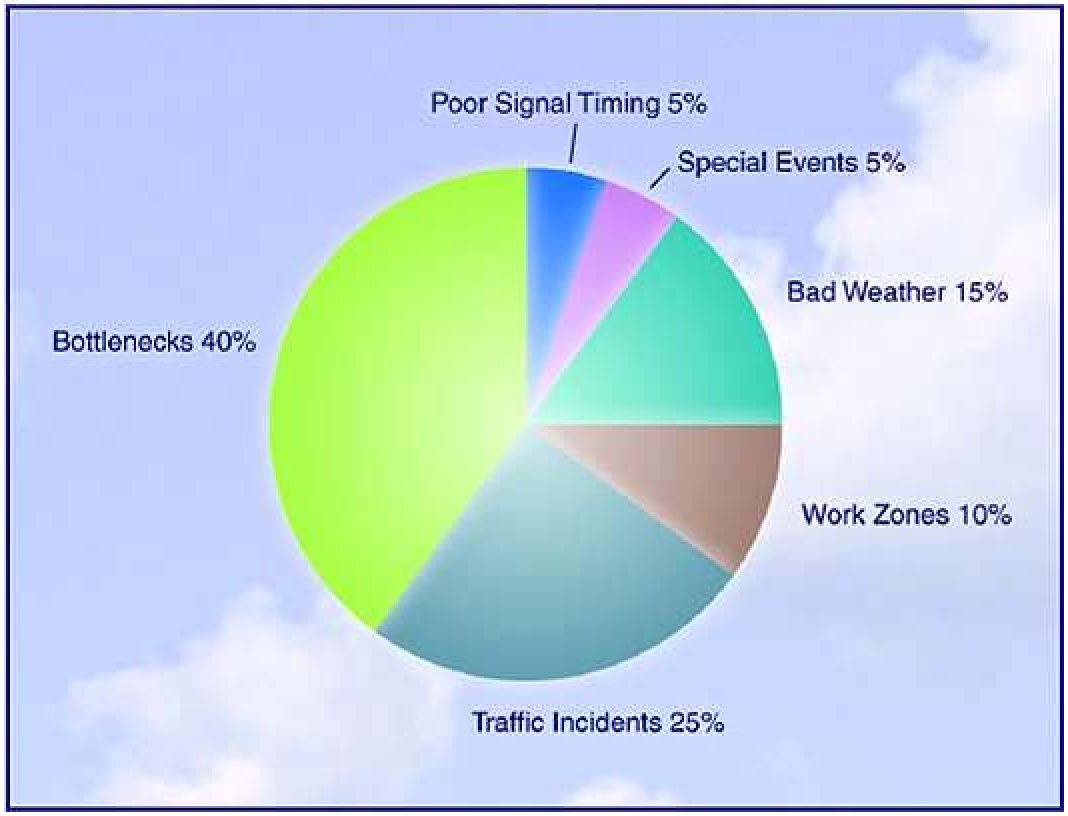


Congestion occurs when the free flow of traffic on a roadway is impeded due to excess vehicle demand, construction, maintenance, traffic incidents, weather, or other road conditions and events. Many urban areas have experienced increases in traffic congestion in recent years. This map shows the percent change in the amount of extra time per trip it took to travel in the peak period from 1982 to 2002, for selected areas.

Source: Texas Transportation Institute. *2004 Urban Mobility Report*. September 2004. Table 5.

Major Sources of Congestion

2002



Congestion Mitigation and Air Quality Improvement (CMAQ) program funds can be used for projects and programs that help clear traffic incidents and improve signal timing. Surface Transportation, National Highway System, Bridge, and other federal-aid funds can be used to reduce other sources of congestion, such as bottlenecks and work zones.

Source: Federal Highway Administration. *Traffic Congestion and Reliability: Linking Solutions to Problems - Executive Summary*. Publication Number: FHWA-HOP-05-004. July 2004.
Web site: http://ops.fhwa.dot.gov/congestion_report/chapter2.htm#2_1 28 June 2005.

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Attachment 4

STATE OF CALIFORNIA
AIR RESOURCES BOARD

PUBLIC HEARING TO CONSIDER THE ADOPTION OF A PROPOSED REGULATION FOR IN-USE OFF-ROAD DIESEL MACHINES	))))	Agenda Item: 07-5-6 January 4, 2008

AFFIDAVIT OF MICHAEL H. NAYLOR

I, Michael H. Naylor, hereby declare and state as follows:

1. I am over the age of 18 and otherwise competent to testify to the matters contained in this affidavit.

Experience and Education

2. I have a master's degree from the California State University at Long Beach in civil engineering (2007), a master's degree in civil engineering from West Virginia University (1976), and a bachelor's degree in aeronautical engineering from the University of Washington (1970).

3. I am registered as a Professional Engineer in two states: Chemical Engineer in California (CH 6192), Civil Engineer in Nevada (CE 5082).

4. I have over 31 years experience calculating air pollution emissions and analyzing the impact of air quality control regulations.

5. I am currently employed as an environmental consultant with Justice & Associates in Long Beach, California. My chief focus has been to secure state funding to reduce emissions from diesel-powered construction equipment. I am the lead project officer for preparing applications for grants to assist construction companies with funding diesel engine repowers. All grant applications need to include an assessment of air pollution produced by the old engine versus the new, replacement engine.

6. Since 2001, Justice & Associates' applications for grants have generated total funding of more than $95 million for construction contractors in seven California Air Quality Management Districts. This money has resulted in the installation of more than 1,200 low-emission diesel engines.

7. Before joining Justice & Associates, I worked for 25 years in the Air Quality Division of the Clark County Health District in Las Vegas, Nevada, serving a 20-year term as director. My responsibilities included emission inventory development and the analysis of the cost and benefits of proposed air quality regulations.

Analysis of Greenhouse Gas Emissions Associated with ARB's ORD Rule

8. The Associated General Contractors of America and the California-based Construction Industry Air Quality Coalition asked me to analyze the emissions analysis of greenhouse gases prepared by the California Air Resources Board (ARB) in connection with its proposed in-use, off-road diesel (ORD) rule. As explained in more detail in the attached analysis, ARB appears to have considered two facets of carbon dioxide (CO2) emissions that ARB expects to result from its rule: a reduction in CO2 emissions from the ORD rule's limitations on excessive idling and an increase in CO2 emissions from a fuel-economy penalty from the ORD rule's aftertreatment requirements.

9. My analysis of the ORD rule's emission impacts identified ten additional emissions increases attributable to the ORD rule from the following actions: (a) manufacture of raw steel materials to manufacture off-road machines (i.e., fabrication of the engines + equipment frames); (b) fabrication of non-steel parts for off-road machines; (c) shipment of the fabricated parts to the factory for manufacturing of the machines and engines; (d) shipment of new machines from the factory to dealership; (e) fuel consumption due to transport of the

new machines from the factory to dealership; (e) fuel consumption due to transport of the machines to a retrofit facility for installation of aftertreatment systems; (f) regeneration of diesel particulate filters (DPFs); (g) manufacture of urea used in the selective catalytic reduction (SCR) aftertreatment systems; (h) distribution of urea by supply trucks to fleets for replenishing urea in the SCRs; (i) urea reaction with nitrogen oxide (NOx) in the SCR systems; and (j) fuel consumed by service trucks that are used by technicians to clean and maintain the DPFs.

10. In my analysis of the ARB ORD rule, I designate ARB's two emission impacts as Steps 1 and 2, respectively, and I identify the additional ten emission effects as Steps 3 through 12, respectively. Figures and tables in the attached analysis identify the estimated emission impacts for each step in the life cycle (i.e., manufacture, delivery, and maintenance) of actions required to implement the ORD rule in 2020.

11. In summary, based on the attached analysis and my best engineering judgment, I estimate that the overall emissions impact of the ORD rule will be an increase of 393,430 metric tonnes per year in CO_2 emissions in 2020. Although I based my analysis on impacts in 2020, the intervening years also would experience related increases from the ORD rule.

12. I have personal knowledge of the foregoing and am competent to testify to it before the Air Resources Board or at trial.

I certify under penalty of perjury under the laws of the State of California that the foregoing is true and correct. Executed on this 2nd day of January 2008, at Long Beach, California.

REGISTERED PROFESSIONAL ENGINEER
MICHAEL NAYLOR
CH 6192
CHEMICAL
STATE OF CALIFORNIA

Michael H. Naylor

METHODOLOGY, ASSUMPTIONS, AND CALCULATIONS
IN SUPPORT OF
AFFIDAVIT OF MICHAEL H. NAYLOR

My findings are explained and documented in this section. This analysis estimates that greenhouse gas emissions that will result from the California Air Resources Board's (ARB) off-road, in-use diesel (ORD) rule. Emission estimates generally use an emission factor defined as the emissions per unit (e.g., emissions per year per machine) and a population number (e.g., the number of machines). The emission factor is multiplied by the population to yield emissions per unit of time. In support of my analysis and calculations, I collected various sources from the U.S. Environmental Protection Agency (EPA) and ARB, as available, and also developed my own set of assumptions. I complied my intermediate calculations and converted the totals from English to metric measurement systems.

Background

In July 2007, ARB adopted regulations to reduce emissions of particulate matter (PM) and nitrogen oxides (NOx) from diesel-powered, off-road equipment currently in use. Based on my evaluation and careful analysis of the technical documents accompanying this rule, it appears that ARB has overlooked several sources of greenhouse gas emissions that would result from the actions (or "life-cycle" steps) necessary to comply with this new engine emissions standard.

In support of its rulemaking effort, ARB issued a staff report in April 2007, titled *Staff Report: Initial Statement of Reasons for Proposed Rulemaking*. Chapter VI, Section C of the report discusses the effect the regulation would have on global warming and greenhouse gas emissions. Specifically, Section C acknowledges that greenhouse emissions under the rule would increase by as much as two to four percent, due to the fuel economy penalty that would result from the required use of cleaner engines and aftertreatment devices. However, the staff report goes on to find that this increase would be mitigated by the reduction in both black carbon emissions and carbon dioxide (CO2) emissions that would result from the idling limits imposed by the rule.

The climate change estimates offered by ARB address only the approximate emissions benefits associated with reduced idling (analyzed in the figures and table below as Step 1) and the emissions outputs from the extra fuel consumption that would result from the drop in fuel economy, as caused by the exhaust back pressure of the diesel particulate filters used in the aftertreatment systems (analyzed in the figures and table below as Step 2).

ARB has failed to account for significant sources of greenhouse gas emissions that would result from the intermediate, life-cycle steps necessary to comply with the off-road diesel rule.

Both ARB and EPA rely on the concept of a life-cycle analysis when preparing a greenhouse gas inventory. Similarly, by analyzing the life-cycle steps for complying with ARB off-road rule, I have identified the following twelve operations or steps that result in the release of greenhouse gas emissions:

1. Excessive idling (according to ARB estimates)
2. Fuel-economy penalty from the ORD rule's aftertreatment requirements (according to ARB estimates)
3. Manufacture of raw steel materials to manufacture off-road machines (i.e., fabrication of the engines + equipment frames)
4. Fabrication of non-steel parts for off-road machines
5. Shipment of the fabricated parts to the factory for manufacturing of the machines and engines

6. Shipment of new machines from the factory to dealership
7. Fuel consumption due to transport of the machines to a retrofit facility for installation of aftertreatment systems
8. Regeneration of the diesel particulate filters (DPFs)
9. Manufacture of urea used in the selective catalytic reduction (SCR) aftertreatment systems
10. Distribution of urea by supply trucks to fleets for replenishing urea in the SCRs
11. Urea reaction with NOx in the SCR systems
12. Fuel consumed by service trucks that are used by technicians to clean and maintain the DPFs.

Assumptions

In order to analyze and estimate CO2 emissions in 2020, I made the following assumptions about the California construction fleet in 2020:

- Turnover: Approximately 57.5 percent of off-road fleet are new (post 2007) machines; 20 percent of the new machines in operation are the result of natural fleet turnover.[1]
- Aftertreatment (2020): Approximately 100 percent of the off-road fleet operating in 2020 will have aftertreatment devices. (This is evident when comparing EPA's Tier 2, 3 and 4 off-road engine standards with the ARB's off-road emissions targets for 2020.) All aftertreatment systems are designed for both PM and NOx reduction, meaning they have both diesel particulate filters and selective catalytic reduction devices.

---

[1] Richard J. McCann, Ph.D., M.Cubed, personal communication, December 20,2007.

- Aftertreatment (2008-2013): Approximately 71.4 percent of the fleet will retrofitted with aftertreatment devices. This is based on the estimate that 28.6 percent (100% - 28.6% = 71.4%) of the fleet after 2013 will be new machines with factory installed aftertreatment. The 28.6 percent figure is the difference between a 28.9 percent turnover in 2013 and a 57.5 percent turnover in 2020.[2]
- Aftertreatment (2014-2020): Approximately 28.6 percent of the fleet has factory installed aftertreatment. (See paragraph above.)
- Repowers: The percentage of repowered machines in the fleet in 2020 is negligible.[3]

Methodology

For each step, I extrapolated the emissions per machine to statewide emission totals. To do so, I multiplied the population of machines by the emissions per machine and converted that figure to statewide CO2 emissions in units of metric tonnes per year.

The staff analysis of the greenhouse gas impacts of the off-road rule suggests that the savings in fuel resulting from the rule's idling limits will reduce CO2 emissions (61,640 metric tonnes per year) by at least the same magnitude as the increase in CO2 emissions (50,960 metric tonnes per year) resulting from the fuel-economy penalty brought about by the rule's aftertreatment requirements. (This amounts to a 2 percent drop in fuel consumption due to idling limitation, and a 2 percent increase in fuel consumption due to poorer fuel economy).

However, my analysis of the estimated emissions increases shows that the increased emissions

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2 Richard J. McCann, Ph.D., M.Cubed, personal communication, December 20, 2007.

3 Richard J. McCann, Ph.D., M.Cubed, personal communication, December 21, 2007.

due to the ORD rule (455,770 metric tonnes per year) are about eight times the amount that would be offset by a reduction in emission from the idling prohibition.

A detailed breakdown of the estimated annual emissions of CO_2 in the year 2020 – associated with the life-cycle steps of the California off-road rule – appears in the table and figures. A detailed analysis of each life-cycle step follows.

My work is strongly supported by EPA and other peer-reviewed data and findings; the most pertinent information is attached. In cases where published data do not exist, assumptions were based on best engineering judgments and properly noted.

Summary of Results

In summary, I estimate the overall greenhouse emission impact of the ORD rule will be an increase of 394,040 metric tonnes per year of CO_2 emissions in the year 2020. A significant portion of the impact derives from the manufacture of the machine parts, transporting the machines, and manufacturing the urea for the SCR systems. These emissions occur whether or not the machine is even being operated. The emissions from each step are listed in Table 1 and are illustrated in the pie and bar charts in Figures 1 and 2, respectively.

Table 1 – Estimates of Annual CO_2 emissions from Various Steps in the Off-road Equipment Life Cycle

Step	CO2 per average machine (pounds/year)	machine population	Total CO2 Emissions (metric tonnes/year)
1.	825.6	164,250	-61,640
2.	766.9	146,180	50,960
3.	9,570	61,594	267,930
4.	1580	61,594	44,250
5.	49.5	61,594	1,390
6.	196	61,594	5,490
7.	93.3	117,270	4,970
8.	28.1	146,180	1,870
9.	464.3	146,180	30,850
10.	546	146,180	36,280
11.	106	146,180	7,040
12.	70	146,180	4,650
Total	--	--	394,040

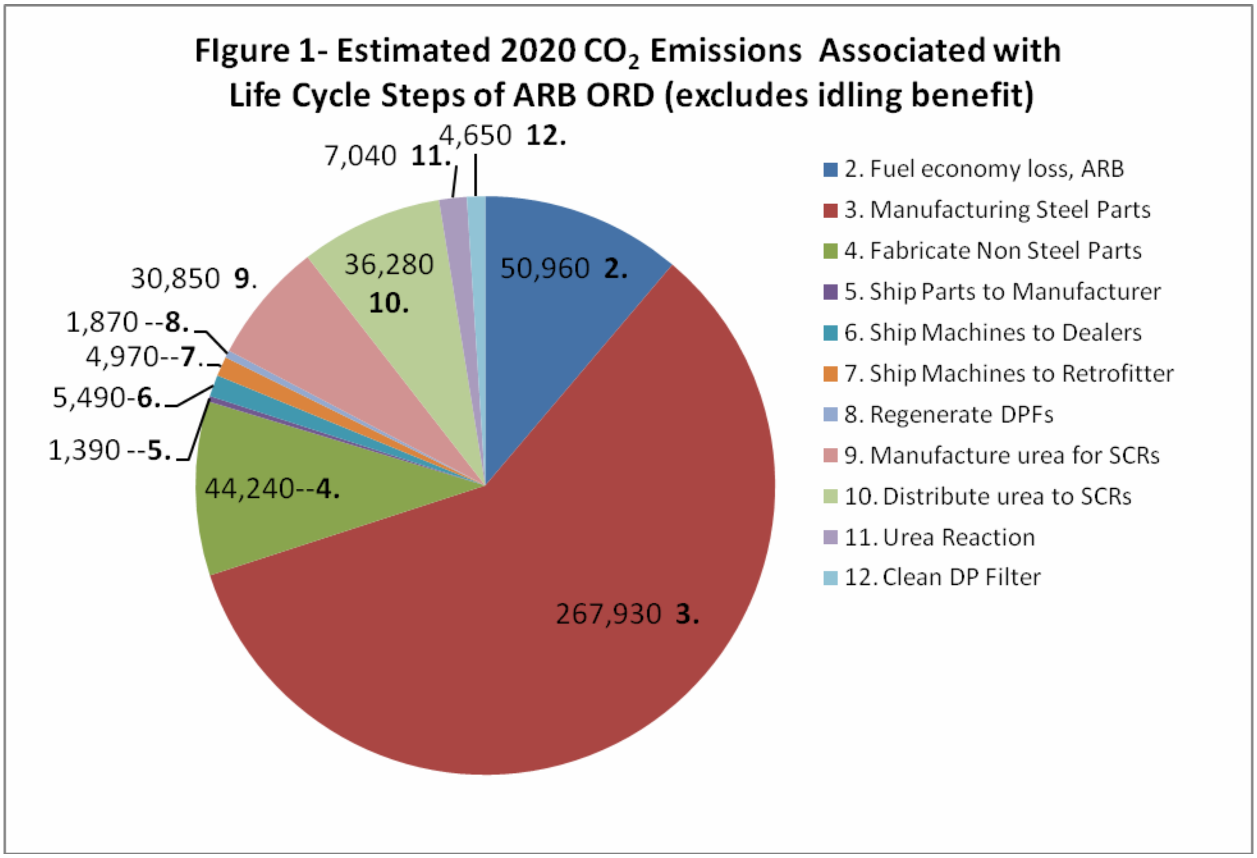
FIgure 1- Estimated 2020 CO_2 Emissions Associated with Life Cycle Steps of ARB ORD (excludes idling benefit)
50,960 2.
267,930 3.
44,240--4.
1,390 --5.
5,490-6.
4,970--7.
1,870 --8.
30,850 9.
36,280 10.
7,040 11.
4,650 12.
2. Fuel economy loss, ARB
3. Manufacturing Steel Parts
4. Fabricate Non Steel Parts
5. Ship Parts to Manufacturer
6. Ship Machines to Dealers
7. Ship Machines to Retrofitter
8. Regenerate DPFs
9. Manufacture urea for SCRs
10. Distribute urea to SCRs
11. Urea Reaction
12. Clean DP Filter

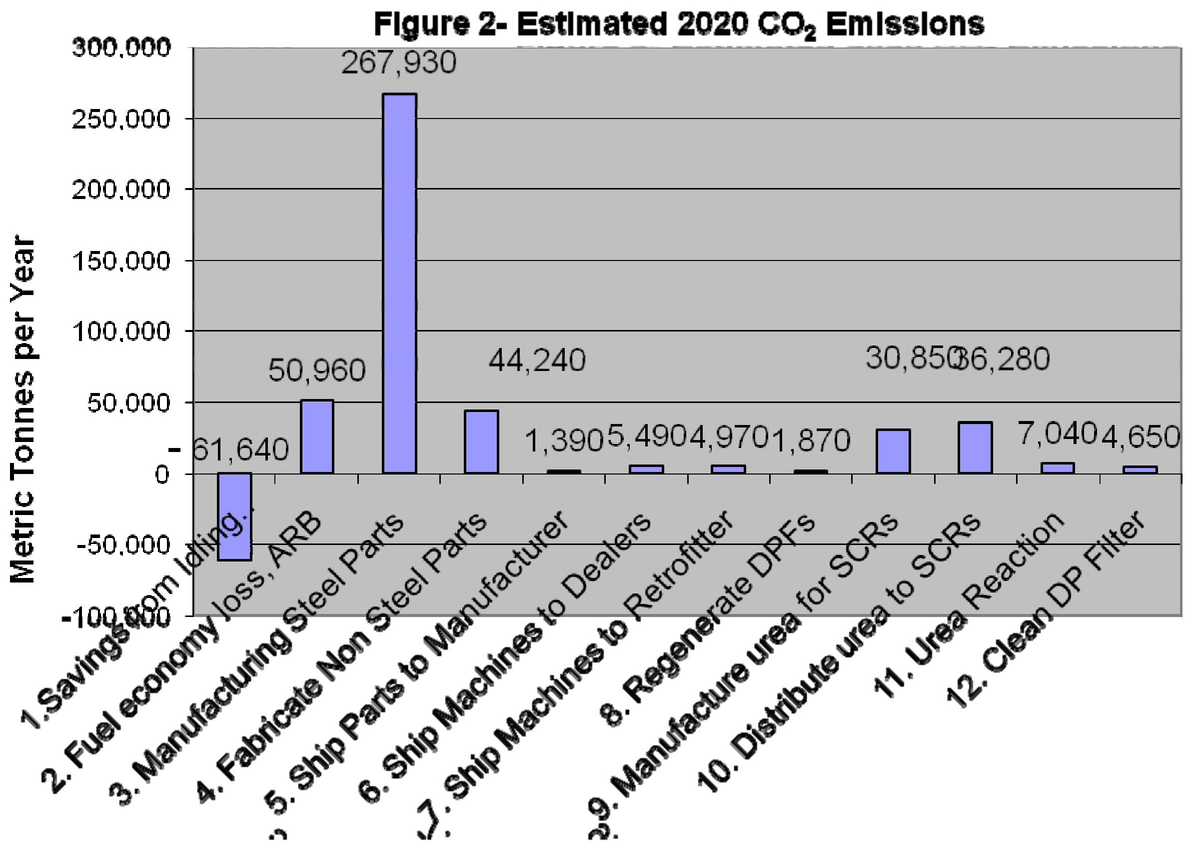
Figure 2- Estimated 2020 CO_2 Emissions
Metric Tonnes per Year
300,000
250,000
200,000
150,000
100,000
50,000
0
-50,000
-100,000
- 61,640
50,960
267,930
44,240
1,390
5,490
4,970
1,870
30,850
36,280
7,040
4,650
1.Savings from Idling...
2. Fuel economy loss, ARB
3. Manufacturing Steel Parts
4. Fabricate Non Steel Parts
5. Ship Parts to Manufacturer
6. Ship Machines to Dealers
7. Ship Machines to Retrofitter
8. Regenerate DPFs
9. Manufacture urea for SCRs
10. Distribute urea to SCRs
11. Urea Reaction
12. Clean DP Filter

Step 1: Emissions from Excessive Idling

Pounds per Average Machine

In an addendum to the Initial Statement of Reasons, titled *Technical Support Document: Proposed Regulation for In-use Off-road Diesel Vehicles* (April 2007), ARB provides additional supporting materials. In Appendix I "Climate Change Impacts of the Off-road In-Use Regulation" of the technical support document, ARB attempts to quantify the anticipated change in CO2 emissions that would result from the combined use of cleaner engines and aftertreatment devices, coupled with the limitation on idling. According to Table 3 in Appendix I, idling CO2 emissions in 2000 were 61,560 metric tonnes, (not MMT as reported in Table 3), apportioned among 164,250 machines .

Calculation

61,560 metric tonnes/yr x 2200 lbs/metric ton/164,250 machines = 825.6 pounds CO2 per year per machine.

Population of Machines

According to page I-4, there were 164,250 off-road diesel machines statewide as of 2000. This analysis does not consider growth

Metric tonnes per Year

825.6 lbs/yr/machine x 164,250 machines x 1 met ton/2200 lbs = 61, 640 metric tonnes per year

Step 2: Fuel Economy Penalty from Aftertreatment Device

Pounds Per Average Machine

ARB states that the fuel economy penalty is equivalent to 2 percent of annual fuel consumption of the machine (see page I-2). According to Appendix I, Table 3, the average machine consumes 1,826 gallons of diesel per year (300,000,000 gallons/yr/164,250 machines). Appendix

I contains the conversion factor for converting one gallon of diesel fuel to CO2 during combustion: 21 lbs CO2 per gallon of fuel.

Calculation

1826 gallons per machine x 2% x 21 lbs CO2 per gallon = 766.9 pounds per year/machine

Population of Machines

To meet the 2020 target levels, I assumed that 100 percent of the off-road machines operating in 2020 will have aftertreatment. Machines manufactured after 2013 will have factory installed aftertreatment. The construction industry estimates that the natural turnover from 2013 to 2020 is 11 percent (91.1% remaining inventory in 2013 – 80.1% remaining inventory in 2020, per Richard J. McCann, Ph.D., M.Cubed, personal communication, December 21, 2007.)

As indicated in Table 3, the population in 2000 is 164,250.machines. The percentage of machines that will have aftertreatment that is not due to turnover will be 89 percent. The net machine population using aftertreatment required by the regulation is 0.89 x 164,250 = 146,180 machines.

Metric Tonnes per Year

766.0 lbs/yr/machine x 146,180 machine x 1 metric tonne/2200 lbs = 50,960 metric tones/yr

Step 3: Emissions from manufacturing steel to make new machines

Pounds per Average Machine

The manufacture of steel starts with the extraction of ore and transporting it to steel mill. One of the last steps is forging the steel material into the desired shapes for product use. As a proxy for this process we are using the life-cycle analysis for a steel can.[4]

Assume that Caterpillar D6T Dozer is representative, composite machine. According to Caterpillar literature its mass is 22.8 tonnes. Assume that 18 tonnes of this machine is steel. The estimate of CO_2 emissions from steel and steel product fabrication can be estimated by using the factor for steel cans from Exhibit 2-2 of EPA's report.

There are 0.79 metric tonnes of carbon equivalent per ton of steel can product using the current mix of virgin and recycled inputs. There are 3.67 metric tonnes of CO_2 per metric ton of carbon equivalent(ratio of molecular weights). Therefore there are 2.90 metric tonnes of CO_2 per ton of steel can or 6380 pounds CO_2 per ton.

Calculation

18 tons of steel x 6380 lbs CO_2/ton/ 12 years= 9,570 pounds per year (averaged over 12 years).

Population of Machines

According to M.Cubed, the percent of new (post 2007) machines due to turnover from 2008 to 2020 is 57.5 percent. The construction industry's estimate of natural turnover by this time is 20 percent (or the remaining inventory is 80.1%). The accelerated portion of this is 37.5 percent (Richard J. McCann, Ph.D., M.Cubed, personal communication, December 21, 2007.) Using the

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[4] EPA has considered the life-cycle emission from steel can manufacture from virgin and recycled materials in *Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks,* (May 17, 2002) (available at http://www.epa.gov/climatechange/wycd/waste/downloads/greengas.pdf). A recent report – (see Ungureanu, C.A.; Das, S.; Jawahir, I.S., Life-Cycle Cost Analysis: Aluminum versus Steel in Passenger Cars; TMS Publication (The Minerals, Metals & Materials Society) 2007) suggests that the emissions factor for steel fabrication is 5.1 kg CO_2 per kg steel. Thus, according to the report, for a 371 kg steel frame, there were 1913 kg of CO_2,), and use of 3.96 kg CO_2 per kg of

(Footnote cont'd on next page)

base population above of 164,250 machines, the number of new machines in the fleet is 61,594.

Metric Tonnes per Year

9,570 lbs/yr/machine x 61,594 machine x 1 met ton/2200 lbs = 267,930 metric tonnes per year

Step 4: Fabrication of non-steel components for off-road machines

Pounds per average machine

From the above EPA source, I assumed that the manufacture of heavy density polyethylene could be used as a proxy for estimating greenhouse gases from manufacturing the non-steel components. The HDPE factor, from Exhibit 2-2 is 0.49 MTCE per ton of product. This figure is based on a the non-steel mass of 4.8 tonnes (22.8 tonnes -18 tonnes).

Calculation

4.8 tonnes x 0.49 met tonnes C x 3.67 met tonnes CO_2/ met ton C/x2200 lbs /met ton/12 years = 1580 pounds per year

Population of Machines

This is the same at Step 3 above.

Metric tonnes per year

1,580 lbs/yr/machine x 61,594 machine x 1 met ton/2200 lbs = 44,240 met tonnes per yr

Step 5: Shipment of the fabricated parts to the factory for manufacturing the machine and engine

Pounds per average machine

Assume that the fabricated steel parts and non-steel parts are shipped by rail for 500 miles.

(Footnote cont'd from previous page.)

steel, is conservative.

Current diesel locomotive technology achieves 403 ton miles per gallon of diesel fuel (see http://www.transportation.anl.gov/pdfs/RR/261.pdf). Therefore the shipment 22.8 tonnes of parts requires 22.8 tonnes x 500 miles/ 403 ton miles/gallon = 28.3 gallons. From page I-1 of Appendix I, "for every gallon of CARB diesel fuel used 9.96 kilograms of CO_2 is emitted. This equals 21 pounds per gallon. Over the 12 year life of the machine this is 28.3 gallons x 21 lbs CO_2 /gallon/12 yr= 49.5 pounds per year/ machine.

Population of Machines

This is the same at Step 3 above.

Metric tonnes per year

49.5 lbs/yr/machine x 61,594 machine x 1 met ton/2200 lbs = 1390 met tonnes per yr

Step 6: Shipment of new machines from factory to dealership

Pounds per average machine

Shipment from factory to dealership of new machine. The presumed manufacturer is Caterpillar, headquartered in Peoria, Illinois. Destination is central California, the one way distance is 1980 miles. The machine weight 22.8 tonnes See Step 3. The ton miles is 1485. Current locomotive technology achieves 403 ton miles per gallon See Step 5. The CO_2 conversion factor is 21 lbs CO_2 per gallon and the life is 12 years (Step 5).

Calculation

22.8 tonnes x 1980 miles /403 ton miles/gallon x 21 lbs CO_2/gal/12 years = 196 pounds per year

Population of Machines

This is the same at Step 3 above.

Metric tonnes per year

196 lbs CO_2/machine/yr x 61,594 machine/12 yr/ 2200 lbs/met ton = 457 metric tonnes per year

Step 7: Fuel consumption due to machine transport to retrofit facility for installation of aftertreatment system

Pounds per average machine

For installation of DPF/SCR device, assume that class 8 flat bed truck is used with a fuel economy of 4.5 miles per gallon (this is default used by South Coast AQMD for their heavy duty on road truck modernization program). Assume that the round trip distance is 100 miles. The project life is 5 years for the retrofit which is the project life for repower/retrofits in the Carl Moyer Program proposed Guidelines.

Calculation

100 miles/4.5 miles/gal/5 yr x 21 lbs CO2 per gal = 93.3 lbs/yr CO2.

Population of Machines

The ARB assumes that the turnover rate will increase from 28.9 percent in 2013 to 57.5 percent in 2020. (Richard J. McCann, Ph.D., M.Cubed, personal communication, December 20, 2007.) Therefore, post 2013 machines will account for 28.6 percent (57.5%-28.9%) of the fleet. Machines acquired after 2013 will have factory installed aftertreatment systems. The rest of the fleet will have retrofitted aftertreatment systems, or 71.4 percent of the fleet. This results in a retrofitted population of 0.714 x 164,250 veh = 117,270 machines.

Metric tonnes per year

93.3 lbs/yr/machine x 117,270 machine/ 1 met ton/2200 lbs = 4970 metric tonnes per year

Step 8: Regeneration of the diesel particulate filters

Pounds per average machine

The diesel particulate filter traps PM during routine operation. (Each filter collects 85% of the particulate that enters the emission control device. The particulate matter is carbonaceous.

During regeneration the carbon is oxidized by outside air to form carbon dioxide.) During regeneration the trapped PM is heated and oxidized to CO_2. According to the emission factors for the off-road rule, a Tier 3 engine has PM emission factor of 0.15 gram/bhphr. The Level 3 filter will retain 85 percent of the weight of Particulate Matter.

Assume that for every gram of soot regenerated to CO_2, that 2.96 grams of CO_2 are released.

This factor is the same as the gas to liquid mass ratio for diesel fuel which is 21 lbs CO_2 per gallon of diesel which weighs 7.1 pounds per gallon. From Table 3 of Appendix I of the off-road rule, the average machine consumes 1,826 gallons of diesel per year (300,000,000 gallons/yr/164,250 machines). Each gallon generates 18.5 hp hr of work using the Moyer guidelines conversion factor.

Calculation

1826 gallons x 18.5 hp hr/gal x 0.15 gram PM /bhphr x 85% x 2.96 gram CO_2/ gram PM/ 454 gm/pound = 28.1 pounds CO_2 per year/machine

Population of Machines

From Step 2 above, the machine population with aftertreatment which results from the regulation (not the machines which have aftertreatment naturally) is 146,180 machines.

Metric tonnes per year

28.1 lbs /yr/machine x 146,180 veh/ x 1 metric ton/ 2200 lbs = 1,850 metric tonnes per year

Step 9: The manufacture of urea for use in the individual aftertreatment system

Pounds per average machine

The following information is obtained from EPA's Greenhouse Inventory (online at http://www.epa.gov/climatechange/emissions/usinventoryreport.html) Chapter 4, Industrial Processes, Ammonia and Urea Application. According to page 4-10, ammonia and CO_2 are used as raw materials in the production of urea ($(NH_2)_2$ CO $_2$). Emissions of CO2 occur during the production of ammonia. The manufacture of each pound of urea, releases 3.2 pounds of CO2.

A Tier 3 engine sends 3 gram /bhphr of NOx to the SCR system. One half of a molecule of urea (MW 60) is needed to neutralize one molecule of NO which is reported as NO2 (MW 46). Therefore 30 grams of urea neutralizes 46 grams of NOx, or 0.65 grams of urea neutralizes one gram of NOx. Consequently, three grams of NOx requires 1.95 grams of urea. In one year the average machine uses 1826 gallons x 18.5 hp hr/gal x 1.95 grams of urea/bphr/454= 145 pounds of urea/year

Calculation

145 lbs urea/year/machine x 3.2 lbs CO2 per pound of urea = 463.3 lbs CO2/yr/machine

Population of Machines

This is the same as Step 8.

Metric tonnes per year

464.3 lbs CO2 /machine/yr x 146,180 machine x 1 met ton/2200 lbs = 30,850 metric tonnes/ year

Step 10: Urea distribution by supply truck

Pounds per average machine

Fuel is consumed by supply or service truck which delivers urea on a weekly basis to the urea supply tank on the machine with the SCR unit.

Assume that one truck serves 20 machines per day and that it covers 100 miles per day. Assume that truck has fuel economy of 10 miles per gallon. Therefore it consumes 0.5 gallons per day per machine. Deliveries are made weekly so the diesel fuel used annually per machine is 26 gallons.

26 gallons x 21 lbs CO2 per gallon=546 lbs CO2 per year

Population of Machines

This is the same as item 8.

Metric Tonnes per year

546 lbs CO2/machine/yr x 145,180 machine x 1 met ton/2200 lbs = 36,280 metric tonnes / year

Step 11: Reaction of urea

Pounds per average machine

When urea is injected into the Selective Catalytic Reactor CO2 is released.

$((NH2)_2 CO + 2NO + 1/2\ O_2 = 2\ N_2 + 2\ H_2O + CO_2$

Continuing from the discussion at Step 9 ,a molecule of urea will release one molecule of CO2 after the re action in the SCR. 60 grams of urea will generate 44 grams of CO2. One gram of urea will generate 0.73 grams of CO2. One pound of urea will generate 0.73 pounds of CO2.

Calculation

145 lbs urea/ year/machine x 0.73 lbs CO2 per lb urea = 105.9 pounds of CO2 /yr/machine

Population of Machines

This is the same as Step 8.

Metric Tonnes per Year

106 lbs CO2 per machine/yr x 146,180 machine x 1 met ton/2200 lbs = 7,040 met tonnes/ year

Step 12: Fuel consumed by service truck for technician to clean the DPF twice per year

Pounds per average machine

Assume that the service truck can clean four machines per day, driving 100 miles per day. Assume that the truck has a fuel economy of 15 miles per gallon. Therefore each machine requires use of 1.67 gallons of fuel (100/15/4). With an emission of 21 pounds CO2 per gallon, this results in 35.07 pounds per machine per cleaning. Based on twice per year cleaning, this means 70.1 pounds per year.

Population of machines

This is the same as Step 8.

Metric Tonnes per Year

70 lbs/machine/yr x 146,180 machine x 1 met ton/2200 lbs = 4,650 metric tonnes per year

Exhibits

Michael Naylor

Subject: FW: FW: CARB Rule - CO2 emissions - underlying estimates (revised)

Importance: High

From: Richard McCann [mailto:rmccann@mcubed-econ.com]
Sent: Friday, December 21, 2007 9:32 AM
To: Michael Naylor
Cc: Larry Joseph; Leah Wood Pilconis; Clayton Miller; Mike Buckantz
Subject: RE: FW: CARB Rule - CO2 emissions - underlying estimates (revised)
Importance: High

Mike
I looked at the analysis we did of the ARB Staff model. The % repowered is 1.4%. 98.6% are replaced. Also, there are no repowers after 2013.

RMc

Michael Naylor

Subject: FW: FW: CARB Rule - CO2 emissions - underlying estimates
Attachments: ConstructionIndustryComplianceCostReportSupplement.doc; ConstructionIndustryComplianceCostReportrevisedfinal.doc; RegTurnover.xls

-----Original Message-----
From: Richard McCann [mailto:rmccann@mcubed-econ.com]
Sent: Thursday, December 20, 2007 5:00 PM
To: Michael Naylor
Cc: Larry Joseph; Leah Wood Pilconis; Clayton Miller
Subject: RE: FW: CARB Rule - CO2 emissions - underlying estimates

At 04:03 PM 12/20/2007, Michael Naylor wrote:
>Richard
>I did not see any attachments.

Sorry, thought you had the report through Mike B.

I've attached the reports, plus I've attached a spreadsheet that shows the proportion of turnover attributable to the regs under the ARB Staff and CIAQC assumptions. The other assumptions seem reasonable.

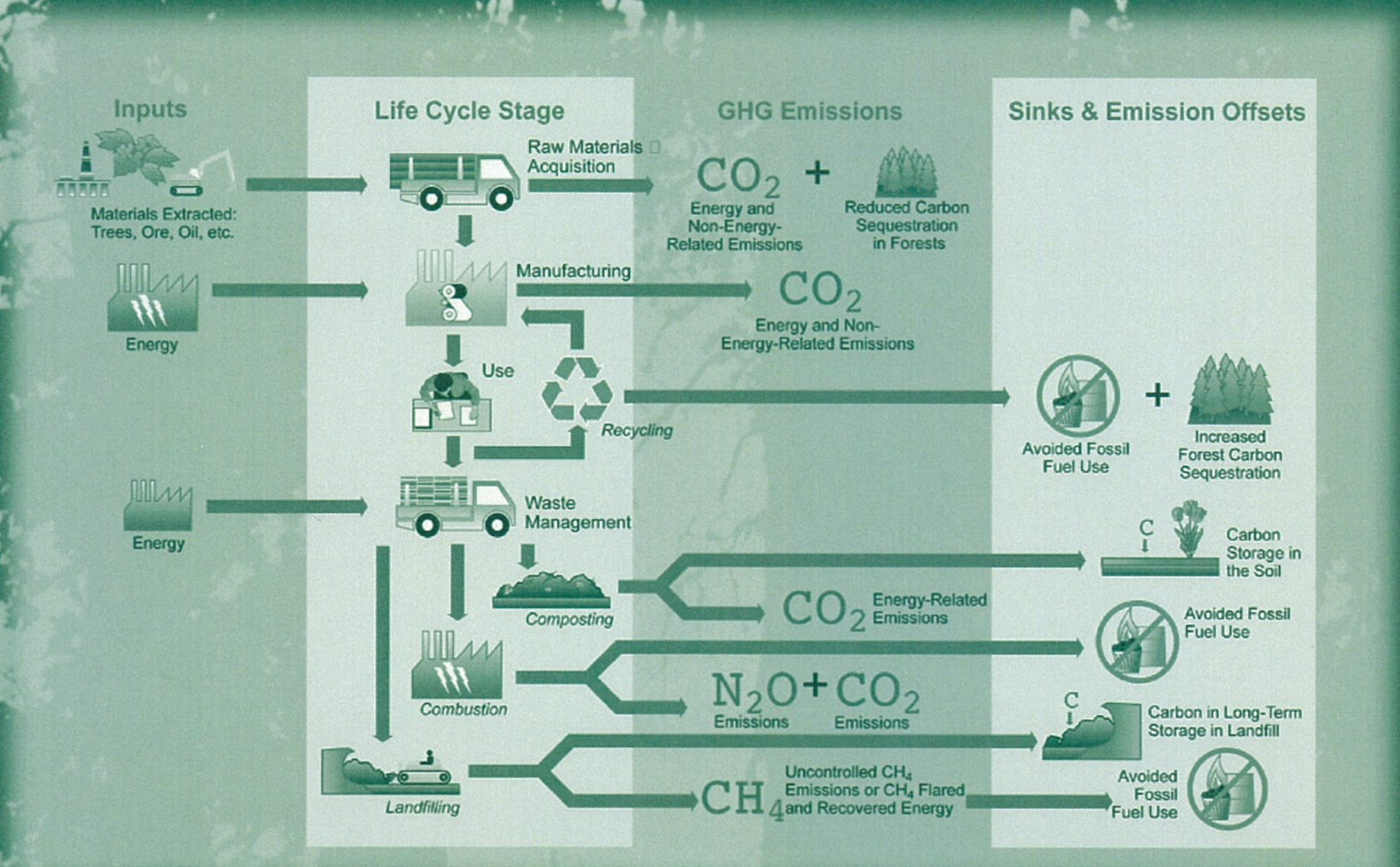
RMc

Table 1
Fleet Changes Implied from ARB Staff Analysis

				Remaining Inventory Vehicles			
			Rule Turnover	Base Turnover		Proportion Reg. Turnover	
				ARB Staff	CIAQC	ARB Staff	CIAQC
Year	**Net Added Turnover**	**Retrofitted**					
2010	3.40%	16.50%	90.6%	93.8%	96.3%	34.0%	60.6%
2011	3.40%	12.70%	83.7%	89.7%	94.5%	36.8%	66.5%
2012	3.40%	12.00%	77.3%	85.8%	92.8%	37.3%	68.3%
2013	3.80%	1.50%	71.1%	82.0%	91.1%	37.7%	69.3%
2014	3.90%	3.00%	65.4%	78.4%	89.5%	37.8%	69.6%
2015	1.50%	1.30%	61.6%	75.0%	87.8%	35.0%	68.4%
2016	4.50%	1.10%	56.2%	71.7%	86.2%	35.4%	68.6%
2017	2.70%	0.60%	52.3%	68.6%	84.7%	34.1%	67.8%
2018	2.50%	0.50%	48.8%	65.6%	83.1%	32.8%	67.0%
2019	2.70%	0.40%	45.4%	62.7%	81.6%	31.8%	66.3%
2020	**2.00%**	**0.40%**	**42.5%**	**60.0%**	**80.1%**	**30.4%**	**65.4%**
2021	2.60%	2.60%	39.6%	57.4%	78.7%	29.4%	64.7%
2022	2.60%	5.10%	36.9%	54.9%	77.2%	28.5%	63.9%
2023	2.40%	5.90%	34.4%	52.5%	75.8%	27.5%	63.1%
2024	2.60%	0.80%	32.1%	50.2%	74.4%	26.6%	62.4%
2025	2.60%	0.00%	29.9%	48.0%	73.1%	25.8%	61.6%
2026	2.10%	0.00%	28.0%	45.9%	71.8%	24.9%	60.8%
2027	1.90%	0.00%	26.2%	43.9%	70.4%	23.9%	59.9%
2028	1.40%	0.00%	24.7%	42.0%	69.2%	22.9%	59.0%
2029	1.00%	0.00%	23.4%	40.1%	67.9%	21.8%	58.1%
2030	0.50%	0.00%	22.3%	38.4%	66.7%	20.7%	57.1%

Solid Waste Management And Greenhouse Gases

A Life-Cycle Assessment of Emissions and Sinks



SOLID WASTE MANAGEMENT AND GREENHOUSE GASES
A Life-Cycle Assessment of Emissions and Sinks

2nd EDITION

EPA530-R-02-006

May 2002

Exhibit 2-2
GHG Emissions from the Manufacture of Selected Materials
(Metric Tons of Carbon Equivalent (MTCE) per Ton of Product)

(a)	(b)	(c)	(d)	(e)	(f)			(g)		
	Virgin Input Combined Process and Transportation Energy Emissions	Recycled Input Combined Process and Transportation Energy Emissions		Current Mix Combined Process and Transportation Energy Emissions	Process Non-Energy Emissions (MTCE per Ton of Product)			Average Combined Process and Transportation Energy and Process Non-Energy Emissions (MTCE per Ton of Product)		
Type of Product	(MTCE per Ton of Product Made With Virgin Inputs)	(MTCE per Ton of Product Made With Virgin Inputs)	Percent Recycled Inputs in the Current Mix of Virgin and Recycled Inputs	(MTCE per Ton of Product Made With the Current Mix of Virgin and Recycled Inputs)	Virgin Inputs	Recycled Inputs	Current Mix	Virgin Inputs	Recycled Inputs	Current Mix
Aluminum Cans	3.52	0.25	49%	1.90	1.15	0.02	0.59	4.67	0.27	2.49
Steel Cans	0.77	0.27	44%	0.55	0.24	0.24	0.24	1.01	0.51	0.79
Glass Containers	0.11	0.07	23%	0.10	0.04	0.00	0.03	0.16	0.07	0.14
HDPE	0.48	0.04	9%	0.44	0.05	0.00	0.05	0.53	0.04	0.49
LDPE	0.59	0.04	4%	0.56	0.05	0.00	0.05	0.64	0.04	0.61
PET	0.55	0.04	18%	0.46	0.03	0.00	0.02	0.58	0.04	0.49
Corrugated Boxes	0.22	0.25	62%	0.24	0.00	0.00	0.00	0.22	0.25	0.24
Magazines/Third-class Mail	0.46	0.46	22%	0.46	0.00	0.00	0.00	0.46	0.46	0.46
Newspaper	0.59	0.34	52%	0.46	0.00	0.00	0.00	0.59	0.34	0.46
Office Paper	0.27	0.37	32%	0.30	0.01	0.00	0.00	0.28	0.37	0.31
Phonebooks	0.67	0.41	12%	0.64	0.00	0.00	0.00	0.67	0.41	0.64
Textbooks	0.59	0.57	13%	0.59	0.00	0.00	0.00	0.59	0.57	0.59
Dimensional Lumber	0.05	0.07	0%	0.05	0.00	0.00	0.00	0.05	0.07	0.05
Medium-density Fiberboard	0.10	0.12	0%	0.10	0.00	0.00	0.00	0.10	0.12	0.10
Mixed Paper										
Broad Def'n (= Boxboard "A")	0.32	0.43	51%	0.38	0.00	0.00	0.00	0.32	0.43	0.38
Residential Def'n (= Boxboard "B")	0.32	0.43	53%	0.38	0.00	0.00	0.00	0.32	0.43	0.38
Office Def'n (= Paper Towels)	0.91	0.75	38%	0.85	0.00	0.00	0.00	0.91	0.75	0.85

Explanatory notes: To estimate the GHG emissions from manufacturing, we first estimated the process and transportation GHG emissions when 100 percent virgin inputs, or 100 percent recycled inputs, are used. For each product and each type of input (virgin or recycled), we summed the estimates for process and transportation GHG emissions. Next we estimated the GHG emissions from manufacturing each material from the current mix of virgin and recycled inputs. We began with estimates of the percentage of recycled inputs currently used in the manufacture of each material, as shown in column "d." We used these percentages to develop a weighted average value for the GHG emissions associated with the manufacture of each material from the current mix of virgin and recycled inputs. Specifically, we used the estimate of the percentage of recycled inputs in the current mix, together with the estimates for GHG emissions from manufacture using virgin or recycled inputs, to develop estimates of GHG emissions from manufacture using the current mix of virgin and recycled inputs (column "e").

Explanatory notes for Exhibit 2-2 (continued):

Column "f" shows estimates of the process non-energy GHG emissions from manufacturing. First, this column shows the process non-energy GHG emissions when virgin inputs are used. Then it shows the emissions when recycled inputs are used (these values are simply copied from the final columns of Exhibits 2-3 and 2-5). Finally, column "f" shows the process non-energy GHG emissions from manufacturing each product from the current mix of virgin and recycled inputs. The values for the current mix are the weighted averages of the values for virgin and recycled inputs, based on the percentage of recycled inputs used in the current mix (as shown in column "d").

The total GHG emissions from manufacturing are shown in column "g." This column shows total GHG emissions when a product is manufactured from virgin or recycled inputs, or from the current mix of virgin and recycled inputs.

Aluminum Alloys for Transportation, Packaging, Aeropsace, and Other Applications
Edited by Subodh K. Das, Weimin Yin
TMS (The Minerals, Metals & Materials Society), 2007

Life-cycle Cost Analysis: *Aluminum versus Steel in Passenger Cars*

C.A. Ungureanu[1], S. Das[2], I.S. Jawahir[1]

[1]University of Kentucky, Lexington, KY, 40506, USA
[2]Secat Inc., 1505 Bull Lea Road, Lexington, KY, 40511, USA

Keywords: Aluminum, life cycle, weight reduction, recycling.

Abstract

In light of escalating fuel prices and the ongoing climate change discussion, sustainability considerations are currently taking a more prominent role in material selection decisions for automotive applications. This paper presents a new methodology for total life-cycle cost analysis and employs a case study involving the use of aluminum in automotive applications. This study is aimed at developing a new sustainability model to quantify the total cost encountered over the entire life-cycle of a vehicle considering all four life-cycle stages: (1) pre-manufacturing, (2) manufacturing, (3) use and (4) post-use. Also, the paper presents a quantitative evaluation of the environmental impact of using aluminum material in a vehicle. The paper compares the use of aluminum with the traditional use of steel alloys in a given automotive application by providing details of economic and environmental performance of the vehicle over the total life-cycle.

Introduction

Reducing manufacturing costs and tailpipe emissions by using light-weight materials which can easily be recycled or reused are among the major issues in today's automobile industry. The growing emphasis on total cost and environmental impact has forced the life-cycle cost issue to be the driving factor. Weight savings in the overall car mass is considered to be a major research focus. Aluminum is proven to be among the potential materials capable of achieving weight reduction without sacrificing the vehicle safety and performance. Despite significant technological advantages in aluminum alloys, the use of aluminum alloys to replace traditional materials such as steels has been slow due to lack of comprehensive economic analysis of the entire life-cycle of automotive products.

In considering the total life-cycle of an automobile covering four stages (pre-manufacturing, manufacturing, use, and post-use), it is apparent that during the operational (use) stage of a vehicle, aluminum is proven to be a reliable alternative for traditional materials currently used in automotive body structures largely due to its cost-effectiveness and superior performance due to light weight. With the gas price variation, the initial cost advantage of using steel in body components gained in pre-manufacturing and manufacturing stages can be overcome during the operational (use) stage of the vehicle, since the lighter alternative provides significant savings in terms of fuel consumption and consequently generation of airborne gas emissions. Also, the superior recyclability and reusability of aluminum in the post-use stage outweighs the traditional materials despite the higher cost involved in producing primary aluminum.

This paper presents a systematic study of the total life-cycle cost analysis and the environmental impact of using aluminum-based automotive products. This study is aimed at developing a new model to quantify the total cost encountered over the entire life-cycle of a vehicle considering material substitution in the body structure of the vehicle, since the so-called body-in-white (BIW) structure plus exterior closure panels represent an important group where significant weight savings can be achieved. Also, the environmental impact over the lifetime of the vehicle is being quantified. Overall, the study concludes that considering the entire life-cycle of an automobile, from extraction of materials to the final disposal including recycling and reuse applications, aluminum proves to be a potential alternative for steels in future automotive applications.

Major Assumptions

Knowing that the greatest opportunity for weight savings comes from the body structure and exterior closure panels, and that additional weight reduction can be achieved by downsizing the other components such as engine components [1, 2], the proposed model considers achieving weight reduction by replacing the conventional material used in vehicle's construction (i.e., steel) with a lighter mass equivalent material (i.e., aluminum), maintaining the same vehicle design and using the same manufacturing processes for body components. The major assumptions for this study are listed in Table 1.

The starting value for gas price is assumed to be \$2.30 per gallon, a value which is considered to be closer to the current gas price. The gas price can fluctuate, and a 20 percent increase or decrease for the current value has been considered in the current study. Thus, the resulting price range is between \$1.84 and \$2.76 per gallon as shown in Table 1. For the pre-manufacturing stage, the cost calculations for both materials are based on the assumption that 308 kg of aluminum sheet would be required to produce the completed 193 kg aluminum body structure and 565 kg steel sheet are needed to produce 371 kg steel body structure. According to Stodolsky [1], the primary material used in the typical passenger car today is steel, which can be purchased for a cost between \$0.77 and \$1.20/kg. A 20 percent increase or decrease for steel sheet cost has also been considered, with a range of values between \$0.63 – \$1.17/kg. Since aluminum is a material which is likely to replace steel in automotive body components [3], the starting value for aluminum sheet has been chosen as \$3.3/kg [1]. A 20 percent increase or decrease in aluminum sheet cost has also been considered, giving a range of values between \$2.31 - \$4.29/kg. The starting values for both materials are considered to be in agreement with the generally known fact that the cost to produce primary aluminum is between 2 to 5 times more expensive than the cost to produce primary steel [4, 5].

For the manufacturing stage of the life-cycle, the calculations use Technical Cost Modeling software developed at MIT [3, 6] for a production volume of 150,000 vehicles per year. The analysis considers both fabrication costs and assembly costs encountered by the body-in-white (BIW) structure and the exterior panels during the manufacturing stage. The fuel consumption of vehicles is assumed to be constant throughout the use stage, with a lower vehicle weight providing improved fuel efficiency. It is assumed that 5 % fuel efficiency can be achieved from a 10 % weight-reduction [3, 5]. In the case of steel BIW, the fuel economy has been assumed to be 20 mpg, whereas the fuel efficiency for aluminum BIW is assumed to be 22 mpg [2].

Table 1: The basic assumptions of major parameters used in the current study

Parameter	Starting value	Range
Gas Price ($/gal)	2.30	1.84 – 2.76
Cost of Steel ($/kg)	0.90	0.63 – 1.17
Cost of Aluminum ($/kg)	3.30	2.31 – 4.29
Price of Scrap ($/kg) Steel Aluminum	 0.09 0.93	 0.069 – 0.129 0.657 – 1.221
Fuel Consumption (mpg) Steel BIW Aluminum BIW	 20 22	
Total Vehicle Weight (kg) Steel BIW Aluminum BIW	 1,418 1,155	
Body-in-White Weight (kg) Steel Aluminum	 371 193	
Life of the Car (years)	14	
Miles Driven in Year 1	15,220	
Lifetime Miles Driven	174,140	
Recycling Percentage Steel Aluminum	 90 90	

The life time of the vehicle has been assumed 14 years [7]. The total number of miles driven over the life time of the vehicle is 174,140 miles, with the assumption that in the first year, the vehicle is driven 15,220 miles, and that the number of miles driven annually decreases as the vehicle age increases as shown in Table 2. The price values of scrap material and recycled material are listed in Table 3 for both materials [8].

Once the vehicle reaches its end-of-life, it is considered that the owner sells the vehicle to a dismantler and that 90 percent of the BIW material is recycled [9, 10]. It is also considered closed-loop recycling of obsolete automotive BIW materials, where the recycled materials are returned to their original usage through further processing.

Table 2: Estimated annual miles driven by the vehicle age

Vehicle Age (Years)	Annual Miles Driven	Total Miles Driven

1	15,220	15,220
2-5	14,250	72,220
6-10	12,560	135,020
10-14	9,780	174,140

Table 3: Material price database for aluminum and steel

Material	Price ($/kg)	Scrap ($/kg)	Recycle ($/kg)
Steel	0.9	0.09	0.12
Aluminum	3.3	0.93	1.32

Apart from the cost analysis, the model also quantifies the amounts of carbon dioxide emissions generated during the processing of the materials, manufacturing the body structures, use of the vehicle, and in recycling the materials. For all four life-cycle stages, carbon dioxide emissions for both materials are listed in Table 4 and these values are derived from [11]. The current model tracks only carbon dioxide emissions associated with fuels used for aluminum and steel operations during each stage. Other fuel-related emissions such as carbon monoxide, nitrous oxides, sulfur dioxide, and other compounds are not considered in this study.

Table 4: Total carbon dioxide emissions for steel and aluminum BIW (Year 1)

Stage	Steel (kg CO_2/BIW)	Aluminum (kg CO_2/BIW)
Pre-manufacturing	1,913.5	2,689
Manufacturing	19.5	18.6
Use	6,772.5	6,139.5
Post-use	282.5	75.7

Being a highly energy-intensive process, producing virgin aluminum generates more carbon dioxide emissions than producing virgin steel. Since their manufacture and assembly processes are assumed to be similar, the amounts of carbon dioxide generated during the manufacturing stage differ slightly, being the direct result of using electricity to operate the machinery. The vehicle's operational (use) stage has the greatest environmental impact in terms of carbon dioxide emissions. Fuel economy, the number of years the vehicle is used on the roads and the emissions rate are among the most common factors contributing to the amount of carbon dioxide generated over the operational stage. The lighter alternative is proven to emit less gaseous substances since it needs less power to move and therefore less fuel. Credits for emission rates are given in accordance with the U.S. Environmental Protection Agency recommendations [12]. For the post-use stage, the amounts of carbon dioxide generated by both materials, are based on the assumption that 90 percent of the material is recycled once the vehicle reaches its end-of-life [9] and that the recycled aluminum saves 95 percent of the energy to produce virgin aluminum [13, 14] whereas the recycled steel saves between 40-75 percent of the energy required to produce virgin steel [10]. All the above values are illustrative, not definitive and they are derived from published sources which helped in developing the model. By changing the starting values according to the actual consent and realistic estimates, the model will recalculate all the costs encountered by the BIW structures over the entire life-cycle of the vehicle.

Preliminary Results

Fuel economy, gas price variation and the number of miles driven on the roads are important parameters which make up for the total cost encountered by the vehicle during the use stage. The cost of gasoline encountered over the operational (use) stage of the vehicle is a function of the gas price variation, for both material scenarios, and is shown in Figure 1. As expected, aluminum substitution would provide important savings over the entire range of the gas price variation. At a price of only $2.30 per gallon and a fuel economy improvement of 10 percent, it is shown that over the life time of the vehicle (14 years), approximately 791.5 gallons of gasoline can be saved. This number translates into about $1,820 saved over the same period of time.

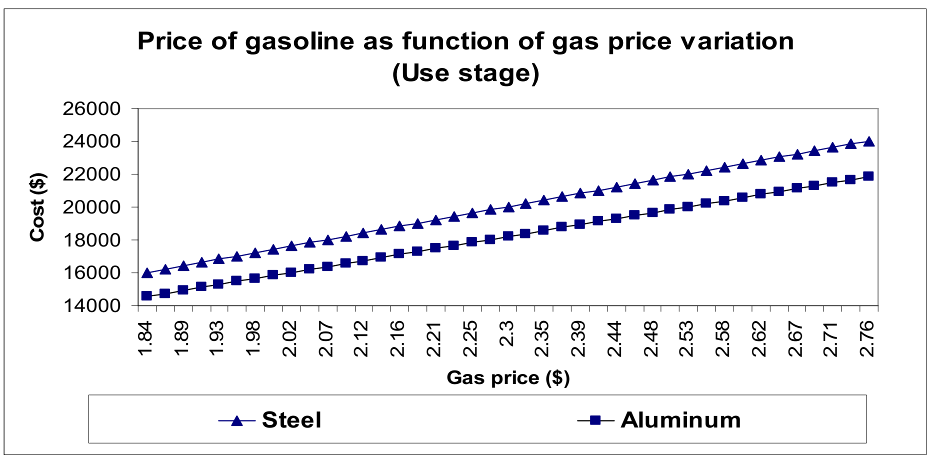


Figure 1: Cost of gasoline as a function of gas price variation (Use stage, 14 years)

The carbon dioxide emissions for the “Use” stage depend on the number of miles driven, fuel economy, and the emissions rate. According to the US Environmental Protection Agency, it is assumed 0.916 pounds of CO_2 emissions per mile for a passenger car’s fuel consumption of 21.5 miles per gallon. Since carbon dioxide emissions are directly proportional to fuel economy, each 1% increase (decrease) in fuel consumption results in a corresponding 1% increase (decrease) in carbon dioxide emissions [12].Therefore, this study considers for aluminum BIW structured vehicle, 0.88 pounds CO_2 emissions per mile and for steel BIW structured vehicle 0.98 pounds CO_2 emissions per mile. The CO_2 emissions generated during the use stage as function of the number of years are shown in Figure 2.

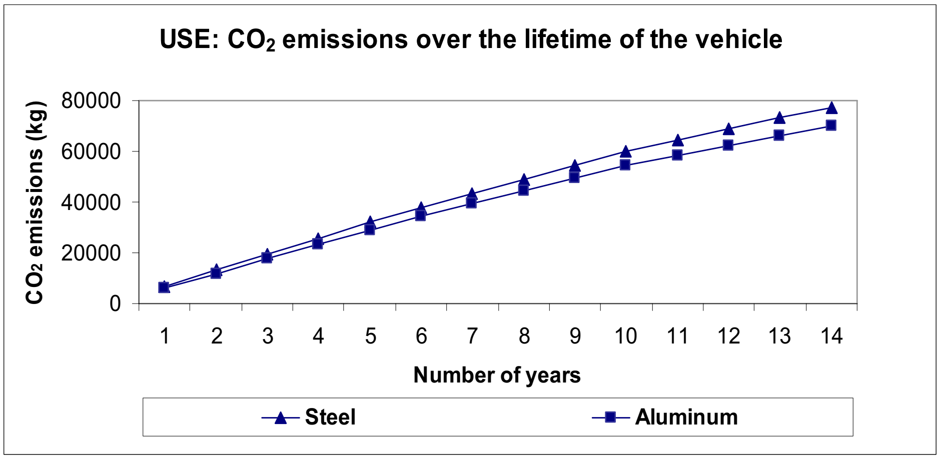


Figure 2: Carbon dioxide emissions over the lifetime of vehicle

Since the cost encountered during the “Use” stage has the highest impact on computing the total ownership cost and the number of miles driven, the recycling content and the price of gas are important parameters to compute the total cost encountered by the vehicle over its life-cycle. This study compares the total costs encountered by vehicle for three different mileage scenarios (15,220 miles, 57,970 miles, and 135,020 miles). Four different levels of recycled material, for each mileage case scenario, are also considered: 0, 25, 75, 100 percent, both recycled materials (steel and aluminum), and a special case scenario, in which 75 percent aluminum and 25 percent steel is recycled material. Pre-manufacturing costs depend greatly on the percent of material recycled. With the increased use of recycled material, the material cost becomes smaller. The manufacturing costs consider both the cost of body fabrication and the cost of final assembly. The cost functions for aluminum and steel sheets and the fabrication costs for body components differ, and it is shown that steel fabrication cost is less than the fabrication cost for aluminum body components. Since the assembly cost for aluminum body structure is higher than the assembly cost for steel body structure, the manufacturing costs to produce steel body structure are generally lower than the manufacturing costs to produce the aluminum body structure. Costs encountered during the “Use” stage of the vehicle are functions of the number of miles driven, fuel consumption, and price of gasoline. An improvement in fuel consumption, and the increase in the number of miles driven by the vehicle lead to an increase in the difference between the number of gallons of gas used by the steel structured vehicle and the number of gallons of gas used by the aluminum structured vehicle, thus, making aluminum BIW vehicle much cheaper in terms of the money spent on gasoline during this stage. The “Post-use” stage costs consider only obsolete scrap from the end-of-life vehicle. Since both materials are considered to be 90 percent recycled, and that aluminum has a higher scrap value, $0.94 per kilogram compared to $0.10 per kilogram for steel, aluminum has a higher post-use value. Figure 3 refers to the first mileage case scenario (15,220 miles driven) for Year 1, and it shows the ratio of the total cost for aluminum versus the total cost for steel over the entire life-cycle of the vehicle as function of gas price variation. As content of material recycled is increased, for instance from 25 % to 75 % material recycled, the ratio becomes closer to the unity value, but still the total cost for steel BIW is smaller than the total cost for aluminum BIW for the entire range of gas price variation. However, a 100% recycled material us for both materials would give a cost advantage for aluminum.

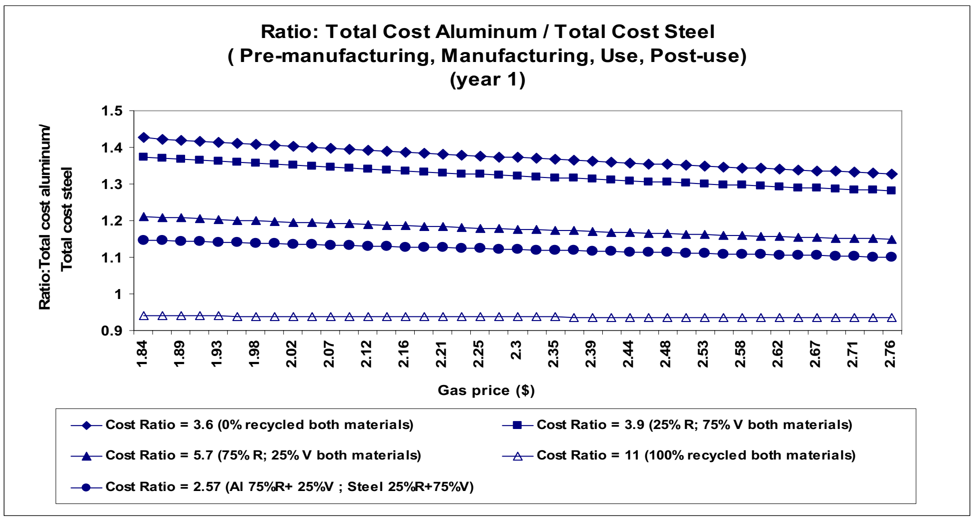


Figure 3: The ratio of the total cost for aluminum versus the total cost for steel (Year 1)

Figures 4 and 5 show the same decreasing trend for all scenarios of recycled material content, but for different number of miles driven: 57,970 miles (Figure 4) and 135,020 miles (Figure 5), driven at Year 4 and Year 10, respectively. The difference between the total costs for aluminum and the total costs for steel reduces, as the difference between the "Use" stage costs becomes larger. After 135,020 miles driven (Year 10), the total cost ratio is less than the unity value, for almost all scenarios of recycled material content. Considering the case scenario where aluminum 75 percent and steel 25 percent material recycled, Figure 6 shows the total ownership cost breakdown for both materials.

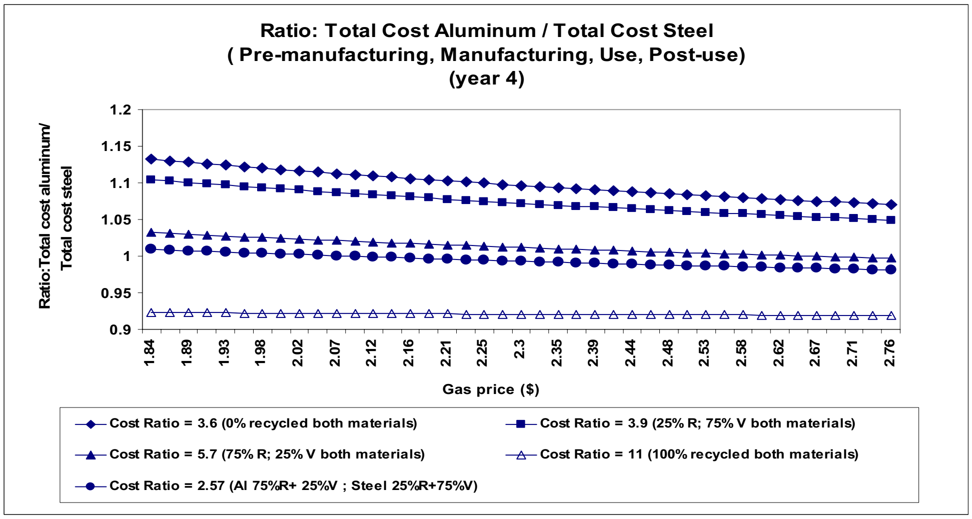


Figure 4: The ratio of the total cost for aluminum versus the total cost for steel
(Year 4)

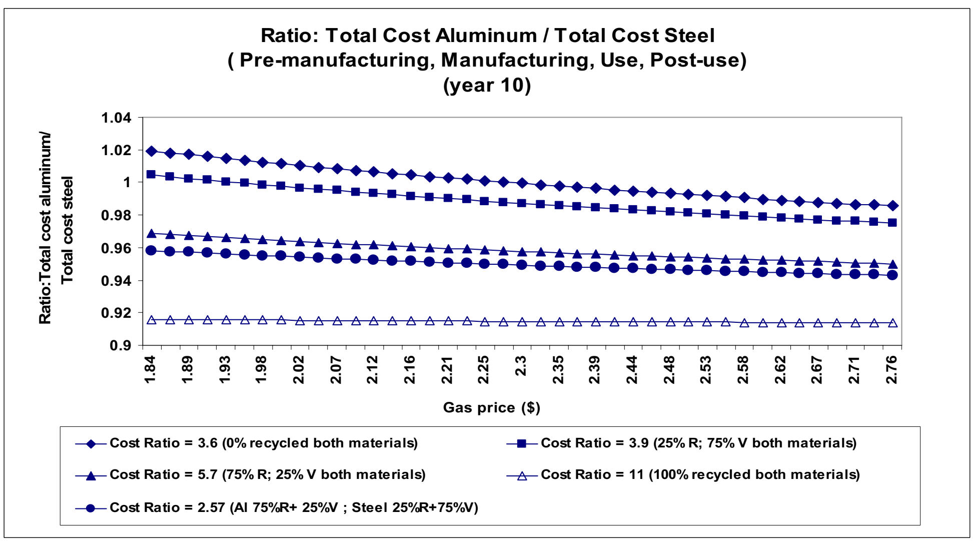


Figure 5: The ratio of the total cost for aluminum versus the total cost for steel
(Year 10)

Being a cheaper material to produce and manufacture, for the first four years of vehicle usage, steel BIW structure is shown to be a more economical option. Once the vehicle's usage is increased, the difference between the use costs for both materials becomes significant, making aluminum BIW structure a more economical option. After ten years, the aluminum structure has a cost advantage of about 5 percent over the steel structure.

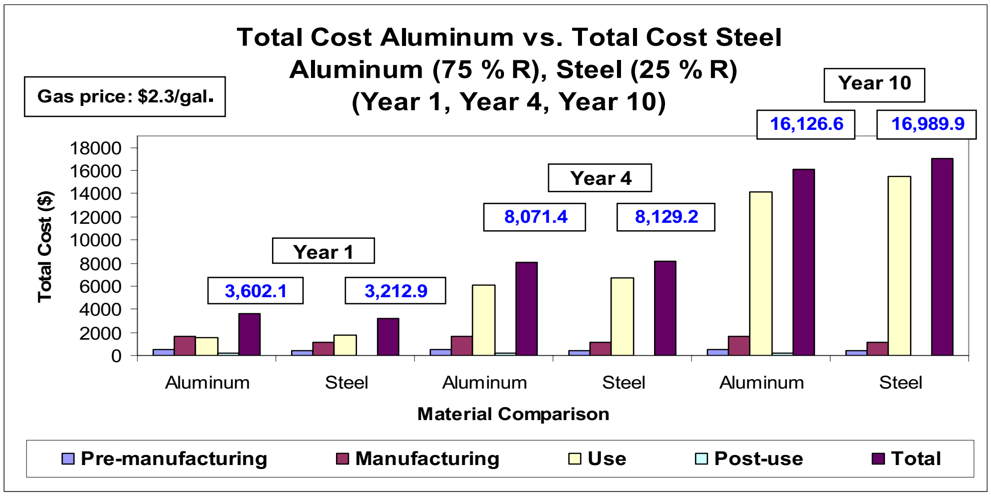


Figure 6: Total cost breakdown (Aluminum vs. Steel) for all four life-cycle stages

For the pre-manufacturing stage, the amount of carbon dioxide generated is calculated based on the content of material recycled. Figure 7 shows the amounts of carbon dioxide generated during this stage for increasing recycling rate for both materials.

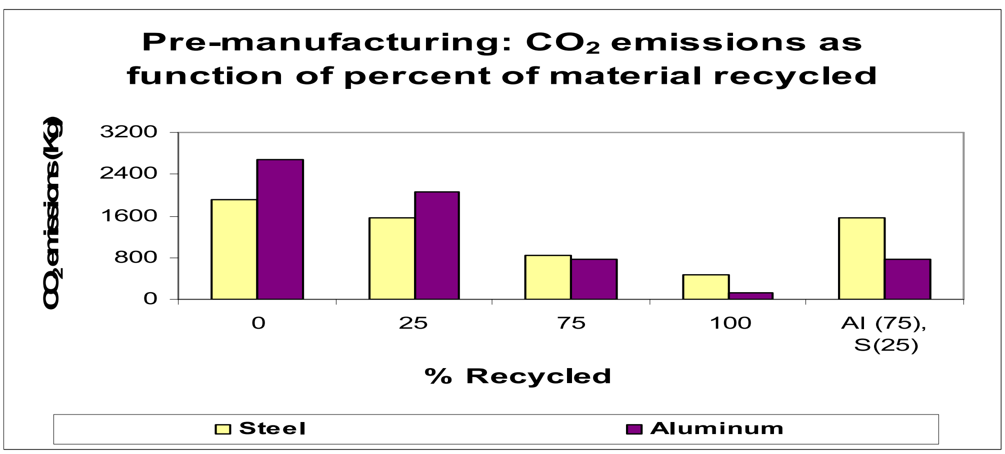


Figure 7: Carbon dioxide emissions as a function of recycled material content during the pre-manufacturing stage

For the manufacturing stage, the amounts of carbon dioxide emissions are quite similar (19.5 kg CO_2 emissions for manufacturing aluminum BIW structure and 18.6 kg CO_2 emissions for manufacturing steel BIW structure) while the manufacturing processes are assumed to be different.

Figure 8 shows the carbon dioxide emissions in all four life-cycle stages, for three different years, for the case of using zero percent recycled materials.

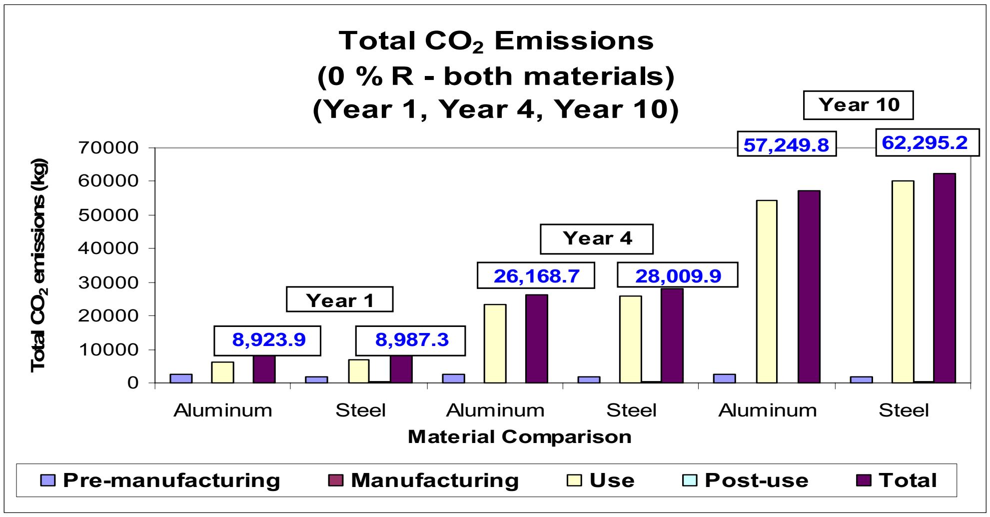


Figure 8: Total carbon dioxide emissions breakdown (0 % R both materials)

Even though the production of virgin aluminum is highly energy-intensive, it takes only one year of vehicle usage for aluminum to offset the carbon dioxide emission disadvantage from the pre-manufacturing stage, as a result of fuel consumption improvement. Figure 9 shows the carbon dioxide emissions for three different years for the case scenario in which aluminum has 75 percent material recycled content and steel has 25 percent material recycled content.

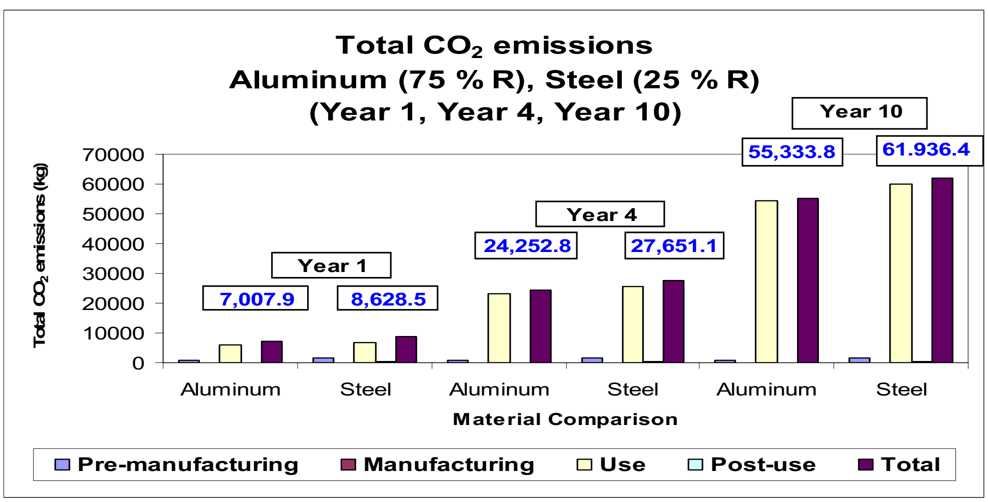


Figure 9: Total carbon dioxide emissions breakdown (Al. 75 % R; steel 25 % R

Fuel efficiency and energy savings from the use of recycled materials reduce dramatically the total amount of carbon dioxide generated by aluminum BIW structure over the entire life-cycle. The carbon dioxide emissions for aluminum BIW structure are about 8 percent lower than those for steel BIW structure after only one year of vehicle usage.

Summary and Future work

This study considers material-substitution as a means to achieve weight reduction, and the shows its benefits by considering the entire life-cycle of the vehicle, from fabrication of raw materials to the final disposal. This work highlights the advantage of using aluminum in auto body structures, from both economical and environmental points of view by using a case study at a single-product level. Reducing the weight of the vehicle has a significant effect upon its lifetime monetary cost, since the cost at the "Use" stage presently constitutes a dominant portion of the overall cost. As the real gasoline price increases and vehicle life is extended, the light weight issue becomes even more important. Previous research has demonstrated the cost advantage of producing automotive components from virgin steel. The other two stages (use and post-use) were not considered significant for computing the total life-cycle cost, since the gas price was considered to be low and recycling facilities for metals were not very well developed [3]. Considering zero percent recycled content both materials, the initial fabrication and manufacturing cost advantage for steel structure is offset by the lower costs for gasoline, and the higher metal scrap value for aluminum structure in the use and post-use stages. This model shows that it takes 9 years or 122,460 miles, at a gas price of $2.53 per gallon for aluminum structured vehicle to offset the total cost for steel structured vehicle. As the gas price increases, at a value of $2.76, the total cost for aluminum structured vehicle ($18,355) becomes lower than the total cost for steel structured vehicle ($18,490). Furthermore, increasing the content of material recycled to 25 percent for both materials, the number of years the aluminum BIW needs to offset the total costs encountered by steel BIW drops to 7. It is shown that after 97,340 miles, at a gas price of $2.76 per gallon, aluminum structured vehicle offsets the total cost of steel structured vehicle. For 75 percent both material recycled, it takes only 4 years or 57,970 miles at a gas price of $2.66 for aluminum structure to offset the total cost for steel structure. Under the most likely case scenario, (aluminum 75 percent and steel 25 percent recycled), the model shows that after 3 years or 43,720 miles at a gas price of $2.76 per gallon, aluminum BIW structure offsets the total costs of steel BIW structure as shown in Table 5.

Table 5: Total cost breakdown for (aluminum 75%, steel 25 % material recycled)

Stage	Aluminum cost ($)	Steel Cost ($)
Pre-manufacturing	559.3	398.4
Manufacturing	1,614.8	1,097.5
Use	5,484.8	6,033.3
Post-use	163.2	33.8
Total Cost	7,495.7	7,496.05

Figure 10 shows the total ownership cost breakdown encountered by both materials during each stage, after three years, at a gas price of $ 2.76.

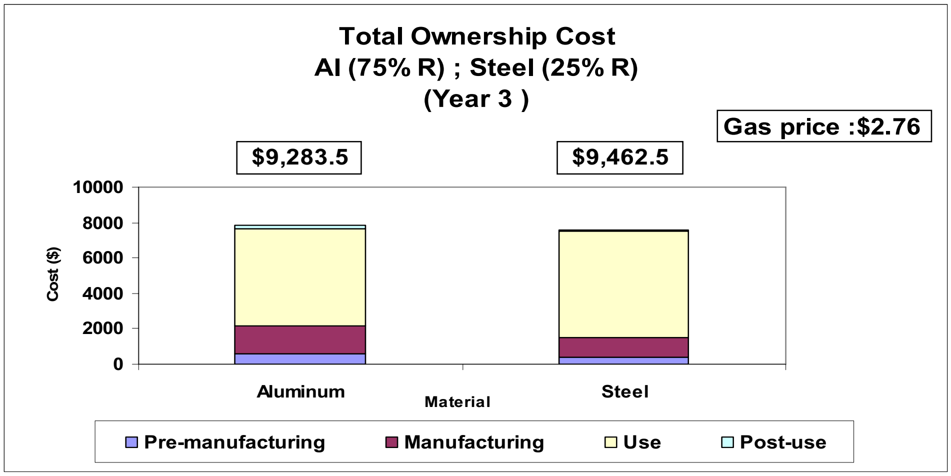


Figure 10: Total ownership cost

Regarding carbon dioxide emissions, the model shows the benefit of using lighter materials in the body construction of vehicles. Figure 11 illustrates the total carbon dioxide emissions, over the vehicle's life-cycle considering that both are virgin materials. Despite the emission disadvantage from the pre-manufacturing stage, it is found that only one year or 15,220 mile driven, needs for aluminum BIW structure to emit less carbon dioxide than the steel counterpart.

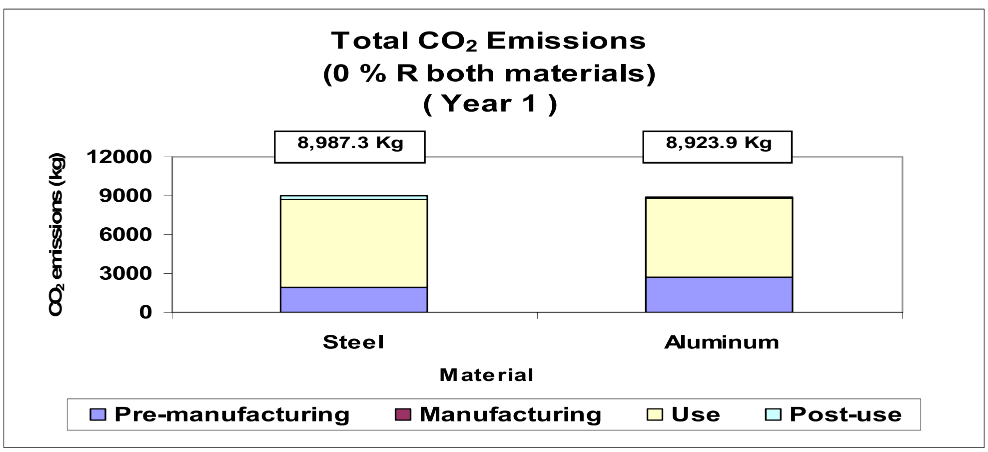


Figure 11: Total CO_2 emissions (both are virgin materials)

The energy savings from the recycled steel are not as dramatic as the energy savings from the recycled aluminum. The amount of carbon dioxide generated in producing the steel sheet with increased content of material recycled is not so drastically low, as that of the amount of carbon dioxide generated in producing the aluminum sheet with increased content of recycled material. Using increased content of aluminum recycled material in the vehicle's body, which dramatically reduces the amount of carbon dioxide generated in the process of making virgin aluminum, aluminum BIW structure is proven to emit about 7 percent less carbon dioxide than what steel BIW structure does emit, after only one year of vehicle usage. As the vehicle continues to "age", the carbon dioxide savings increase, and after ten years, there will be about 11 percent carbon dioxide emissions savings from the use of recycled aluminum in the vehicle's body structure (Figure 12).

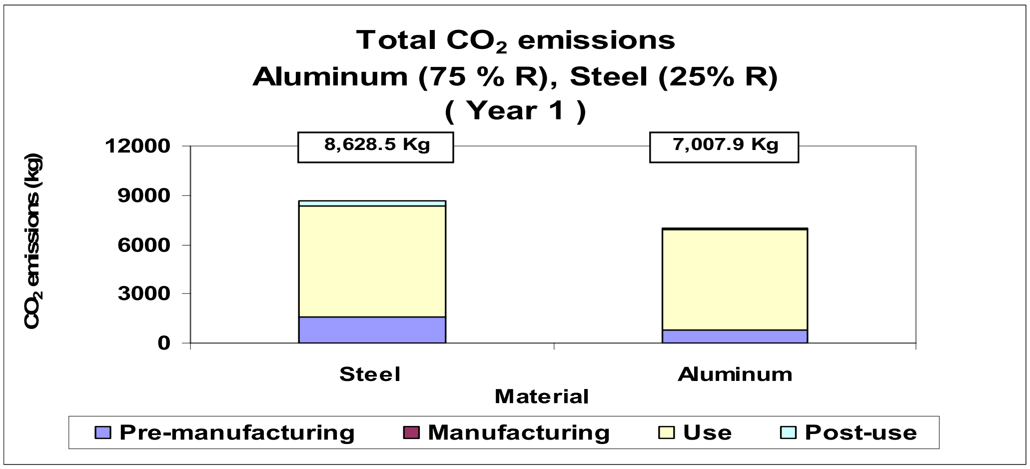


Figure 12: Total carbon dioxide emissions (Aluminum 75 % R, Steel 25 % R)

Based on these findings, and from the economical and environmental benefits of using both materials, future work should be focused on determining the right combination of these two materials in automotive industry. This would help to reduce total costs and greenhouse gas emissions over the life-cycle of the vehicle and to improve the safety and performance. Since take-back options are fast becoming an inevitable and unavoidable for car makers, it would be essential to quantify and estimate the total life-cycle cost encountered by the vehicles by considering two options: reuse of parts, and the use of recycled materials.

References:

[1] Stodolsky, F., A. Vyas, R. Cuenca, and L. Gaines, "Life-Cycle Energy Savings Potential from Aluminum-Intensive Vehicles", *SAE 1995 Total Life Cycle Conference and Exposition,* Vienna, Austria (October 16 – 19, 1995).

[2] Linda Gaines and Roy Cuenca, "Operation of an Aluminum-Intensive Vehicle: Report on a Six-Year Project", Center for Transportation Research, Argonne National Laboratory, 1994.

[3] Helen N. Han, Joel P. Clark, "Lifetime Costing of the Body-in-Whites: Steel vs. Aluminum", *JOM,* May 1995.

[4] Fridlyander, I.N., V.G. Sister, O.E. Grushko, V.V. Berstenev, L.M. Sheveleva and L.A. Ivanova, “Aluminum Alloys: Promising Materials in the Automotive Industry”, *Metal Science and Heat Treatment,* September 2002, pp. 3-9.

[5] Frank Field, Randolph Kirchain and Joel P. Clark, “Life-Cycle Assessment and Temporal Distributions of Emissions”, *Journal of Industrial Ecology,* Volume 4, Number 2, 2001.

[6] Anish Kelkar, Richard Roth, and Joel P. Clark, “Automotive Bodies: Can Aluminum be an Economical Alternative to Steel?”, *JOM* (August 2001), pp. 28-32.

[7] Sujit Das, “The Life-Cycle Impacts of Aluminum Body-in-White Automotive Material”, *JOM* (August 2000), pp. 41-44.

[8] Jeff R. Dieffenbach and Anthony E. Mascarin, “Body-in-White Material Systems: A Life-Cycle Cost Comparison”, *JOM* , June 1993.

[9] Hadley, S.W., Das, S., Miller, J. W., “Aluminum R&D for Automotive Uses and the Department of Energy’s Role”, Oak Ridge National Laboratory, March 2000.

[10] American Iron and Steel Institute (AISI), Steel Recycling Institute,” Recycling Scrapped Automobiles”, http://www.recycle-steel.org/

[11] Helen N. Han, “The Environmental Impact of Steel and Aluminum Body-in-Whites”, *JOM,* February 1996.

[12] U.S. Environmental Protection Agency, “Emission Facts: Average annual Emissions and Fuel Consumption for Passenger Cars and Light trucks”, Office of Transportation and Air Quality, April 2000.

[13] The Aluminum Association, Inc., Automotive Aluminum, “Recyclability and Scrap value”, http://www.aluminum.org/.

[14] Adam Gesing, and Richard Wolanski, “Recycling Light Metals from End-of-Life Vehicles”, *JOM,* November 2001.

Attachment 5

STATE OF CALIFORNIA
AIR RESOURCES BOARD

PUBLIC HEARING TO CONSIDER THE ADOPTION OF A PROPOSED REGULATION FOR IN-USE OFF-ROAD DIESEL MACHINES	))))	Agenda Item: 07-5-6 January 4, 2008

<u>AFFIDAVIT OF JEB STUART</u>

I, Joseph "Jeb" Stuart, hereby declare and state as follows:

1. I am over the age of 18 and otherwise competent to testify to the matters contained in this affidavit.

2. I served as Executive Officer of the South Coast Air Quality Management District (SCAQMD—Los Angeles, Orange, Riverside and San Bernardino counties) for ten years following its inception in 1976. During that time, I was directly involved in designing and implementing cost-effective control strategies for lowering ozone in the most heavily polluted air basin in the country.

3. During the 21 years following my term, the SCAQMD has experienced a dramatic reduction in hydrocarbon and nitrogen oxide emissions, effectively eliminating Stage one and Stage two ozone episodes and making daily ozone standard violations the exception to the rule. Modeling results show that the ozone reductions that have taken place in the Southern California since 1987 are mostly due to volatile organic compound (VOC) emissions reductions, and not nitrogen oxides (NOx).

4. During these years of overall air quality improvement in California, however, weekend ozone levels have remained significantly above weekday ozone levels. In fact, the weekend/weekday ozone gap continues to widen in California when compared to earlier years. I understand that this weekend/weekday phenomena has been documented in other parts of the

county as well.

5. For example, at four air monitoring stations across the basin in 1999 and 2000 the average hourly ozone level on Saturdays was 28% higher than on midweek days and 50% higher on Sundays even though ozone forming emissions were much lower on weekends than weekdays.

6. This "weekend ozone effect" was comprehensively analyzed by a working group in 1999 and 2000 that was funded by the U.S. Department of Energy, the Coordinating Research Council and the California Air Resources Board. Among other things, the working group studied in detail six different hypotheses of the possible causes of elevated weekend ozone levels. Reports of the group's findings are online at http://www.arb.ca.gov/aqd/weekendeffect/weekendeffect.htm.

7. In summary, the working group concluded that lower concentrations of nitrogen oxides on weekend mornings leads to less nitric oxide inhibition of ozone formation during the early morning hours.

8. The working group's findings were confirmed by Blanchard and Tanenbaum in Southern California during the 1980-2000 period (see Blanchard, C.L.; Tanenbaum, S.J. Differences between Weekday and Weekend Air Pollutant Levels in Southern California; *J. Air & Waste Manage. Assoc.* 2003, *53* (7), 816-828) and by Fujita et al., who also observed during the 1981-2000 period that lower emissions of nitrogen oxides on weekend mornings – along with a higher nitrogen dioxide/nitrogen oxides ratio on weekends compared to weekdays – allows ozone to form one hour earlier than on weekdays (see Fujita, E.M.; Stockwell, W.R.; Campbell, D.E.; Keislar, R.E.; Lawson, D.R. Evolution of the Magnitude and Spatial Extent of the Weekend Ozone Effect in California's South Coast Air Basin, 1981–2000; *J. Air & Waste*

Manage. Assoc. 2003, *53* (7), 802-815).

9. In addition, emission inventory studies of point, area and mobile sources in Southern California show that on-road mobile sources are the largest single category of ozone precursors producing 49%, 62% and 80% of the average daily volatile organic compounds, nitrogen oxides and carbon monoxide emissions, respectively (see Chinkin, L.R.; Coe, D.L.; Funk, T.H.; Hafner, H.H.; Roberts, P.T.; Ryan, P.A.; Lawson, D.R. Weekday versus Weekend Activity Patterns for Ozone Precursor Emissions in California's South Coast Air Basin; *J. Air & Waste Manage. Assoc.* 2003, *53* (7), 829-843).

10. Caltrans traffic counts obtained from sensors embedded in Southern California freeways confirm that truck and bus traffic decreases by as much as 80% on weekends and total traffic volumes were about 25% lower on weekends.

11. These and other related papers by eminent scholars support the contention that reductions in emissions of nitrogen oxides will result in higher ozone levels in California's urban areas, where the majority of the State's population resides.

12. This finding raises serious questions about the wisdom of spending several billion dollars on further nitrogen oxide reductions, as required by the recently adopted California Air Resources Board (CARB) off-road regulation.

13. The CARB off-road rule, adopted on July 26, 2007, will progressively require owners to use lower pollutant emitting off-road engines, commencing in 2010 for larger owners and in 2015 for smaller owners. Based on past trends, other states are expected to "opt-in" to CARB's rule.

14. The ultimate cost of this California program, estimated at $3 billion by regulators and $12 billion by the construction industry, will probably result in the takeover of most family

owned construction businesses by national and international corporations with an associated increase in the cost and a reduction in the availability of home remodeling and household repair services.

15. The weekend ozone effect studies provide a strong basis for concluding that further NOx reduction under the CARB off-road regulation will most likely cause ozone formation to worsen on weekends and on weekdays and generate more negative health effects than reducing volatile organic compounds.

16. To fully assess the available and feasible alternatives, CARB should consider more cost-effective measures to reduce ozone levels, such as further reductions in emissions of volatile organic compounds.

17. For instance, 75% to 90% of ambient VOC concentrations in the SCAB are produced by automobile exhaust and gasoline-related emissions, with the majority of those on-road emissions being produced by a small fraction of the vehicles. This observation was first reported to CARB by Wayne and Horie in their 1983 report titled "Evaluation of CARB's In-Use Vehicle Surveillance Program" (CARB Contract A2-043-32), and has been corroborated by several other on-road studies and surveys conducted over the past 24-year period by CARB, BAR, and other researchers.

18. If some of these billions could instead be used to repair or replace high VOC-emitting vehicles in urban and downwind areas, ozone precursors would be greatly reduced and ambient ozone levels will be brought into attainment for less money and with greater confidence in the results. Also, it would not shut down most of the family-owned construction businesses in California and subsequent laying off of their employees.

19. I have personal knowledge of the foregoing and am competent to testify to it before the Air Resources Board or at trial.

20. I certify under penalty of perjury under the laws of the State of California that the foregoing is true and correct. Executed on this 20th day of December 2007, at Newport Beach, California.

Jeb Stuart

Jeb Stuart

Attachment 6

Forum invites authors to share their opinions on environmental issues with *EM* readers. Opinions expressed in Forum are those of the author(s), and do not reflect official A&WMA policy. *EM* encourages your participation by either responding directly to this Forum or addressing another issue of interest to you.

The Weekend Ozone Effect—The Weekly Ambient Emissions Control Experiment

by Douglas R. Lawson

Despite large reductions of hydrocarbons and nitrogen oxide emissions on weekends, weekend ozone levels are nearly identical to or higher than weekday ozone levels in many U.S. urban locations. The results from the study described in this article can be used to help air quality managers in designing effective ozone control strategies.

For more than 35 years, weekend ozone (O_3) levels in the California South Coast (Los Angeles) Air Basin (SoCAB) have been nearly as high as or even higher than on weekdays.[1,2] This observation is counterintuitive because weekend emissions of all O_3 precursors (i.e., volatile organic compounds [VOCs], carbon monoxide [CO], and oxides of nitrogen [NO_x]) are much lower than on weekdays. In California, people typically spend somewhat less than 100 minutes per day outdoors on weekdays, compared with 129 minutes and 138 minutes on Saturdays and Sundays, respectively, so their exposure to elevated O_3 levels on weekends is significantly compounded when compared with weekday exposures.[3] During the 1990s, O_3 air quality improved dramatically in the SoCAB, but the weekday/weekend (WD/WE) O_3 gap widened compared with earlier years.[4] In 1999 and 2000, at four SoCAB O_3-monitoring locations across the region (i.e., Los Angeles–N. Main, Pico Rivera, Azusa, and Riverside), the average hourly O_3 on Saturdays was 28% higher than on midweek days and 50% higher on Sundays.[4] The weekend O_3 maxima in the Los Angeles area raise challenging control policy questions regarding which strategies would be most efficient and least costly to reduce high weekend O_3 levels.

The so-called "weekend ozone effect" provides air quality managers and scientists with the opportunity to make empirical observations of the kind that are important in testing hypotheses by asking "What if?" questions regarding emissions reductions that are needed to reduce ambient O_3 levels. Such opportunities are seldom available using ambient data concerning how the atmosphere actually responds to changes in emissions, because most air quality regulations provide only small incremental benefits and take effect over long periods of time. Beginning in 1999, several groups interested in the weekend ozone effect formed a working group to coordinate research efforts and began a comprehensive, coordinated program of data analysis, emissions inventory development, ambient field study experiments, and air quality simulation modeling to study the weekend ozone effect in the SoCAB and other locations. This effort, which was funded by the U.S. Department of Energy's (DOE) Office of FreedomCAR and Vehicle Technologies (through the National Renewable Energy Laboratory), the Coordinating Research Council (CRC), and the California Air Resources Board (CARB), has been conducted in a collaborative manner. Reports from the program can be found at CARB's Web site (*www.arb.ca.gov/aqd/weekendeffect/weekendeffect.htm*). A number of related papers are published in the July 2003 issue of the *Journal of the Air & Waste Management Association*. This article summarizes results from the studies funded by DOE and CRC. (*Editor's Note:* In this article, the term VOC is used to represent volatile organic compounds or non-methane hydrocarbons. In California, VOC emissions also are characterized as reactive organic gases [ROGs], especially in emissions inventories. In keeping with convention, inventory data in this article are reported as ROG; ambient data as VOC.)

At the beginning of the study, the working group formulated six hypotheses that might explain the causes of elevated weekend O_3 levels in the SoCAB. The six hypotheses are

1. **NO_x reduction —** Lower concentrations of NO_x on weekend mornings leads to less NO_x inhibition of O_3 formation:
   (a) O_3 accumulation begins earlier on weekends because less nitric oxide (NO) is emitted, resulting in less titration of O_3 with NO (by the reaction $NO + O_3 \rightarrow NO_2 + O_2$), and there is less removal of hydroxyl radicals because less nitrogen dioxide (NO_2) is present (by the reaction $NO_2 + OH \rightarrow HNO_3$; radical concentrations are necessary to begin and sustain O_3 formation);

(b) O_3 accumulation rates are higher on weekends due to an increase in VOC/NO_x ratios and higher radical concentrations, which cause more efficient O_3 formation.

2. **NO_x emissions timing (NO_x "boost")** — NO_x emitted later in the day on weekends into an aged photochemical system causes those emissions to produce O_3 more efficiently compared to NO_x emitted earlier on weekdays.
3. **Pollutant carryover near the ground** — Greater carryover of precursor emissions due to increased vehicle activity on Friday and Saturday evenings results in increased O_3 formation on weekend mornings.
4. **Pollutant carryover aloft** — Carryover of aged pollutants from aloft during weekends has a greater influence on weekend mornings due to lower emissions of NO_x.
5. **Increased weekend VOC emissions** — Increased VOC emissions from the use of lawn and garden equipment, recreational vehicles, backyard barbecues, and household solvents on weekends produce higher weekend O_3 concentrations.
6. **Increased photolysis and O_3 formation due to decreased emissions of fine particles** — Lower particulate matter (PM) concentrations during weekends increase radiation available for photolysis, thus increasing the rate of O_3 formation compared to weekdays.

The research program addressed each of these hypotheses.

ANALYSIS OF AMBIENT AIR QUALITY DATA

Blanchard and Tanenbaum[5] evaluated the effects of VOC and NO_x emissions reductions on ambient WD/WE O_3 levels in southern California during the 1980–2000 period. Of 78 southern California monitoring sites in five air basins (South Coast, South Central Coast, San Diego, Mojave, and Salton Sea), 28 sites had statistically significant higher Sunday O_3 levels, while 49 of the remaining 50 sites showed no statistically significant differences between mean weekday and Sunday O_3 concentrations, despite much lower weekend O_3 precursor emissions (see Figure 1). Average Sunday NO_x and VOC concentrations at all monitoring sites were 25%–41% and 16%–30% lower than on weekdays, respectively. Statistically significant lower ambient CO also was measured at 42 of 47 sites on Saturdays and 45 of 47 sites on Sundays, with CO levels averaging 0%–17% lower on Saturdays and 12%–32% lower on Sundays compared with weekdays.

Fujita et al.[4] examined ambient O_3 and precursor data in the SoCAB during the 1981–2000 period to formulate hypotheses to be tested in the field study. They observed that lower emissions of NO on weekend mornings, along with a higher NO_2/NO_x ratio on weekends compared with weekdays, allows O_3 to form approximately one hour earlier on weekends compared with weekdays. This is shown in Figure 2 using 1995 monitoring data for the Azusa monitoring site, which is representative of other SoCAB monitoring sites. The NO/O_3 crossover point (i.e., when O_3 concentrations equal NO, the time at which O_3 inhibition or titration by NO is overtaken by more rapid formation of O_3) occurs one hour earlier on weekends relative to weekdays. In addition to an earlier start in O_3 formation, Fujita et al. observed that VOC/NO_x ratios are higher on weekends, as a result of greater NO_x reductions relative to VOC reductions, and that higher VOC/NO_x weekend ratios produce a more photochemically reactive mixture than on weekdays. This produces a more rapid rate of weekend O_3 formation, noted by the slope of the O_3 formation line during the O_3 accumulation period, as compared with weekdays (see Figure 2). Their analyses also showed that average NO concentrations at four SoCAB monitoring sites were 39% and 65% lower on Saturdays and Sundays, respectively, than average midweek NO values.

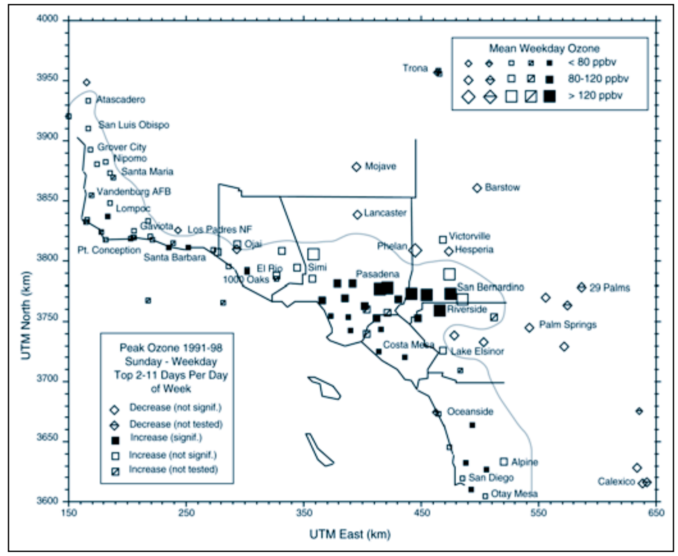


Figure 1. Comparison of mean Sunday with mean weekday peak O_3 based on the top 2–11 days for each day of the week during 1991–1998. Sites marked as increasing had higher mean Sunday peak O_3. The irregular line delineates an approximate transition between higher mean Sunday O_3 and higher mean weekday O_3.[5]

EMISSIONS INVENTORY ACTIVITIES

When this program began, there was no available emissions inventory for weekends for southern California from either CARB or the South Coast Air Quality Management District (SCAQMD). Chinkin et al.[6] collected emissions activity data for mobile, area, and point sources throughout the SoCAB during the study period, with the objective of estimating emissions that result from changes in emissions activities by day of week. CARB's estimated average summertime 2000 weekday emissions for the SoCAB (as of December 2001) are given in Table 1. According to the inventory, on-road mobile sources

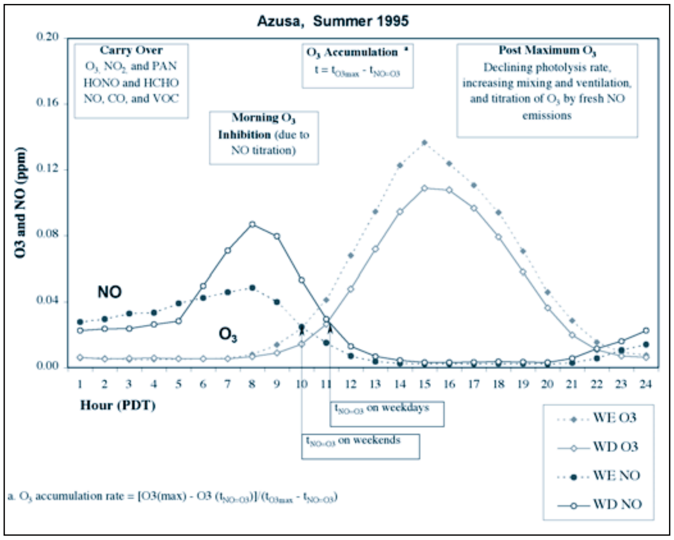


Figure 2. Average summer 1995 diurnal variations of O_3 and nitric oxide at Azusa during the weekday and weekend. The morning crossover ($t_{NO=O3}$), when morning inhibition of O_3 ends and O_3 accumulation begins, takes places approximately one hour earlier on weekends than on weekdays.[4]

are the largest single category for O_3 precursors, producing 49%, 62%, and 80% of the average daily ROG, NO_x, and CO emissions, respectively (on-road mobile emissions estimates were produced with CARB's mobile source model EMFAC2000 Version 2.02). Because the mobile source category is the largest single contributor to O_3 precursors, emphasis was placed on understanding WD/WE differences in mobile source activity in the SoCAB.

Using traffic counts obtained by Caltrans Weigh-In-Motion (WIM) sensors embedded in southern California freeways, Chinkin et al. reported that truck and bus traffic decreased by as much as 80% on weekends. Traffic data acquired with pneumatic sensors on 10 surface streets during the study showed that traffic volumes were 15%–30% lower on weekends and peaked around midday (with the peak occurring approximately one hour later on Sundays than on Saturdays), as opposed to the two modes that normally occur on weekdays during the morning and afternoon rush hours.

According to Table 1, area-wide and residential emissions sources produce 35% of ROG and 10% of NO_x emissions in the SoCAB. To provide WD/WE data from these source categories, surveys were conducted by mail and telephone interviews and were centered in 4-km by 4-km neighborhoods surrounding four air quality monitoring sites used during the field study (i.e., Los Angeles–N. Main, Pico Rivera, Azusa, and Industry Hills). A total of 450 households, 131 businesses, and 151 lawn and garden maintenance companies were surveyed.[6]

Table 1. Estimated average summertime weekday emissions for 2000 in the SoCAB (t/day).[6]

Source Category	ROG	NO_x	CO	PM_{10}
Stationary and Area Sources				
Fuel Combustion	11.6	87.3	42.7	7.8
Waste Disposal	2.6	1.9	0.9	0.4
Cleaning and Surface Coatings (industrial)	137.1	0	0	0.1
Petroleum Production and Marketing	36.6	4.1	4.8	1.3
Industrial Processes	22.5	10.5	5.8	13
Solvent Evaporation (consumer)	182.1	0	0	0
Misc. Processes (residential fuel combustion, road dust)	16.4	24.3	82.8	283.9
Total, Stationary, and Area Sources	**408.9**	**128.1**	**137**	**306.5**
On-Road Mobile Sources				
Passenger Cars	323	247	2990	9
Light- and Medium-Duty Trucks	160	192	1896	8
Light-, Medium-, and Heavy-Duty Trucks (gasoline)	46	56	622	6.3
Light-, Medium-, and Heavy-Duty Trucks (diesel)	12.5	227	62.3	8.1
Other On-Road Mobile	10.3	1.4	106	2.4
Off-Road Mobile Sources	154.6	313.4	1250.3	19.9
Total On- and Off-Road Mobile Sources	**706.4**	**1036.8**	**6926.6**	**53.7**
Total (all anthropogenic categories)	**1115.3**	**1164.9**	**7063.6**	**360.2**
Total (all biogenic categories)[a]	**125**	**–**	**–**	**–**

[a]Current estimates of biogenic hydrocarbon emissions are uncertain.

The residential survey showed that barbeques, fireplaces, fuel cans, lawn and garden equipment, and garden chemicals were used 40%–140% more frequently on weekends than on weekdays. Use of paints, solvents, and personal care products varied less than 25% by day of week. The business survey showed activity levels declining by 70% and 79% on Saturdays and Sundays, respectively, as compared with weekdays. Commercial lawn and garden services reduced their activity by 92% and 96% on Saturdays and Sundays, respectively. Lawn and garden equipment produce only 2% of ROG and 0.2% of NO_x emissions on Saturdays, and 1% of ROG and 0.1% of NO_x emissions on Sundays. Mobile sources are by far the largest contributor to O_3 precursors, and the source category where WD/WE emissions change most substantially. Construction equipment usage (the largest source of off-road NO_x emissions) was not surveyed during this study. Instead, those emissions were estimated and scaled according to changes in small business activity.

According to the SoCAB emissions inventory (see Table 1), stationary and area-wide sources contribute approximately 10% of the total daily NO_x. Continuous emissions monitoring (CEM) data from point sources for June–August 1999 and 2000 account for approximately three-fourths of the stationary source NO_x emissions in the SoCAB. CEM data show NO_x emissions reductions of 13%–25% on Fridays, Saturdays, and Sundays, relative to Monday through Thursday.

The traffic counts, surveys, and stationary source data provide day-of-week estimates for NO_x and ROG emissions for the SoCAB in the year 2000 and are shown in Figure 3.[6] Overall, emissions reductions on summer weekends in the SoCAB are estimated at 12%–18% for ROG and 35%–41% for NO_x on Saturdays and Sundays. These estimated weekend reductions of ROG and NO_x correspond well with the observed ambient concentration declines on weekends.[5] The relative decreases in O_3 precursor emissions on weekends are greater for NO_x than they are for ROG. This results in higher hydrocarbon-to-NO_x ratios on weekends, thereby producing a more reactive photochemical mix of pollutants. This more reactive mix is responsible for a rapid increase in O_3 formation on weekends relative to weekdays, as shown in Figure 2.

AMBIENT FIELD STUDY

A nine-day field study was conducted in the SoCAB from September 30 through October 8, 2000, to examine relationships between emissions and pollutant species responsible for the

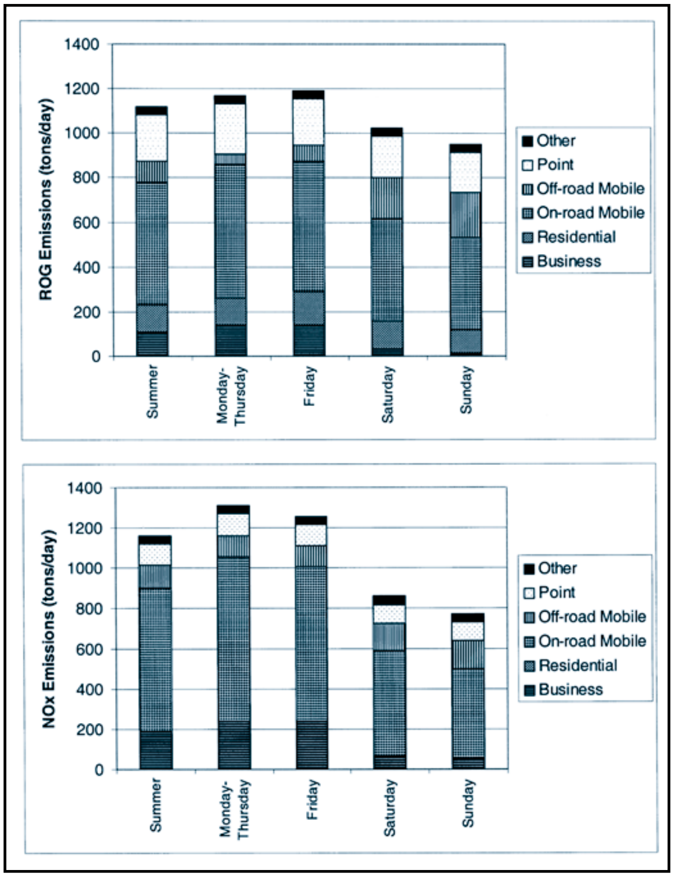


Figure 3. Estimated day-of-week 2000 SoCAB emissions inventory after applying emissions activity scaling factors.[6]

weekend ozone effect.[7] The study spanned two weekends with weekday sampling between the weekends. In addition to acquiring data at fixed ambient SCAQMD sites, extensive on-road monitoring of a variety of pollutants, including CO, NO, black particulate carbon, and speciated hydrocarbons, was performed beginning at 2:00 a.m. PDT and ending at 12:00 p.m. PDT on each study day.

Fujita et al.[7] estimated source contributions to ambient hydrocarbons using the Chemical Mass Balance (CMB) model. Source profiles of fresh freeway gasoline exhaust (alongside the Pasadena freeway, which prohibits truck traffic), heavy-duty diesel emissions (downwind of a truck stop), and whole gasoline samples (five brands, two grades each) were used along with previously established profiles for surface coatings, consumer products, natural gas, liquefied petroleum gas, and isoprene. Motor vehicle exhaust and gasoline-related emissions were shown to be the dominant VOC sources in all samples, comprising 65%–85% of the total at the regional fixed monitoring sites. In contrast, gasoline exhaust and total mobile source emissions and petroleum marketing contribute 62% and 4%, respectively, according to the 2000 SoCAB emissions inventory. This discrepancy between observed gasoline-like emissions and those estimated by the emissions inventory has changed only slightly since the 1987 Southern California Air Quality Study.[8,9]

Multiple linear regression source apportionment of NO_x during the field study at the regional, fixed sampling sites used CO and black particulate carbon as markers for spark-ignition and compression-ignition engines, respectively.[7] This approach suggests that the proportions of NO_x associated with black carbon are approximately 55% on weekdays, and 34%–43% on weekends. These results are similar to WD/WE patterns in heavy-duty vehicle activity, as derived from fuel-based emissions estimates.

Chinkin et al.[6] evaluated spatial and temporal characteristics of ambient VOCs using speciated hydrocarbon data from eight SoCAB Photochemical Assessment Monitoring Stations (PAMS) network sites during 1998–2000. The PAMS monitors 56 hydrocarbon species, 2 carbonyl compounds, O_3, NO_x, and/or reactive oxidized nitrogen species, and meteorological data. The PAMS-measured hydrocarbons were highly correlated, with most species suggesting motor vehicle emissions as the single common source. Evaporative components from gasoline were a higher portion of total VOC during midday, when temperatures are highest, as compared with other parts of the day. The weight percent or composition of observed hydrocarbons did not show a statistically significant change by day of week, indicating that the relative contribution of different source types did not change much from weekdays to weekends. Total VOC concentrations were 10%–27% lower on Saturdays and 24%–27% lower on Sundays than on weekdays.

MODELING STUDIES

Yarwood et al.[10] used the Comprehensive Air-quality Model with extensions (CAMx) to study causes of WD/WE O_3 differences in the SoCAB for an August 3–7 episode from the 1997 Southern California Ozone Study. They estimated WD/WE emissions changes from currently available data because official government emissions inventories were not available from the California regulatory agencies. Using data available at the time, they estimated a 5% increase in Friday on-road mobile source NO_x emissions, a 27% decrease on Saturday, and a 37% decrease on Sunday, relative to Monday–Thursday emissions. Corresponding on-road mobile source VOC emissions increased by 8% on Friday, decreased by 8% on Saturday, and decreased by 15% on Sunday. Modeling only those changes in mobile source emissions to the total inventory explained the observed WD/WE O_3 differences very well.

Yarwood et al. showed that changes to the mass of emitted mobile NO_x emissions were the main cause of WD/WE O_3 differences rather than changes in the timing of mobile NO_x emissions (study Hypotheses 1 and 2). They also reported that the elevated weekend O_3 levels are caused by decreases in NO_x emissions, because O_3 formation is strongly VOC-sensitive throughout the SoCAB (i.e., the most effective O_3 reduction is through VOC reduction). Their modeling results indicated that carryover of precursors and/or O_3 is not a significant factor in explaining elevated weekend O_3 (study Hypotheses 3 and 4).

Finally, the Yarwood et al. modeling results and separate analyses by Fujita et al.[11] showed that decreases in ambient particles (i.e., notably less soot from fewer heavy-duty vehicles on the road on weekends) did not decrease solar radiation sufficiently to affect O_3 levels in the SoCAB (study Hypothesis 6).

Using a box model with detailed chemistry, Fujita et al.[4] illustrated why VOC control measures since 1987 in the SoCAB have been effective in reducing ambient O_3 levels. The change in ambient O_3 levels since 1987 was predicted by the model to be reduced from an hourly maximum of 200 parts per billion (ppb) to approximately 100 ppb in 2000, which agrees reasonably well with ambient observations. The current ambient levels of VOC and NO_x are in the VOC-sensitive portion of the O_3 isopleth (i.e., that portion of the model region where VOC/NO_x ratios are generally less than 10 and the most effective predicted O_3 reduction is through VOC emissions reduction), with VOC/NO_x ratios (6:00 a.m.–9:00 a.m. PDT) of 4.9 and 5.5 on Saturdays and Sundays, respectively, as compared with ratios of 3.7–3.9 on Tuesdays through Fridays. Since the 1987 Southern California Air Quality Study,[8,9] the ambient VOC/NO_x ratios have decreased by approximately 50%, implying that the SoCAB is even more VOC-sensitive now than in previous years. This analysis indicated that previous O_3 reductions in the SoCAB have been achieved more by VOC, rather than NO_x, emissions reductions.

The modeling results show that under current conditions in the urban regions of the SoCAB, NO_x reductions increase ambient O_3 levels. At current VOC levels, NO_x emissions would have to be reduced by approximately 90% from current weekend levels before O_3 reductions would be observed.[4,5] Until such NO_x reductions are obtained, compliance with the ambient air quality standards for O_3 would be delayed, and O_3 levels might even increase, dependent upon changes in VOC emissions. These conclusions are similar to those recently reported for California's Central Valley.[12]

THE WEEKEND EFFECT FOR OTHER POLLUTANTS

Decreases in NO_x emissions should lead to lower ambient levels of nitric acid (HNO_3) and PM nitrate. However, using data collected during the 1987 Southern California Air Quality Study, Fujita et al.[9] reported that inorganic PM nitrate was only a small percentage, on the order of 5%–10%, of the total measured nitrogenous pollutant burden in the SoCAB. A similar finding emerged from the 1996–1997 Northern Front Range Air Quality Study in Colorado.[13,14] These results suggest that the conversion of NO_x to PM nitrate, one of its reaction products, is highly nonlinear. Blanchard and Tanenbaum[5] showed that WD/WE comparisons of existing ambient SoCAB NO_x, PM nitrate, and HNO_3 data reveal surprising differences. Ambient NO_x concentrations at 15 of 16 SoCAB sites were statistically lower on weekends, but there were no corresponding significant changes in PM nitrate or HNO_3 (at locations where it was measured). Some monitoring sites showed a WD/WE decrease in PM nitrate, while others showed an increase. These empirical observations suggest a lack of responsiveness of HNO_3 and PM nitrate to the large decreases in NO_x emissions that take place between weekdays and weekends in the SoCAB. The potential lack of responsiveness of NO_x reaction products (HNO_3 and PM nitrate) to large weekend NO_x reductions in the SoCAB is now being investigated in studies funded by DOE and CRC, and results from those studies will be available in early 2004.

FUTURE OZONE EMISSIONS IN THE SOCAB

At the time the emissions inventory work was completed (December 2001), CARB was projecting nonbiogenic SoCAB weekday emissions in the year 2010 to be 811 and 756 t/day for ROG and NO_x, respectively. Chinkin et al.[6] estimated 12%–18% and 35%–41% ROG and NO_x emissions reductions on weekends, respectively, as compared with weekdays. Blanchard and Tanenbaum[5] reported 16%–30% and 25%–41% lower ambient VOC and NO_x levels on Sundays than on weekdays. Using the averages of these reductions and the weekday emissions data shown in Table 1, the estimated 2000 weekend nonbiogenic emission totals are 890 and 760 t/day for ROG and NO_x, respectively. Therefore, the projected 2010 weekday emissions estimates are not greatly different from current weekend ROG and NO_x emissions inventories. Presuming that NO_x reductions are the most important factor causing elevated weekend O_3 levels, these projected emissions changes suggest that attainment of the O_3 standard will be extremely difficult, and may in fact produce higher O_3 levels in the future.[6] Previous studies have raised considerable doubts regarding the accuracy of emissions inventories,[9] therefore any emissions projections must be viewed with caution.

OTHER CITIES

Recent studies by Altshuler et al.[15] and Marr and Harley[16] in northern and central California locations have described the weekend ozone effect in those portions of the state. Marr and Harley[17] also documented the expansion of the weekend ozone effect throughout California, and concluded that the growth was due to increased sensitivity of O_3 formation to VOC controls and larger decreases in NO_x emissions on weekends relative to VOC emissions. In fact, the weekend ozone effect is observed in other U.S. urban locations, including Denver,[18] Chicago, Philadelphia, and Atlanta. The WD/WE analyses for the latter three cities were conducted by Pun et al.[19] Data from that report for five Atlanta monitoring sites for the period 1995–1999 have been analyzed. For these Atlanta regional monitoring sites, the means of maximum hourly and 8-hr average O_3 concentrations were nearly identical between weekdays and weekends, but ambient NO_x was 19% and 34% lower on Saturdays and Sundays, respectively, than on weekdays.

Data from the Houston area[20] (nine monitoring sites) collected May through October for the period 1997–2001 show little change in ambient average O_3 by day of week (only 5 ppb range from the low to high day), with ambient peak hourly average NO_x levels dropping by 28% and 44% on Saturdays and Sundays, respectively, relative to weekdays. Ambient average O_3 data from eight monitoring sites in the Dallas/Ft. Worth area over the same time period are nearly identical by day of week: a range of 3 ppb over all days, with Friday and Saturday having the highest O_3 levels. However, the maximum NO_x hourly averages are 31% and 44% lower on Saturdays and Sundays, respectively, relative to weekdays. The ambient monitoring data for the Atlanta, Houston, and Dallas/Ft. Worth regions show little, if any, WD/WE O_3 differences, despite large decreases in ambient NO_x levels on weekends. Additional, detailed, and long-term VOC data are also needed in these and other urban locations to more fully evaluate WD/WE changes in VOC and NO_x emissions and their relationship to weekend O_3 formation.

Table 2. Hypotheses regarding the weekend ozone effect in the SoCAB.[4-7,10,11,18]

Hypothesis	Significance for Ozone Formation	Supported by Study Results	Confidence Level
1. Lower weekend NO_x emissions	Significant	Yes	High
2. NO_x emissions timing (NO_x "boost")	Insignificant	No	High
3. Pollutant carryover at ground level	Small	Yes	High
4. Pollutant carryover from aloft	Insignificant	No	Medium
5. Increased weekend VOC emissions	Small to insignificant	No	Medium
6. Increased photolysis due to decreased weekend PM emissions	Small to insignificant	No	Medium

OZONE IN DOWNWIND LOCATIONS

The highest O_3 levels in the United States are found in and downwind of urban areas. It is commonly thought that areas downwind of urban areas are NO_x-sensitive with respect to O_3 formation (i.e., areas that exhibit VOC/NO_x ratios greater than 10, where the most effective way to reduce O_3 is through NO_x emissions reductions). White et al.[21,22] examined O_3 and methylchloroform readings at rural locations 300 km downwind of Los Angeles during the mid-1980s, when methylchloroform served as a useful indicator of transported SoCAB emissions. They documented robust associations between downwind O_3 and methylchloroform, and between downwind O_3 and earlier upwind SoCAB O_3 levels. Although downwind methylchloroform concentrations exhibited clear Monday–Tuesday minima, lagging the weekend drop in upwind SoCAB emissions by a plausible transport time, "only modest" day-of-week differences were observed in associated O_3 concentrations, despite large NO_x and VOC weekend emissions reductions.[4] In this region, despite large weekend O_3 precursor reductions, there was little, if any, observable change in weekend O_3. Therefore, a closer examination of WD/WE differences in O_3 and its precursors is needed in isolated downwind areas, away from fresh emissions and confounding sources or influences, to fully understand the influence of upwind urban O_3 and its precursors on those areas.

OZONE AIR QUALITY MANAGEMENT

In 1983, Wayne and Horie[23] reported that the majority of tailpipe emissions from mobile sources come from a small percentage of the fleet (currently the majority of exhaust hydrocarbon emissions from light-duty vehicles come from approximately 5% of the fleet[24]). Results from this study suggest that the 75%–90% of ambient VOC concentrations in the SoCAB are produced by motor vehicle exhaust and gasoline-related emissions. If effective control strategies could be put in place to repair/remove high VOC-emitting vehicles from the road in urban and downwind regions, ambient O_3 and precursor levels in and downwind of those urban locations would be greatly reduced, and the ambient O_3 levels in those regions might be brought into attainment by this single control strategy.

STUDY SUMMARY

After all analyses were completed, the project's investigators evaluated the significance of each of the six study hypotheses in forming elevated weekend O_3, whether the study hypotheses were supported or contradicted by the program results, and the degree of certainty associated with each of the hypothesis conclusions. These results are given in Table 2.[11] Hypothesis testing using empirical observations, data analysis, and different modeling approaches suggested that decreased weekend NO_x emissions (study Hypothesis 1), resulting mostly from fewer trucks on the roads on weekends, was the largest single contributor to elevated weekend O_3 in the SoCAB. This conclusion was made with a high degree of confidence. Hypothesis 2, regarding increased NO_x emissions later in the day on weekends, was shown not to be significant for elevated O_3 formation and not supported by separate analyses by Fujita et al.[4] and Yarwood et al.[10] Pollutant carryover, either from ground-level (increased late weekend-night mobile source emissions; study Hypothesis 3) or aloft influences (Hypothesis 4), was suggested to be of small or insignificant importance for O_3 formation, with medium to high confidence.[4,6,10] The ambient data analysis and inventory results did not support Hypothesis 5, because those analyses showed ambient VOC concentrations and ROG emissions are lower on weekends.[4-7] Hypothesis 6 was also rejected as a result of two separate modeling studies.[10,11] Complete discussion of this hypothesis testing is presented in the papers published in the July 2003 issue of the *Journal of the Air & Waste Management Association*[4-7,10,18] and in Fujita et al.[11]

CONCLUSIONS

Ambient O_3 levels in many urban U.S. locations are nearly the same as or higher on weekends than on weekdays, despite large O_3 precursor weekend emissions reductions. In the urban Los Angeles area, average O_3 levels are 28% and 50% higher on Saturdays and Sundays, respectively, than on midweek days, while NO_x emissions are as much as 25%–40% lower. Because the SoCAB is generally VOC-sensitive with regard to O_3 formation, weekend O_3 would be even higher than it is, were it not for the concurrent 12%–30% VOC emissions reductions that take place on weekends. These findings are not unique to Los Angeles, and the weekend effect has been observed in other locations, including Chicago, Philadelphia, Atlanta, Houston, Dallas/Ft. Worth, and Denver.

On a finer scale, Saturday–Sunday emissions reductions can be considered analogous to an emissions control experiment. Light- and heavy-duty vehicle traffic patterns are similar between Saturdays and Sundays and much different from those on weekdays, but there is less light- and heavy-duty vehicle traffic on Sundays than on Saturdays. This Saturday–Sunday change would be similar, say, to a NO_x control regulation for mobile sources. The ambient data from the Los Angeles basin show that average O_3 levels are significantly higher on Sundays than on Saturdays.

Independent photochemical modeling approaches show that the O_3 reductions that have taken place in the SoCAB since 1987 are mostly due to VOC emissions reductions, and not NO_x. The models performed well in describing the weekend effect and were able to discriminate between likely and unlikely candidate hypotheses that describe the weekend ozone effect. Modeling results also suggest that at current VOC levels, NO_x emissions reductions as large as 80%–90% will be needed before the increasing effect of NO_x emissions reductions on ambient O_3 levels can be overcome.

Ambient O_3 levels in the SoCAB dropped significantly during the 1990s, but since 1999 the rate of decrease has slowed considerably.[25] CARB's 2010 emissions projections suggest that attainment of the O_3 standard, even by that date, will be very difficult, especially if additional NO_x controls are mandated. Using CARB's emissions projections, calculations suggest that weekday ambient O_3 levels in the SoCAB in 2010 might be similar to current weekend O_3 concentrations. Despite large reductions in NO_x weekend emissions, ambient concentrations of HNO_3 and PM nitrate concentrations do not change significantly in the SoCAB. The lack of responsiveness of HNO_3 and PM nitrate to large decreases of weekend NO_x emissions is being investigated in ongoing studies.

Analyses from this study suggest that weekend NO_x emissions reductions, as measured by ambient NO, might be significantly larger than estimates provided by standard inventory techniques. This discrepancy must be resolved, so that modelers will have reliable input regarding weekend emissions reductions. Additional studies also are needed downwind of urban locations, preferably in more isolated areas to avoid confounding influences, to understand how the large weekend emissions reductions in O_3 precursors in urban regions influence weekend O_3 levels in those downwind areas.

The results from this study allow decision-makers to ask "What if?" questions regarding whether VOC and/or NO_x reductions are more effective in reducing ambient O_3 levels at the most effective and lowest cost to society. Moreover, empirical observations collected during the course of this program permit modelers to evaluate the accuracy and reliability of air quality simulation models for O_3. With highest average O_3 being observed on weekends (or in some locations with weekend O_3 being nearly the same as on weekdays), emissions control strategies that include weekend emissions changes must be considered by regulatory agencies for planning purposes.

ACKNOWLEDGMENTS

The author thanks Dr. James Eberhardt of DOE's Office of FreedomCAR and Vehicle Technologies and CRC's Atmospheric Impacts and Committee and Real-World Vehicle Emissions and Emissions Modeling Group for providing collaborative financial support and technical direction for work cited in this article. The author also thanks CARB for coordinating the working group that provided guidance and input for the overall study. CARB is currently funding a major effort to collect additional data for development of weekend emissions inventories. The reports mentioned in this article have been reviewed by staff at CARB, the U.S. Environmental Protection Agency, and CRC technical members.

REFERENCES

1. Elkus, B.; Wilson, K.R. Photochemical Air Pollution: Weekend–Weekday Differences; *Atmos. Environ.* **1977**, *11*, 509-515.
2. Chock, D.P.; Pierson, D.M. *On the Weekday–Weekend Oxidant Differences in the California South Coast Air Basin*; General Motors Research Laboratories Research Publication GMR-2799; ENV #48; September 1978.
3. Robinson, J.P.; Godbey, G.; Jacobson, A.J. Time for Life: *The Surprising Ways Americans Use Their Time*; 2nd ed.; Pennsylvania State University Press, September 1999.
4. Fujita, E.M.; Stockwell, W.R.; Campbell, D.E.; Keislar, R.E.; Lawson, D.R. Evolution of the Magnitude and Spatial Extent of the Weekend Ozone Effect in California's South Coast Air Basin, 1981–2000; *J. Air & Waste Manage. Assoc.* **2003**, *53* (7), 802-815.
5. Blanchard, C.L.; Tanenbaum, S.J. Differences between Weekday and Weekend Air Pollutant Levels in Southern California; *J. Air & Waste Manage. Assoc.* **2003**, *53* (7), 816-828.
6. Chinkin, L.R.; Coe, D.L.; Funk, T.H.; Hafner, H.H.; Roberts, P.T.; Ryan, P.A.; Lawson, D.R. Weekday versus Weekend Activity Patterns for Ozone Precursor Emissions in California's South Coast Air Basin; *J. Air & Waste Manage. Assoc.* **2003**, *53* (7), 829-843.
7. Fujita, E.M.; Campbell, D.E.; Zielinska, B.; Sagebiel, J.C.; Bowen, J.L.; Goliff, W.S.; Stockwell, W.R.; Lawson, D.R.; Diurnal and Weekday Variations in the Source Contributions of Ozone Precursors in California's South Coast Air Basin; *J. Air & Waste Manage. Assoc.* **2003**, *53* (7), 844-863.
8. Lawson, D.R. The Southern California Air Quality Study; *J. Air & Waste Manage. Assoc.* **1990**, *40*, 156-165.
9. Fujita, E.M.; Croes, B.E.; Bennett, C.L.; Lawson, D.R.; Lurmann, F.W.; Main, H.H. Comparison of Emission Inventory and Ambient Concentration Ratios of CO, NMOG, and NO_x in California's South Coast Air Basin; *J. Air & Waste Manage. Assoc.* **1992**, *42*, 264-276.
10. Yarwood, G.; Stoeckenius, T.E.; Heiken, J.G.; Dunker, A.M.; Modeling Weekday/Weekend Ozone Differences in the Los Angeles Region for 1997; *J. Air & Waste Manage. Assoc.* **2003**, *53* (7), 864-875.
11. Fujita, E.M.; Stockwell, W.R.; Campbell, D.E.; Chinkin, L.R.; Main, H.H.; Roberts, P.T. *Weekend/Weekday Ozone Observations in the South Coast Air Basin: Volume I—Executive Summary, Final Report.* Prepared for National Renewable Energy Laboratory, NREL Subcontracts ACI-0-29086-01 and ACI-0-29086-02, and the Coordinating Research Council Contract No. E-53, June 2002.
12. Reynolds, S.D.; Blanchard, C.L.; Ziman, S.D. Understanding the Effectiveness of Precursor Reductions in Lowering 8-Hr Ozone Concentrations; *J. Air & Waste Manage. Assoc.* **2003**, *53* (2), 195-205.
13. Watson, J.G.; Fujita, E.; Chow, J.C.; Zielinska, B.; Richards, L.W.; Neff, W.; Dietrich, D. *Northern Front Range Air Quality Study Final Report.* Prepared for Colorado State University, 1998.
14. Lawson, D.R.; Smith, R.E. *The Northern Front Range Air Quality Study, A Report to the Governor and General Assembly*; Colorado State University, December 1998.
15. Altshuler, S.L.; Arcado, T.D.; Lawson, D.R. Weekday versus Weekend Ambient Ozone Concentrations: Discussion and Hypotheses with Focus on Northern California; *J. Air & Waste Manage. Assoc.* **1995**, *45*, 967-972.
16. Marr, L.C.; Harley, R.A. Modeling the Effect of Weekday-Weekend Differences in Motor Vehicle Emissions on Photochemical Air Pollution in Central California, *Environ. Sci. Technol.* **2002**, *36*, 4099-4106.
17. Marr, L.C.; Harley, R.A. Spectral Analysis of Weekday–Weekend Differences in Ambient Ozone, Nitrogen Oxide, and Non-Methane Hydrocarbon Time Series in California; *Atmos. Environ.* **2002**, *36*, 2327-2335.
18. Reddy, P. *Ozone Alert Forecasting for the Denver Metro Area.* Presentation to the Denver Regional Air Quality Council, October 2002; available at http://raqc.org/ozone/Workshop/October%202,%202002/Pat%20Reddy.PDF.
19. Pun, B.K.; Seigneur, C.; White, W.; Day-of-the-Week Behavior of Atmospheric Ozone in Three U.S. Cities; *J. Air & Waste Manage. Assoc.* **2003**, *53* (7), 789-801.
20. Wharton, S.; McDowell, S. Personal communication, data provided by the Texas Commission on Environmental Quality, 2002.
21. White, W.H.; Macias, E.S.; Miller, D.F.; Schorran, D.E.; Hoffer, T.E. Regional Transport of the Urban Workweek: Methylchloroform Cycles in the Nevada-Arizona Desert; *Geophys. Res. Lett.* **1990**, *17*, 1081-1084.
22. White, W.H.; Macias, E.S.; Miller, D.F.; Schorran, D.E.; Hoffer, T.E.; Rogers, D.P. *Observations of Los Angeles Smog in Southern Nevada, in Tropospheric Ozone and the Environment*; Transaction No. 19, A&WMA Transaction Series, Pittsburgh, PA, 1991; 837-849.
23. Wayne, L.G.; Horie, Y. *Evaluation of CARB's In-Use Vehicle Surveillance Program*; California Air Resources Board Contract No. A2-043-32. Prepared by Pacific Environmental Services Inc. for California Air Resources Board, Sacramento, CA, 1983.
24. Pokharel, S.S.; Bishop, G.A.; Stedman, D.H. *On-Road Remote Sensing of Automobile Emissions in the Los Angeles Area: Year 3 (Riverside)*; Coordinating Research Council Project E-23-4; June 2002; available at http://www.crcao.com.
25. *South Coast Air Quality Management District Historic Ozone Air Quality Trends*; South Coast Air Quality Management District; available at http://www.aqmd.gov/smog/o3trend.html.

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Attachment 7

STATE OF CALIFORNIA
AIR RESOURCES BOARD

PUBLIC HEARING TO CONSIDER THE ADOPTION OF A PROPOSED REGULATION FOR IN-USE OFF-ROAD DIESEL MACHINES	))))	Agenda Item: 07-5-6

AFFIDAVIT OF LAWRENCE J. JOSEPH

I, Lawrence J. Joseph, hereby declare and state as follows:

1. I am over the age of 18, and I reside in McLean, Virginia.

2. I am an attorney representing the Associated General Contractors of America ("AGC") and the Construction Industry Air Quality Coalition ("CIAQC") in responding to the California Air Resources Board ("ARB") on in-use off-road diesel ("ORD") rulemaking. I am admitted to practice law in the District of Columbia and California.

3. In my capacity as an attorney, I obtained the following documents in email exchanges:

(a.) An email from ARB's Philip Loder to the California Alliance for Jobs' Judi Quan, in which Mr. Loder purports to represent the ARB Ombudsman's Office and advise her that "There will be a 15 day public comment period for these changes. You may also submit comments for the entire package during this 15 day period." I advised CIAQC and AGC that the California Administrative Procedure Act allowed ARB to consider comments on its entire rulemaking as part of its 15-day notice and, based on this email, that ARB apparently intended to do so under the APA or under alternate provisions of the California Environmental Quality Act ("CEQA"). CIAQC and AGC staff and members relied on the email's representation in preparing their comments for ARB.

(b.) In an email exchange between myself and ARB's Kim Heroy-Rogalski between October 29 and November 1, 2007, I requested a copy of ARB's search results from the Machinery Trader and Ritchie Brothers websites for February 24, 2007, listed as references in ARB's Independent Statement of Reasons, and Ms. Heroy-Rogalski provided copies of the ARB spreadsheets for that February 24, 2007, date (attached as Exhibit 1) and portable document format copies of the 440-page 2006 Machinery Trader output also referenced in ARB's supporting documents.

(c.) In a follow-up email on November 14, 2007, I asked Ms. Heroy-Rogalski whether ARB could provide the Ritchie Brothers (RB) data analogous to the Machinery Trader (MT) data that she had provided. In a reply email on November 16, 2007, Ms. Heroy-Rogalski indicated that she "checked with the staff who did the work, and we do not have such data," adding that "We only stored the summaries of RB that I already provided to you," by which she could only have meant the spreadsheets attached as Exhibit 1.

(d.) In an email dated July 31, 2007, to the Clerk of the Board, I requested an electronic copy of the Board Resolution approved on the in-use off-road diesel regulation at the hearing on July 26. In a reply email that same day, ARB's Lori Andreoni indicated that "the final resolution is currently being routed through our staff for review and approval," but she attached a copy of the proposed resolution handed out at the Board meeting and "note[d] that this version does not reflect any discussion or requested changes that took place at the meeting."

4. Because my clients' staff and their members advised me that they did not believe ARB's analysis of the market in used equipment, we attempted to get the supporting data from

ARB (see above) and, failing there, from Ritchie Brothers and Machinery Trader. By email dated December 6, 2007, Machinery Trader advised us that it would not provide any data to us, and by email dated January 3, 2008, Ritchie Brothers advised us that "it wasn't possible to go back in the past at a certain point to see how much was advertised." We therefore were unable to confirm the accuracy of ARB's analysis of sales on February 24, 2007. Ritchie Brothers did, however, confirm to us that its entire product line was listed on the Machinery Trader website circa February 24, 2007, although (at present) the decision to list or not list a particular Ritchie Brothers auction item is done on a case-by-case basis.

5. As an alternative to the specific date that ARB analyzed, we did manage to obtain from Ritchie Brothers aggregate data on from February 1 through March 15, 2007 (as well as the corresponding data for November 1 through December 15, 2007) for selected exemplars of small, inexpensive, high-turnover equipment and larger, expensive, low-turnover workhorse equipment. We also received calendar-year 2007 U.S. and California sales data for key exemplar equipment. Exhibits 2 and 3 represent relevant data that we received from Ritchie Brothers.

6. Before putting our request to Ritchie Brothers, our legal team convened a teleconference of industry experts to select representative equipment types and models for both our small-equipment and large-equipment categories. As part of that process, Michael Shaw of Perry-Shaw analyzed the ARB spreadsheet on Ritchie Brothers to determine whether ARB's used-equipment analysis included equipment (such as portable equipment on on-road equipment) not covered by the ORD rule (and in our view irrelevant here). His analysis of the ARB spreadsheet is attached as Exhibit 4.

7. For the same reasons that Mr. Shaw concludes that ARB's Ritchie Brothers analysis includes irrelevant portable and on-road equipment, ARB's Machinery Trader

spreadsheet also would include irrelevant data. Because ARB's Machinery Trader is broken down by manufacturer, rather than equipment type, however, we determined that we could not even guess at the relative amounts of relevant and irrelevant data.

8. On January 1, 2008, in my capacity as an attorney, I visited the website of the California Office of Planning and Research ("OPR") and queried the database of CEQA documents filed by ARB from January 2007 to that time. My search and results (attached as Exhibit 5) indicate that ARB has not filed its ORD rulemaking documents with OPR.

9. The length of the comment period on ARB's "15-day notice" has prejudiced AGC's and CIAQC's ability to prepare comments and supporting affidavits. In particular, and primarily because of the holidays between mid-December and the first week of January, some potential affiants were unavailable to complete affidavits that our legal team had commenced with them. In addition, we requested data from various sources even before the comment period began, but (as the period began to run) we downgraded our requests to help ensure that we received information before the comment period expired. For example, we had hoped to get data on used-equipment purchases and sales from Ritchie Brothers ("RB") in states that we would expect to opt into the NOx provisions of the revised ORD rule, but deferred making that request for fear that it would prevent our timely getting RB's data. Similarly, we limited our request for sales data on various "exemplar" models of equipment to ensure that we would obtain any RB data at all. As it is, we received RB data on January 3, 2008, at approximately noon, Eastern time. Our getting the information so close to the comment deadline prevented a complete analysis of the RB data.

10. I have personal knowledge of the foregoing and am competent to testify to it before the California Air Resources Board or at trial.

I certify under penalty of perjury under the laws of the State of California that the foregoing is true and correct. Executed on this 4th day of January 2008, at McLean, Virginia.

Lawrence J. Joseph

Joseph Affidavit, Ex. 1

Machinery Trader.com 2/24/2007

Equipment Manufacturer	Number fc	USA	CA	CA% of US
CATERPILLAR	19,371	12,830	1370	11%
DEERE	5,836	5,326	248	5%
KOMATSU	4,568	3,031	98	3%
CASE	3,064	2,669	166	6%
GENIE	3,064	2,997	150	5%
JLG	2,930	2,799	66	2%
BOBCAT	2,211	1,972	124	6%
VOLVO	1,702	1,100	44	4%
INGERSOLL-RAND	1,564	1,379	107	8%
HITACHI	1,379	791	51	6%
TEREX	1,234	1,098	88	8%
JCB	1,015	741	23	3%
NEW HOLLAND	898	853	37	4%
LULL	798	614		
SKY TRAK	791	609		
KOBELCO	752	579		
GROVE	589	454		
GRADALL	526	405		
BOMAG	498	383		
GEHL	495	381		
LINK-BELT	447	344		
VERMEER	412	317		
LIEBHERR	407	313		
DYNAPAC	397	306		
DITCH WITCH	388	299		
TAKEUCHI	380	293		
HYSTER	350	270		
YANMAR	324	249		
HYUNDAI	316	243		
DAEWOO	279	215		
KAWASAKI	279	215		
FORD	272	209		
DRESSER	236	182		
TIMBERJACK	233	179		
CEDARAPIDS	214	165		
WACKER	201	155		
SNORKEL	197	152		
MULTIQUIP	194	149		
FIAT HITACHI	191	147		

SKYJACK	191	147
BLAW-KNOX	190	146
KUBOTA	187	144
FIATALLIS	177	136
HAMM	176	136
MITSUBISHI	176	136
TOYOTA	173	133
LEEBOY	169	130
MANITOU	169	130
MUSTANG	168	129
INTERNATIONAL	166	128
ASV	151	116
P & H	149	115
SAKAI	137	105
KATO	136	105
CLARK	131	101
DEMAG	127	98
AMERICAN	121	93
TADANO	114	88
SULLAIR	112	86
NIFTY LIFT	108	83
PRENTICE	108	83
REYNOLDS	108	83
IHI	106	82
POWERSCREEN	103	79
CMI	102	79
NATIONAL	100	77
MANITOWOC	98	75
ATLAS COPCO	97	75
O & K	97	75
CHAMPION	96	74
EUCLID	93	72
MOXY	90	69
GALION	86	66
GOMACO	84	65
BUCYRUS-ERIE	83	64
BARBER-GREENE	80	62
FURUKAWA	79	61
MORBARK	78	60
PIONEER	78	60
ALLIS-CHALMERS	77	59
SAMSUNG	77	59
HARLO	76	59

Joseph Affidavit, Ex. 1

KRUPP	76	59
SUMITOMO	75	58
YALE	73	56
UP-RIGHT	71	55
DOOSAN DAEWOO	68	52
THOMAS	68	52
BITELLI	66	51
ROCK SYSTEMS	66	51
MOROOKA	64	49
TAYLOR	64	49
HYPAC	62	48
HYDRO-AX	60	46
BRODERSON	59	45
ETNYRE	59	45
KOEHRING	59	45
LORAIN	59	45
IMT	57	44
PETTIBONE	57	44
VIBROMAX	56	43
BELL	54	42
TIMBCO	54	42
NORDBERG	53	41
TRAVERSE LIFT	53	41
MICHIGAN	52	40
ROSCO	52	40
COLEMAN	51	39
POTAIN	51	39
EXTEC	50	39
LIFTLUX	49	38
TCM	49	38
TIGERCAT	49	38
BANDIT	48	37
ELGIN	48	37
FUCHS	48	37
ATLAS	47	36
B L - PEGSON	46	35
MANITEX	46	35
MEC	46	35
NORTHWEST	46	35
BARKO	45	35
MASSEY-FERGUSON	45	35
SUPERPAC	45	35
AMIDA	44	34

Joseph Affidavit, Ex. 1

EAGLE PICHER	43	33
FREIGHTLINER	42	32
MACK	42	32
NISSAN	42	32
WIRTGEN	42	32
ASHLAND	41	32
BROCE	41	32
HAULOTTE	40	31
FRANKLIN	39	30
MAULDIN	39	30
SCHAEFF	39	30
ALTEC	38	29
LIMA	38	29
MAGNUM	38	29
KOLBERG	37	28
CEC	36	28
AKERMAN	34	26
TELSMITH	34	26
AIRMAN	33	25
STONE	33	25
TERRAMITE	33	25
UNIVERSAL	33	25
CUMMINS	32	25
MISKIN	32	25
SHUTTLELIFT	31	24
ABG	30	23
FINLAY	30	23
KENWORTH	30	23
SCATTRAK	30	23
HANOMAG	29	22
KAESER	29	22
AMMANN	28	22
LINDE	28	22
TREE FARMER	28	22
HOUGH	27	21
INGRAM	27	21
ROADTEC	27	21
SUPERIOR	27	21
VOGELE	27	21
ALLMAND BROS	25	19
BADGER	25	19
DOOSAN	25	19
TRIO	25	19

GENERAC	24	18
POWER CURBERS	24	18
PUCKETT BROS	24	18
RAYGO	24	18
SCREEN MACHINE	24	18
TAMROCK	24	18
TROJAN	24	18
VALMET	24	18
LEROI	23	18
MERLO	23	18
SULLIVAN	23	18
GRAMLIFT	22	17
MODERN MACHINERY CO	22	17
REX	22	17
SYMONS	22	17
DEISTER	21	16
LAY-MOR	21	16
OLYMPIAN	21	16
POCLAIN	21	16
EAGLE CRUSHER	20	15
KLEIN	20	15
KRAMER-ALLRAD	20	15
MASABA	20	15
ONAN	20	15
RAMMAX	20	15
TESMEC	20	15
WABCO	20	15
HALLA	19	15
JOHNSTON	19	15
MCCLOSKEY	19	15
PETERSON PACIFIC	19	15
FERGUSON	18	14
KALMAR	18	14
ROME	18	14
SENNEBOGEN	18	14
SIMPLICITY	18	14
WALDON	18	14
ATHEY MOBIL	17	13
BOSS	17	13
CLEVELAND	17	13
CUSTOM BUILT	17	13
FERMEC	17	13
GMC	17	13

Joseph Affidavit, Ex. 1

PUTZMEISTER	17	13
XCMG	17	13
CASE POCLAIN	16	12
DETROIT	16	12
DRESSTA	16	12
DROTT	16	12
FAUN	16	12
GILCREST	16	12
HEWITT-ROBINS	16	12
LIPPMANN	16	12
MARATHON	16	12
PEL JOB	16	12
PPM	16	12
AUSTIN-WESTERN	15	12
CARELIFT	15	12
CONDOR	15	12
CTR	15	12
ELLIOTT	15	12
JCI	15	12
MANTIS	15	12
PSI	15	12
TAMPO	15	12
TENNANT	15	12
TORO	15	12
GARDNER-DENVER	14	11
HI RANGER	14	11
KOLMAN	14	11
MECALAC	14	11
MOFFETT	14	11
PETERBILT	14	11
ICON	13	10
RAYCO	13	10
SHOP MADE	13	10
STILL	13	10
TRENCOR	13	10
BENFORD	12	9
BIDWELL	12	9
CSI	12	9
EAGLE IRON WORKS	12	9
EL JAY	12	9
FASSI	12	9
HAZEMAG	12	9
JOY	12	9

LEBRERO	12	9
MORGAN	12	9
READ	12	9
SCHWING	12	9
SIMON	12	9
SUPERTRAK	12	9
ASTEC	11	8
AVELING BARFORD	11	8
CONCEPT PRODUCTS	11	8
ERIN	11	8
HANIX	11	8
PALFINGER	11	8
SCHWARZE	11	8
SECO	11	8
THOMPSON	11	8
TYLER	11	8
ZETTELMEYER	11	8
ANDERS	10	8
AUTOCRANE	10	8
BEUTHLING	10	8
BROS	10	8
FIAT KOBELCO	10	8
FINN	10	8
PAYHAULER	10	8
SAFE-T-SHORE	10	8
SDMO	10	8
SIMON-RO	10	8
TARGET	10	8
TELSTA	10	8
TOREQ	10	8
UNITED TRUCK	10	8
VERSALIFT	10	8
Other	2045	1575
1082	71932	55370

Joseph Affidavit, Ex. 1

	Total	>2002	
Dozer	2763	861	31%
Excavators	2873	1210	42%
Cat D7	222	20	9%
Cat D8	498	98	20%
Cat D9	187	39	21%
Cat D10	92	12	13%

IN California

Caterpillar	1370

Joseph Affidavit, Ex. 1

Ritchie Brothers
rbauction.com
2/24/2007

Articulated Dump Trucks	208
Compaction - Compactors	61
Compaction - Rollers	189
Compaction - Vibratory Padfoot	104
Compaction - Vibratory Rollers	461
Crawler Loaders	128
Crawler Tractors	591
Demolition Excavators	2
Dumpers	70
Excavators - Hydraulic	663
Excavators - Midi	100
Excavators - Mini	403
Excavators - Mobile	91
Integrated Tool Carriers	1
Loader Backhoes	515
Material Handlers	2
Motor Graders	220
Motor Scrapers	159
Rock Trucks	31
Sign Boards	31
Skid Steer Loaders	421
Skip Loaders	85
Street Sweepers	35
Wheel Dozers	8
Wheel Loaders	614
Aggregate - Cone Crushers	7
Aggregate - Control Vans	3
Aggregate - Conveyors	110
Aggregate - Feeders	8
Aggregate - Impact Crushers	20
Aggregate - Jaw Crushers	17
Aggregate - Miscellaneous	27
Aggregate - Other Crushers	5
Aggregate - Roll Crushers	1
Aggregate - Sand Screws	4
Aggregate - Screen Plants	80
Agriculture - Belted Ag Tractors	25
All Terrain Vehicles	216
Asphalt - Distributors	29
Asphalt - Misc	71
Asphalt - Pavement Profilers	24
Asphalt - Paving Equipment	130
Asphalt - Road Wideners	9
Brooms & Sweepers	96
Compaction - Walk Behind	941
Concrete - Paving Equipment	20
Cranes - All Terrain	4
Cranes - Crawler, Dragline	9
Cranes - Other	23
Cranes - Rough Terrain	34
Cranes - Tower	8
Drills - Boring Machines	15
Drills - Directional Drills	25
Drills - Drills & Air Tracks	29
Drills - Miscellaneous	39
Excavators - Front Shovels	2
Lifts - Boom Lifts	510
Lifts - Electric Forklifts	215
Lifts - Forklifts	706
Lifts - Rough Terrain Forklifts	89
Lifts - Scissorlifts	887
Lifts - Telescopic Forklifts	232
Pile & Hydraulic Hammers	455
Pipeline - Pipelayers	6
Pipeline - Tack Tractors	1
Pull Scrapers	38
Snow Equipment	14
Trenchers	164
Water Wagons	23
	10564

Joseph Affidavit, Ex. 2

LOTS SOLD

	Feb 1 to March 15, 07	Feb 1 to March 15, 07	Nov 1 to Dec 15, 07	Nov 1 to Dec 15, 07
	US Total	US MY 2003+	US Total	US MY 2003+
Skid Steer Loaders	444	214	669	408
Lifts - Forklifts	382	21	509	49
Lifts - Boom Lifts	407	74	383	23
Loader Backhoe	370	84	531	187
Wheel Loaders	518	99	548	97
Small-Equip. Totals	**2121**	**492**	**2640**	**764**
Crawler Tractors: Cat D7	6	0	17	1
Crawler Tractors: Cat D8	42	2	74	5
Crawler Tractors: Cat D9	12	1	28	0
Crawler Tractors: Cat D10	8	0	10	2
Motor Scrapers: Cat 621	21	0	33	0
Motor Scrapers: Cat 623	10	1	20	5
Motor Scrapers: Cat 633	1	0	9	0
Motor Scrapers: Cat 631	2	0	43	4
Motor Scrapers: Cat 627	26	15	29	2
Motor Scrapers: Cat 637	15	0	23	0
Motor Scrapers: Cat 651	2	0	0	0
Motor Scrapers: Cat 657	1	0	35	1
Wheel Loaders: Cat 980	29	1	48	5
Wheel Loaders: Cat 988	7	0	20	2
Wheel Loaders: Cat 992	0	0	6	0
Motor Graders: Cat 12	19	2	33	0
Motor Graders: Cat 120	8	1	5	0
Motor Graders: Cat 140	38	4	42	0
Motor Graders: Cat 14	10	0	25	1
Motor Graders: Cat 160	1	0	2	0
Motor Graders: Cat 16	2	0	3	0
Rock Truck Cat 769	12	0	6	0
Rock Truck Cat 773	16	0	4	0
Rock Truck Cat 777	0	0	4	0
Large-Equip. Totals	**288**	**27**	**519**	**28**

	Calendar 2007	Calendar 2007	Calendar 2007	Calendar 2007
Category	US MY 2003+ Sales	US MY 2002- Sales	CA MY 2003+ Sales	CA MY 2002- Sales
Crawler Tractors: Cat D8	22	299	4	32
Crawler Tractors: Cat D9	7	109	1	34
Motor Scrapers: Cat 637	2	73	2	26
Motor Scrapers: Cat 657	3	46	3	46
Wheel Loaders: Cat 988	3	90	0	12
Motor Graders: Cat 140	27	248	7	25
Rock Truck Cat 773	0	43	0	16

The spreadsheet listed below is CARB's summary of equipement available from the Ritchie Brothers Auction Site on February 24, 2007. A review of the equipment categories listed shows that there are a number of "counted" equipment that fall into three categories: 1 - This equipment can legitimately be counted because it is self propelled off road diesel 25 hp or greater; 2 - It should not be counted because is is not self propelled off road diesel 25hp or greater (for example sign boards (no diesel motor) or crushers (PERP); or 3 - It is questionable as to whether it should be counted because some of the equipment in the listed category will not fall under this rule.

Ritchie Brothers
rbauction.com
2/24/2007

DESCRIPTION	QUAN	Off Road Diesel > 25 HP?	Off Road Diesel	Does not Qualify	Questionable / Need more Info.	NOTES:	
Articulated Dump Trucks	208	Y	208				
Compaction - Compactors	61	Y	61				
Compaction - Rollers	189	?			189	Some could be small with <25 hp	
Compaction - Vibratory Padfoot	104	Y	104				
Compaction - Vibratory Rollers	461	Y	461				
Crawler Loaders	128	Y	128				
Crawler Tractors	591	Y	591				
Demolition Excavators	2	Y	2				
Dumpers	70	Y	70				
Excavators - Hydraulic	663	Y	663				
Excavators - Midi	100	Y	100				
Excavators - Mini	403	?			403	Many Mini Excavators are under 25HP	
Excavators - Mobile	91	Y	91				
Integrated Tool Carriers	1	Y	1				
Loader Backhoes	515	Y	515				
Material Handlers	2	Y	2				
Motor Graders	220	Y	220				
Motor Scrapers	159	Y	159				
Rock Trucks	31	Y	31				
Sign Boards	31	N		31		Not self propelled, small gas motors or electric	
Skid Steer Loaders	421	Y	421				
Skip Loaders	85	Y	85				
Street Sweepers	35	N		35		SE License or onroad	
Wheel Dozers	8	Y	8				
Wheel Loaders	614	Y	614				
Aggregate - Cone Crushers	7	N		7		Stationary, PERP	
Aggregate - Control Vans	3	N		3		Stationary, PERP	
Aggregate - Conveyors	110	N		110		Stationary, PERP	
Aggregate - Feeders	8	N		8		Stationary, PERP	
Aggregate - Impact Crushers	20	N		20		Stationary, PERP	
Aggregate - Jaw Crushers	17	N		17		Stationary, PERP	
Aggregate - Miscellaneous	27	N		27		Stationary, PERP	
Aggregate - Other Crushers	5	N		5		Stationary, PERP	
Aggregate - Roll Crushers	1	N		1		Stationary, PERP	
Aggregate - Sand Screws	4	N		4		Stationary, PERP	
Aggregate - Screen Plants	80	N		80		Stationary, PERP	
Agriculture - Belted Ag Tractors	25	Y	25				
All Terrain Vehicles	216	?			216	Some are gas, some small HP	
Asphalt - Distributors	29	N		29		These are onroad truckes license or SE	ATTACH
Asphalt - Misc	71	?			71	Many of these pieces are not diesel.	ATTACH
Asphalt - Pavement Profilers	24	Y	24				
Asphalt - Paving Equipment	130	Y	130				
Asphalt - Road Wideners	9	Y	9				
Brooms & Sweepers	96	Y	96		96	LPG, Misc small	ATTACH
Compaction - Walk Behind	941	N		941		Small Equipment, small motor	ATTACH
Concrete - Paving Equipment	20	y	20			Many have very small motores	
Cranes - All Terrain	4	Y	4				
Cranes - Crawler, Dragline	9	Y	9				
Cranes - Other	23	Y	23			Some/all may be on road?	
Cranes - Rough Terrain	34	Y	34				
Cranes - Tower	8	N		8		Not Self Propelled	
Drills - Boring Machines	15	N		15		Not Self Propelled	
Drills - Directional Drills	25	Y	25				
Drills - Drills & Air Tracks	29	?			29	Air Tracks use Generator (Stationary)	
Drills - Miscellaneous	39	?		39	39	Misc Equipment for Drills (attachments, etc)	ATTACH
Excavators - Front Shovels	2	Y	2				
Lifts - Boom Lifts	510	Y	510				
Lifts - Electric Forklifts	215	N		215		Electric	
Lifts - Forklifts	706	?			706	Many are LPG	ATTACH
Lifts - Rough Terrain Forklifts	89	Y	89				
Lifts - Scissorlifts	887	N		887		Electric or small gas motors	ATTACH
Lifts - Telescopic Forklifts	232	Y	232				
Pile & Hydraulic Hammers	455	N		455		Stationary power source	ATTACH
Pipeline - Pipelayers	6	Y	6				
Pipeline - Tack Tractors	1	Y	1				
Pull Scrapers	38	N		38		No Engine	ATTACH
Snow Equipment	14	Y	14				
Trenchers	164	?			164	Many Walk behind / small hp / Gasoline	ATTACH
Water Wagons	23	Y	23				
TOTAL:	**10,564**		**5,811**	**2,975**	**1,913**		
PERCENTAGE OF TOTAL :			**55.0%**	**28.2%**	**18.1%**		

Joseph Affidavit, Ex. 4

rbauctionResults▼ Help▼

rbauctionRe$ults - Search Results

Mike Shaw
Monday, December 17, 2007

Industry - Asphalt/Aggregate/Concrete
Equipment Category - Asphalt - Distributors
Manufacturer - KENWORTH
Period - Last 12 Months, Auction Location - USA

4 Items Found **Launch New Search** **Previous Page** (to refine or save this search)

Year ▲ Sort ▼	Description ▲ Sort ▼	Serial No. Series ▲ Sort ▼	Auction Date ▲ Sort ▼	Auction Location ▲ Sort ▼	Sold For ▲ Sort ▼
1975	KENWORTH COE T/A ASPHALT DISTRIBUTOR TRUCK	3012000	Sep - 2007	USA-CO	1,400 USD
	Detroit 6 cyl, 10 spd, spring susp, 171 in. WB, Etnyre BTHL 3,233 gal, 8 - 1 4 ft spray bar				
1975	KENWORTH COE T/A ASPHALT DISTRIBUTOR TRUCK	3012000	Jun - 2007	USA-CO	1,250 USD
	Detroit 671, 10 spd, spring susp, 171 in. WB, Etnyre BTHL 3,233 gal, 8 - 14 ft spray bar				
1976	KENWORTH W900 4,000 GALLON T/A ASPHALT DISTRIBUTOR TRUCK	1491000	Nov - 2007	USA-AZ	8,000 USD
	Cummins NTC350, 8 spd, spring susp, Bearcat rear spray bar				
1988	KENWORTH T800 3,525 GALLON T/A ASPHALT DISTRIBUTOR TRUCK	1XKDDB9X7JS502000	Nov - 2007	USA-WY	62,500 USD
	Cat 3406B, eng brake, 9 spd, Bear Cat BC501 dist tank w/computerized rate co ntrol, cab control, 8 ft rear spray bar w/extensions to 20 ft				

4 Items Found **Launch New Search** **Previous Page** (to refine or save this search)

Note: Reviewing our Historic Auction Results is only part of a proper valuation exercise. Please click here to find out more information. Also, please note that the database does not include items in the Miscellaneous category that sold for less than 3000 (in the currency of the auction).

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rbauctionRe$ults - Search Results

Mike Shaw
Monday, December 17, 2007

Industry - Asphalt/Aggregate/Concrete
Equipment Category - Asphalt - Misc
Manufacturer - CUSTOMBUILT
Period - Last 12 Months, Auction Location - USA

22 Items Found Launch New Search Previous Page (to refine or save this search)

Year ▲ Sort ▼	Description ▲ Sort ▼	Serial No. Series ▲ Sort ▼	Auction Date ▲ Sort ▼	Auction Location ▲ Sort ▼	Sold For ▲ Sort ▼
2002	CUSTOMBUILT S/A TAR POT TRAILER	AC20901000	Oct - 2007	USA-MD	500 USD
1991	CUSTOMBUILT CRACK FILLER Honda 9 hp, 550 gal agitated emulsion tank, air comp w/Honda 18 hp, hoses, m td on T/A trailer s/n 303447		Mar - 2007	USA-NV	3,750 USD
	CUSTOMBUILT 200 TON STATIONARY ASPHALT STORAGE SILOS qty of (3), transfer conv		Jun - 2007	USA-NM	55,000 USD
	CUSTOMBUILT 30 IN. X 100 FT DRAG SLAT CONVEYOR		Jun - 2007	USA-NM	35,000 USD
	CUSTOMBUILT 600 BBL PORTABLE LIME/FLYASH STORAGE SILO vane feeder, weigh cells, mtd on Delta 40 ft T/A flatbed trailer s/n 1878 + 1973 DELTA 40 FT T/A FLATBED TRAILER s/n 1878		Nov - 2007	USA-WY	27,000 USD
	CUSTOMBUILT 40 FT PORTABLE ASPHALT LAND PLANE to fit Blaw-Knox PF180 & PF220		Nov - 2007	USA-WY	2,250 USD
	CUSTOMBUILT PORTABLE ASPHALT BURNER Deutz 3 cyl		Dec - 2007	USA-MO	1,500 USD
	CUSTOMBUILT PORTABLE DRUM DRYER to fit asphalt plant		Apr - 2007	USA-CO	1,250 USD
	CUSTOMBUILT PORTABLE HOT OIL DISTRIBUTOR		Dec - 2007	USA-TX	700 USD
	CUSTOMBUILT 50 FT TRUSS SCREED twin Honda 1 cyl		Feb - 2007	USA-CA	300 USD
	CUSTOMBUILT OIL TANK		Nov - 2007	USA-NM	200 USD
	CUSTOMBUILT 200 GALLON PORTABLE TACK POT Wisconsin 1 cyl		May - 2007	USA-CA	200 USD
	CUSTOMBUILT PORTABLE HOT PATCH ASPHALT BOX		Mar - 2007	USA-MO	100 USD
	CUSTOMBUILT PORTABLE TAR POT		Mar - 2007	USA-MO	50 USD
	CUSTOMBUILT PORTABLE TAR POT Briggs & Stratton 13 hp, wand	10115507000	Jul - 2007	USA-TX	1,250 USD
	CUSTOMBUILT ASPHALT COATING MACHINE Hercules 4 cyl diesel, 5 x 8 ft feed hopper, 24 in. x 13 ft feed conv, 24 in . x 31 ft disch conv, T/A carrier	845000	May - 2007	USA-TX	500 USD
	CUSTOMBUILT PORTABLE CRACK SEALER Onan 24 gas, 350 gal tank, 8 ft spreader	D987720000	Sep - 2007	USA-CA	6,500 USD
	CUSTOMBUILT 12,000 GALLON SKID MTD BURNER FUEL TANK 2 hp, heating coils, temp control unit	OBL	Feb - 2007	USA-AZ	3,500 USD
	CUSTOMBUILT PORTABLE EMULSION TANK Briggs & Stratton, 16 hp, T/A mtd	OBL	Jun - 2007	USA-NV	1,250 USD

Joseph Affidavit, Ex. 4

CUSTOMBUILT PORTABLE HOT OIL STORAGE TANK	OBL	Jun - 2007	USA-MO	1,000 USD
mtd on T/A carrier				
CUSTOMBUILT PORTABLE SPRAY PATCHER	OBL	Feb - 2007	USA-CA	300 USD
Wisconson 1 cyl, 8 ft sprayer, 500 gal tank + 1979 CUSTOMBUILT S/A TRAILER s/n 320008				
CUSTOMBUILT 500 GALLON SKID MOUNTED ASPHALT TANK	OBL	Jul - 2007	USA-TX	200 USD
Homelite 1 cyl				

22 Items Found **Launch New Search** **Previous Page** (to refine or save this search)

Note: Reviewing our Historic Auction Results is only part of a proper valuation exercise. Please click here to find out more information. Also, please note that the database does not include items in the Miscellaneous category that sold for less than 3000 (in the currency of the auction).

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Ritchie Bros. Auctioneers - Equipment Search Result Details

Many auctions now have most major items available for live Internet bidding with **rbauctionBid-Live**. Check here for updated information on auctions & items available for live internet bidding.

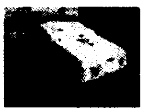
New Search

All > Brooms & Sweepers >

Search results: **1** - **4** of **4** items found on **1 page**
Result Pages: First **1** Last

Brooms & Sweepers : TENNANT

Lot 1326 - 1999 TENNANT 8410 RIDE ON BROOM



PHOTOS (6)

Serial No: 841012768
Comes With: LP, gutter broom, belly broom, canopy
Notes: NO TITLE AVAILABLE, SOLD WITH BILL OF SALE ONLY
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

1999 TENNANT 7400 BROOM

PHOTOS (4)

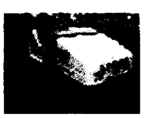
Serial No: 74004769
Comes With: 4 cyl, LPG, 4 ft broom, canopy
Delivery status: In Yard
Selling on day: 1 of 5 (Tuesday)
Sale information: Tue, Feb 19, 2008 - Sat, Feb 23, 2008, ORLANDO, FL

Lot 1328 - 1999 TENNANT 6500 RIDE ON BROOM

PHOTOS (6)

Serial No: 65005773
Comes With: LP, gutter broom, canopy
Notes: NO TITLE AVAILABLE, SOLD WITH BILL OF SALE ONLY
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 1329 - 1999 TENNANT 6500 RIDE ON BROOM



PHOTOS (5)

Serial No: 65005239
Comes With: LP, Gutter Broom
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Result Pages: First **1** Last

All > Brooms & Sweepers >

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Joseph Affidavit, Ex. 4

Ritchie Bros. Auctioneers - Equipment Search Result Details

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No Payments with Auction Credit Express. Apply for online financing from CitiCapital for many of our unreserved auctions in the US and Canada, or call 1.866.823.9838.

New Search

All > Compaction - Walk Behind >

Search results: **1 - 41** of **41** items found on **1 page**
Result Pages: First **1** Last

Compaction - Walk Behind : AMMANN

AMMANN DVH6010 PLATE COMPACTOR

Serial No: 50446
Delivery status: In Yard
Selling on day: 1 of 3 (Wednesday)
Sale information: Wed, Feb 27, 2008 - Fri, Feb 29, 2008, MOERDIJK, NLD

AMMANN DVS52 JUMPING JACK

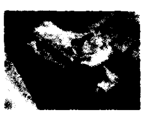
PHOTO (1)

Serial No: S1088
Delivery status: In Yard
Selling on day: 1 of 3 (Wednesday)
Sale information: Wed, Feb 27, 2008 - Fri, Feb 29, 2008, MOERDIJK, NLD

Compaction - Walk Behind : BOMAG

2004 BOMAG BW65S2 TANDEM WALK BEHIND VIBRATORY SMOOTH DRUM ROLLER

Serial No: 101100011793
Comes With: Hatz 1 cyl, 25 in. drum
Delivery status: Delivery pending
Selling on day: 1 of 5 (Tuesday)
Sale information: Tue, Feb 19, 2008 - Sat, Feb 23, 2008, ORLANDO, FL

2004 BOMAG BW65S2 TANDEM WALK BEHIND VIBRATORY SMOOTH DRUM ROLLER

Serial No: 101100011789
Comes With: Hatz 1 cyl, 25 in. drum
Delivery status: Delivery pending
Selling on day: 1 of 5 (Tuesday)
Sale information: Tue, Feb 19, 2008 - Sat, Feb 23, 2008, ORLANDO, FL

2004 BOMAG BW65S2 TANDEM WALK BEHIND VIBRATORY SMOOTH DRUM ROLLER

Serial No: 101100011780
Comes With: Hatz 1 cyl, 25 in. drum
Delivery status: Delivery pending

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Selling on day: 1 of 5 (Tuesday)
Sale information: Tue, Feb 19, 2008 - Sat, Feb 23, 2008, ORLANDO, FL

2004 BOMAG BW65S2 TANDEM WALK BEHIND VIBRATORY SMOOTH DRUM ROLLER

Serial No: 101100011778
Comes With: Hatz 1 cyl, 25 in. drum
Delivery status: Delivery pending
Selling on day: 1 of 5 (Tuesday)
Sale information: Tue, Feb 19, 2008 - Sat, Feb 23, 2008, ORLANDO, FL

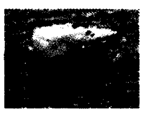
Compaction - Walk Behind : DYNAPAC

2000 DYNAPAC LP852 TRENCH COMPACTOR


PHOTOS (2)

Serial No: 48610333
Delivery status: In Yard
Selling on day: 1 of 3 (Wednesday)
Sale information: Wed, Feb 27, 2008 - Fri, Feb 29, 2008, MOERDIJK, NLD

2000 DYNAPAC LP852 TRENCH COMPACTOR


PHOTOS (2)

Serial No: 46810290
Delivery status: In Yard
Selling on day: 1 of 3 (Wednesday)
Sale information: Wed, Feb 27, 2008 - Fri, Feb 29, 2008, MOERDIJK, NLD

2001 DYNAPAC LT52 JUMPING JACK

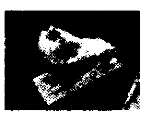


PHOTO (1)

Serial No: 55201700
Delivery status: In Yard
Selling on day: 1 of 3 (Wednesday)
Sale information: Wed, Feb 27, 2008 - Fri, Feb 29, 2008, MOERDIJK, NLD

Compaction - Walk Behind : DYNAPACK

2000 DYNAPACK LT68 JUMPING JACK


PHOTO (1)

Serial No: 56703714
Delivery status: In Yard
Selling on day: 1 of 3 (Wednesday)
Sale information: Wed, Feb 27, 2008 - Fri, Feb 29, 2008, MOERDIJK, NLD

Compaction - Walk Behind : GENTEC

Lot 669 - 2007 GENTEC PC60 WALK BEHIND COMPACTOR (UNUSED)

Comes With: OHV 6.5 hp
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Joseph Affidavit, Ex. 4

Lot 668 - 2007 GENTEC PC60 WALK BEHIND COMPACTOR (UNUSED)

Comes With: OHV 6.5 hp
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 42 - 2007 GENTEC HS60 WALK BEHIND PLATE COMPACTOR (UNUSED)


PHOTO (1)

Comes With: 6.5 hp
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, BUXTON, ND

Lot 569 - GENTEC WALK BEHIND PLATE COMPACTOR

Comes With: OHV 6.5 hp
Delivery status: Delivery pending
Sale information: Tue, Dec 18, 2007, PRINCE GEORGE, BC

Lot 570 - GENTEC WALK BEHIND PLATE COMPACTOR

Comes With: OHV 6.5 hp
Delivery status: Delivery pending
Sale information: Tue, Dec 18, 2007, PRINCE GEORGE, BC

Compaction - Walk Behind : INGERSOLL-RAND

INGERSOLL-RAND RX65 JUMPING JACK


PHOTO (1)

Serial No: AR6255
Delivery status: In Yard
Selling on day: 1 of 3 (Wednesday)
Sale information: Wed, Feb 27, 2008 - Fri, Feb 29, 2008, MOERDIJK, NLD

Compaction - Walk Behind : MASALTA

2005 MASALTA MS15 PLATE COMPACTOR


PHOTO (1)

Serial No: 1151050081
Delivery status: In Yard
Selling on day: 1 of 3 (Wednesday)
Sale information: Wed, Feb 27, 2008 - Fri, Feb 29, 2008, MOERDIJK, NLD

Compaction - Walk Behind : MATSUKI

Lot 674 - 2007 MATSUKI WALK BEHIND PLATE COMPACTOR

Comes With: Maxvibe technology, Honda GX160
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Joseph Affidavit, Ex. 4

Lot 673 - 2007 MATSUKI WALK BEHIND PLATE COMPACTOR

Comes With: Maxvibe technology, Honda GX160
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 670 - 2007 MATSUKI WALK BEHIND PLATE COMPACTOR (UNUSED)

Comes With: Maxvibe technology, Honda GX160
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 672 - 2007 MATSUKI WALK BEHIND PLATE COMPACTOR

Comes With: Maxvibe technology, Honda GX160
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 671 - 2007 MATSUKI WALK BEHIND PLATE COMPACTOR

Comes With: Maxvibe technology
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Compaction - Walk Behind : OTHER

QTY OF 2006 BOMAG BT 60/4 JUMPING JACKS (UNUSED)

Notes: ** NON-DUTY FREE CIRCULATION EU ** NO EC DECLARATION OF CONFORMITY **
Delivery status: In Yard
Selling on day: 1 of 3 (Wednesday)
Sale information: Wed, Feb 27, 2008 - Fri, Feb 29, 2008, MOERDIJK, NLD

QTY OF 2006 BOMAG BT 60/4 JUMPING JACKS (UNUSED)

Notes: ** NON-DUTY FREE CIRCULATION EU ** NO EC DECLARATION OF CONFORMITY **
Delivery status: In Yard
Selling on day: 1 of 3 (Wednesday)
Sale information: Wed, Feb 27, 2008 - Fri, Feb 29, 2008, MOERDIJK, NLD

QTY OF 2006 BOMAG BT 60/4 JUMPING JACKS (UNUSED)

Notes: ** NON-DUTY FREE CIRCULATION EU ** NO EC DECLARATION OF CONFORMITY **
Delivery status: In Yard
Selling on day: 1 of 3 (Wednesday)
Sale information: Wed, Feb 27, 2008 - Fri, Feb 29, 2008, MOERDIJK, NLD

QTY OF 2006 BOMAG BT 60/4 JUMPING JACKS (UNUSED)

Notes: ** NON-DUTY FREE CIRCULATION EU ** NO EC DECLARATION OF CONFORMITY **
Delivery status: In Yard

Joseph Affidavit, Ex. 4

Selling on day: 1 of 3 (Wednesday)
Sale information: Wed, Feb 27, 2008 - Fri, Feb 29, 2008, MOERDIJK, NLD

PLATE COMPACTOR

PHOTO (1)

Delivery status: In Yard
Selling on day: 1 of 3 (Wednesday)
Sale information: Wed, Feb 27, 2008 - Fri, Feb 29, 2008, MOERDIJK, NLD

JUMPING JACK

PHOTO (1)

Delivery status: In Yard
Selling on day: 1 of 3 (Wednesday)
Sale information: Wed, Feb 27, 2008 - Fri, Feb 29, 2008, MOERDIJK, NLD

Compaction - Walk Behind : WACKER

Lot 419 - WACKER RT820 TANDEM WALK BEHIND TRENCH COMPACTOR

PHOTOS (6)

Serial No: 717201189
Comes With: 2 cyl diesel, 32 in. drums
Notes: ADDITIONAL ITEMS LOCATED IN CHECK IN BLDG
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 418 - 2006 WACKER RSS800A WALK BEHIND ROLLER

PHOTOS (2)

Serial No: 5650510
Comes With: Honda
Notes: UNITED GUARD WARRANTY IS AVAILABLE FOR PURCHASE ON THIS UNIT FROM UNITED RENTALS. ADDITIONAL INFORMATION AVAILABLE IN OFFICE.
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Compaction - Walk Behind : YOKOHUMA

2007 YOKOHUMA YKZ2045 PLATE COMPACTOR (UNUSED)

PHOTO (1)

Comes With: 6.5 hp
Delivery status: In Yard
Selling on day: 1 of 5 (Tuesday)
Sale information: Tue, Feb 19, 2008 - Sat, Feb 23, 2008, ORLANDO, FL

2007 YOKOHUMA YKZ2045 PLATE COMPACTOR (UNUSED)

PHOTO (1)

Comes With: 6.5 hp
Delivery status: In Yard
Selling on day: 1 of 5 (Tuesday)
Sale information: Tue, Feb 19, 2008 - Sat, Feb 23, 2008, ORLANDO, FL

Joseph Affidavit, Ex. 4

2007 YOKOHUMA YKZ2045 PLATE COMPACTOR (UNUSED)


PHOTO (1)

Comes With: 6.5 hp
Delivery status: In Yard
Selling on day: 1 of 5 (Tuesday)
Sale information: Tue, Feb 19, 2008 - Sat, Feb 23, 2008, ORLANDO, FL

2007 YOKOHUMA YKZ2045 PLATE COMPACTOR (UNUSED)

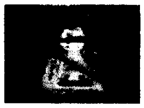


PHOTO (1)

Comes With: 6.5 hp
Delivery status: In Yard
Selling on day: 1 of 5 (Tuesday)
Sale information: Tue, Feb 19, 2008 - Sat, Feb 23, 2008, ORLANDO, FL

Lot 571 - YOKOHUMA YKZ2045 PLATE COMPACTOR


PHOTO (1)

Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, PRINCE GEORGE, BC

Lot 572 - YOKOHUMA YKZ2045 PLATE COMPACTOR


PHOTO (1)

Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, PRINCE GEORGE, BC

Lot 574 - YOKOHUMA YKZ2045 PLATE COMPACTOR


PHOTO (1)

Serial No: 914
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, PRINCE GEORGE, BC

Lot 573 - YOKOHUMA YKZ2045 PLATE COMPACTOR


PHOTO (1)

Serial No: 321
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, PRINCE GEORGE, BC

2007 YOKOHUMA YKR80 TAMPING RAMMER (UNUSED)


PHOTO (1)

Comes With: 6.5 hp
Delivery status: In Yard
Selling on day: 1 of 5 (Tuesday)
Sale information: Tue, Feb 19, 2008 - Sat, Feb 23, 2008, ORLANDO, FL

2007 YOKOHUMA YKR80 TAMPING RAMMER (UNUSED)

Comes With: 6.5 hp

Joseph Affidavit, Ex. 4


PHOTO (1)

Delivery status: In Yard
Selling on day: 1 of 5 (Tuesday)
Sale information: Tue, Feb 19, 2008 - Sat, Feb 23, 2008, ORLANDO, FL

2007 YOKOHUMA YKR80 TAMPING RAMMER (UNUSED)


PHOTO (1)

Comes With: 6.5 hp
Delivery status: In Yard
Selling on day: 1 of 5 (Tuesday)
Sale information: Tue, Feb 19, 2008 - Sat, Feb 23, 2008, ORLANDO, FL

Result Pages: First **1** Last

All > Compaction - Walk Behind >

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Ritchie Bros. Auctioneers - Equipment Search Result Details

Many auctions now have most major items available for live Internet bidding with **rbauctionBid-Live**. Check here for updated information on auctions & items available for live internet bidding.

New Search

All > Drills - Miscellaneous >

Search results: **1 - 3** of **3** items found on **1 page**
Result Pages: First **1** Last

Drills - Miscellaneous : AMERICAN

Lot 762 - AMERICAN SKID MOUNTED MUD MIXING SYSTEM

PHOTOS (5)

Serial No: 1500031
Comes With: Isuzu 3 cyl, 3 in. trash pump *THIS LOT SOLD WITH: EAGER BEAVER B9D0W 8 X 16 FT TRI/A TAG TRAILER s/n: 112DPM271SL044561 c/w: walking beam susp, 4 ft beavertail
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Drills - Miscellaneous : OTHER

Lot 780B - 30 IN. DRILL STEM

PHOTOS (2)

Comes With: approx 100 ft
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Drills - Miscellaneous : VERMEER

Lot 761 - VERMEER ST300 MUD MIXING SYSTEM

Comes With: Honda
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Result Pages: First **1** Last

All > Drills - Miscellaneous >

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rbauctionResults Help

rbauctionRe$ults - Search Results

Mike Shaw
Monday, December 17, 2007

Industry - Asphalt/Aggregate/Concrete
Equipment Category - Lifts - Forklifts
Manufacturer - CLARK
Period - Last 6 Months, Auction Location - USA

50 most recently sold displayed Launch New Search Previous Page (to refine or save this search)

Year ▲ Sort ▼	Description ▲ Sort ▼	Serial No. Series ▲ Sort ▼	Auction Date ▲ Sort ▼	Auction Location ▲ Sort ▼	Sold For ▲ Sort ▼
	CLARK POWERWORKER 3048RSTF42 ELECTRIC FORKLIFT		Dec - 2007	USA-MN	1,000 USD
	CLARK FORKLIFT 4 cyl LPG, 154 in. 2 stage mast, canopy, solid tires	OBL	Dec - 2007	USA-IL	800 USD
1986	CLARK C500S800 7,225 LB FORKLIFT 4 cyl LPG, 153 in. 2 stage mast, canopy	6851094000	Nov - 2007	USA-CA	1,750 USD
	CLARK C500-Y580 6,050 LB FORKLIFT LPG, 2 stage mast w/SS, canopy, solid tires	Y6850129639000	Oct - 2007	USA-FL	3,000 USD
1983	CLARK C500YS225 9,900 LB FORKLIFT Detroit 6 cyl diesel, 216 in. 2 stage mast, canopy	Y1625464605000	Nov - 2007	USA-CA	13,000 USD
	CLARK C500YS200 20,000 LB FORKLIFT Detroit 4 cyl, 240 in. 2 stage mast w/SS, cab	OBL	Dec - 2007	USA-CA	11,000 USD
2002	CLARK C500Y150 15,000 LB FORKLIFT 4 cyl diesel, 2 stage mast, canopy, duals	Y10157825000	Nov - 2007	USA-TX	15,000 USD
1989	CLARK C500YS80 8,000 LB FORKLIFT 4 cyl LGP, 14 ft 3 stage mast, SS	Y68503857413000	Nov - 2007	USA-AZ	5,000 USD
1979	CLARK C500YS80 8,000 LB FORKLIFT 4 cyl diesel, 14 ft 3 stage mast	Y6855234000	Nov - 2007	USA-AZ	4,000 USD
	CLARK C500-YS80 7,300 LB FORKLIFT 4 cyl, diesel, 173 in. 2 stage mast W/ss	Y68504207575000	Dec - 2007	USA-CA	8,500 USD
1987	CLARK C500Y70 7,000 LB FORKLIFT 2 stage mast, canopy	Y68500676660000	Dec - 2007	USA-MD	4,750 USD
	CLARK C500YS60 6000 LB FORKLIFT straight mast	Y3550382546000	Dec - 2007	USA-MN	3,000 USD
1981	CLARK C500S60 5,700 LB FORKLIFT 4 cyl LPG, 169 in. 3 stage mast w/SS, canopy	35523534635000	Nov - 2007	USA-CA	500 USD
	CLARK C50055 5,500 LB FORKLIFT 3 stage mast	355352438212000	Dec - 2007	USA-MD	700 USD
	CLARK C500-50 4,450 LB FORKLIFT 4 cyl LPG, 189 in. 3 stage mast, canopy, solid tires	35511914000	Oct - 2007	USA-FL	1,250 USD
	CLARK C50050 4,600 LB FORKLIFT 4 cyl LPG, 130 in. 2 stage mast w/SS, canopy	3555494000	Nov - 2007	USA-CA	750 USD
	CLARK C50045 3,200 LB FORKLIFT 4 cyl LPG, 212 in. 3 stage mast w/SS, canopy	3551045123000	Nov - 2007	USA-CA	1,000 USD
1975	CLARK C500Y40 4,000 LB FORKLIFT 4 cyl LPG, 151 in. 3 stage mast, canopy	4355123000	Nov - 2007	USA-CA	2,500 USD
1979	CLARK C500-40 4,000 LB FORKLIFT LPG, 188 in. 3 stage mast, SS, solid tires	3554344000	Nov - 2007	USA-AZ	2,250 USD
1981	CLARK C500-25 2,150 LB FORKLIFT 4 cyl LPG, 188 in. 3 stage mast, canopy, aux hyd	2359264515000	Nov - 2007	USA-CA	1,250 USD
	CLARK C500Y-13 6,500 LB FORKLIFT Detroit 4 cyl, 118 in. 2 stage mast, fork positioners, canopy	Y101S122000	Nov - 2007	USA-CA	800 USD

Joseph Affidavit, Ex. 4

2000	CLARK CMP570D 15,000 LB FORKLIFT Perkins 4 cyl, 177 in. 2 stage mast w/SS, canopy, duals	CMP570D0013688000	Nov - 2007	USA-TX	13,000 USD
	CLARK C500 15,000 LB FORKLIFT Detroit 3 cyl, 135 in. 2 stage mast, cab	1015276000	Dec - 2007	USA-MO	7,000 USD
1952	CLARK CY150 15,000 LB FORKLIFT 6 cyl, 240 in. 2 stage mast, canopy	52000	Nov - 2007	USA-CA	3,000 USD
1959	CLARK CFY150 15,000 LB FORKLIFT 6 cyl, 2 stage mast	174337000	Nov - 2007	USA-AZ	4,500 USD
1982	CLARK YS80 7,425 LB FORKLIFT 4 cyl diesel, 2 stage mast, canopy	Y6855354845000	Nov - 2007	USA-GA	4,000 USD
	CLARK CY80 FORKLIFT LP, 147 in. 2 stage mast, canopy	Y685582000	Nov - 2007	USA-IA	3,250 USD
	CLARK CF00YS80 7,000 LB FORKLIFT LPG, 3 stage mast, canopy	Y68500575705FA000	Nov - 2007	USA-GA	2,750 USD
1977	CLARK C5ADY5D 5,000 LB FORKLIFT	Y3553183000	Dec - 2007	USA-MD	750 USD
1999	CLARK CGP50 FORKLIFT duel fuel, 178 in. 3 stage mast w/SS, canopy	CGP460L0366950000	Dec - 2007	USA-IL	15,000 USD
	CLARK CGP40L 7,200 LB FORKLIFT 4 cyl LPG, 211 in. 3 stage mast	CGP46060147945000	Dec - 2007	USA-TX	7,000 USD
	CLARK C40 FORKLIFT 4 cyl LPG, 2 stage mast, canopy, solid tires	746000	Dec - 2007	USA-IL	500 USD
1991	CLARK GPX30 6,000 LB FORKLIFT 4 cyl LPG, 123 in. 3 stage mast w/SS	GPX23013017600000	Dec - 2007	USA-TX	3,750 USD
2000	CLARK CGP30 6,000 LB FORKLIFT LP, 130 in. 2 stage mast w/SS, canopy	P365L0008952000	Nov - 2007	USA-PA	7,500 USD
1998	CLARK CGP30 4,200 LB FORKLIFT dual fuel, 240 in. 3 stage mast w/SS	P365G0521947000	Nov - 2007	USA-TX	6,500 USD
	CLARK CGC30 5,500 LB FORKLIFT 4 cyl LPG, 189 in. 3 stage mast w/SS, solid tires	C365L0704946000	Nov - 2007	USA-TX	6,500 USD
2001	CLARK C30CL 5,500 LB FORKLIFT 4 cyl, LPG, 189 in. 3 stage mast w/SS, solid tires	C232L0463957000	Dec - 2007	USA-CA	5,000 USD
2001	CLARK C30CL 5,500 LB FORKLIFT 4 cyl, LPG, 189 in. 3 stage mast w/SS, solid tires	C232L0468957000	Dec - 2007	USA-CA	5,000 USD
1987	CLARK GPS25MB 4,000 LB FORKLIFT 4 cyl, LPG, 188 in. 3 stage mast w/SS, canopy	GP138MB0822683000	Nov - 2007	USA-CA	2,750 USD
	CLARK GPS25MB 5,000 LB FORKLIFT Mitsubishi 4 cyl LPG, 188 in. 3 stage mast, aux hyd	GP138MB0231553000	Dec - 2007	USA-TX	3,750 USD
	CLARK GPS25MB 4,000 LB FORKLIFT 4 cyl LPG, 188 in. 3 stage mast w/SS, canopy	GP138MB0786683000	Dec - 2007	USA-CO	3,000 USD
	CLARK GCX25 5,000 LB FORKLIFT LPG, 188 in. 3 stage mast, solid tires	GX23002919141000	Nov - 2007	USA-AZ	2,000 USD
	CLARK GCS25MB 4,150 LB FORKLIFT 4 cyl LPG, 3 stage mast w/SS	G138MB02746000	Nov - 2007	USA-TX	5,000 USD
2001	CLARK CPG25H 4,500 LB FORKLIFT 4 cyl LPG, 189 in. 3 stage mast, canopy	PH365L0009942000	Nov - 2007	USA-CA	4,500 USD
	CLARK CGX25 5,000 LB FORKLIFT 4 cyl LPG, 188 in. 3 stage mast w/SS, solid tires	GX23002288730000	Nov - 2007	USA-TX	5,000 USD
	CLARK CGC25 4,600 LB FORKLIFT LP, 189 in. 3 stage mast w/SS, canopy, solid tires	C365LI0697948000	Nov - 2007	USA-PA	4,000 USD
1998	CLARK CDP25 5,000 LB FORKLIFT dual fuel, 3 stage mast w/SS	948000	Dec - 2007	USA-TX	6,250 USD
1992	CLARK GPX20E 3,700 LB FORKLIFT LPG, 2 stage mast w/SS, canopy, solid tires	GPX230E0055923000	Dec - 2007	USA-NC	4,500 USD
	CLARK GCS20MB 3,350 LB FORKLIFT 4 cyl LPG, 188 in. 3 stage mast, canopy	G138MB6476920000	Nov - 2007	USA-CA	1,000 USD
	CLARK GPS15 2,700 LB FORKLIFT 4 cyl LPG, 188 in. 3 stage mast w/fork shift, canopy	GP12702777237000	Oct - 2007	USA-FL	3,000 USD

50 most recently sold displayed **Launch New Search** **Previous Page** **(to refine or save this search)**

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Ritchie Bros. Auctioneers - Equipment Search Result Details

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New Search

All > Lifts - Scissorlifts >

Search results: **1 - 75** of **75** items found on **1 page**
Result Pages: First **1** Last

Lifts - Scissorlifts : AICHI

AICHI SVD60 ELECTRIC SCISSORLIFT

Serial No: 319245

Notes: ** NON-DUTY FREE CIRCULATION EU **

Delivery status: Delivery pending

Selling on day: 1 of 3 (Wednesday)

Sale information: Wed, Feb 27, 2008 - Fri, Feb 29, 2008, MOERDIJK, NLD

Lifts - Scissorlifts : GENIE

Lot 858 - 2002 GENIE GS3246 ELECTRIC SCISSORLIFT

PHOTOS (6)

Serial No: 48172

Comes With: platform ext, solid tires

Hour meter reading: 220 H

Notes: UNITED GUARD WARRANTY IS AVAILABLE FOR PURCHASE ON THIS UNIT FROM UNITED RENTALS. ADDITIONAL INFORMATION AVAILABLE IN OFFICE.

Delivery status: In Yard

Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 859 - 2002 GENIE GS3246 ELECTRIC SCISSORLIFT

PHOTOS (6)

Serial No: 48169

Comes With: platform ext, solid tires

Hour meter reading: 259 H

Notes: UNITED GUARD WARRANTY IS AVAILABLE FOR PURCHASE ON THIS UNIT FROM UNITED RENTALS. ADDITIONAL INFORMATION AVAILABLE IN OFFICE.

Delivery status: In Yard

Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 857 - 2000 GENIE GS3246 ELECTRIC SCISSORLIFT

PHOTOS (6)

Serial No: 27666

Comes With: platform ext, solid tires

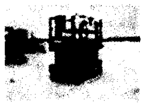
Notes: UNITED GUARD WARRANTY IS AVAILABLE FOR PURCHASE ON THIS UNIT FROM UNITED RENTALS. ADDITIONAL INFORMATION AVAILABLE IN OFFICE.

Delivery status: In Yard

Joseph Affidavit, Ex. 4

Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 862 - 2000 GENIE GS3246 ELECTRIC SCISSORLIFT



PHOTOS (5)

Serial No: 25503
Comes With: platform ext, solid tires
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 867 - 2002 GENIE GS2646 ELECTRIC SCISSORLIFT

PHOTOS (6)

Serial No: GS4647965
Comes With: platform ext, solid tires
Hour meter reading: 171 H
Notes: UNITED GUARD WARRANTY IS AVAILABLE FOR PURCHASE ON THIS UNIT FROM UNITED RENTALS. ADDITIONAL INFORMATION AVAILABLE IN OFFICE.
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 866 - 2002 GENIE GS2646 ELECTRIC SCISSORLIFT

PHOTOS (6)

Serial No: 48166
Comes With: platform ext, solid tires
Hour meter reading: 228 H
Notes: UNITED GUARD WARRANTY IS AVAILABLE FOR PURCHASE ON THIS UNIT FROM UNITED RENTALS. ADDITIONAL INFORMATION AVAILABLE IN OFFICE.
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 870 - 2000 GENIE GS2646 SCISSORLIFT

PHOTOS (6)

Serial No: 32448
Comes With: platform ext, solid tires
Notes: UNITED GUARD WARRANTY IS AVAILABLE FOR PURCHASE ON THIS UNIT FROM UNITED RENTALS. ADDITIONAL INFORMATION AVAILABLE IN OFFICE.
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 869 - 2000 GENIE GS2646 SCISSORLIFT

PHOTOS (6)

Serial No: 31488
Comes With: platform ext, solid tires
Notes: UNITED GUARD WARRANTY IS AVAILABLE FOR PURCHASE ON THIS UNIT FROM UNITED RENTALS. ADDITIONAL INFORMATION AVAILABLE IN OFFICE.
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 872 - 2000 GENIE GS2646 ELECTRIC SCISSORLIFT

Serial No: 30981
Comes With: platform ext, solid tires

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PHOTOS (6)

Notes: UNITED GUARD WARRANTY IS AVAILABLE FOR PURCHASE ON THIS UNIT FROM UNITED RENTALS. ADDITIONAL INFORMATION AVAILABLE IN OFFICE.

Delivery status: In Yard

Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 868 - 2000 GENIE GS2646 ELECTRIC SCISSORLIFT

PHOTOS (6)

Serial No: 29349

Comes With: platform ext, solid tires

Notes: UNITED GUARD WARRANTY IS AVAILABLE FOR PURCHASE ON THIS UNIT FROM UNITED RENTALS. ADDITIONAL INFORMATION AVAILABLE IN OFFICE.

Delivery status: In Yard

Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 871 - 2000 GENIE GS2646 ELECTRIC SCISSORLIFT

PHOTOS (6)

Serial No: 29276

Comes With: platform ext, solid tires

Notes: UNITED GUARD WARRANTY IS AVAILABLE FOR PURCHASE ON THIS UNIT FROM UNITED RENTALS. ADDITIONAL INFORMATION AVAILABLE IN OFFICE.

Delivery status: In Yard

Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 885 - 1999 GENIE GS2032 ELECTRIC SCISSORLIFT

PHOTOS (7)

Serial No: 11671

Comes With: platform ext, solid tires

Delivery status: In Yard

Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 895 - 1999 GENIE GS1930 ELECTRIC SCISSORLIFT

PHOTOS (6)

Serial No: 13415

Comes With: platform ext, solid tires

Delivery status: In Yard

Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 896 - GENIE GS1930 ELECTRIC SCISSORLIFT

PHOTOS (6)

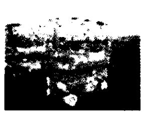
Serial No: 1875

Comes With: platform ext, solid tires

Delivery status: In Yard

Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 897 - GENIE GS1930 ELECTRIC SCISSORLIFT



PHOTOS (6)

Serial No: 1154

Comes With: platform ext, solid tires

Delivery status: In Yard

Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Joseph Affidavit, Ex. 4

Lifts - Scissorlifts : GROVE

Lot 845 - 1999 GROVE SM3884XT 4X4 SCISSORLIFT

PHOTOS (7)

Serial No: 250448
Comes With: dual fuel, hyd rotating platform
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 846 - 1998 GROVE SM3884XT 4X4 SCISSORLIFT

PHOTOS (6)

Serial No: 45491
Comes With: dual fuel, platform ext
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 847 - GROVE SM3884XT 4X4 SCISSORLIFT

PHOTOS (7)

Serial No: 43647
Comes With: dual fuel, platform ext
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 848 - GROVE SM3884XT 4X4 SCISSORLIFT

PHOTOS (7)

Serial No: 40212
Comes With: dual fuel, platform ext
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 850 - 1999 GROVE SM3269XT 4X4 SCISSORLIFT

PHOTOS (6)

Serial No: 252297
Comes With: dual fuel, platform ext
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 851 - 1999 GROVE SM3269XT 4X4 SCISSORLIFT

PHOTOS (6)

Serial No: 250440
Comes With: dual fuel, hyd rotating platform
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lifts - Scissorlifts : JLG

2003 JLG 3246E2 ELECTRIC SCISSORLIFT

Serial No: 200111997
Hour meter reading: 30 H
Delivery status: Delivery pending
Selling on day: 1 of 5 (Tuesday)

Joseph Affidavit, Ex. 4

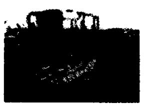
Sale information: Tue, Feb 19, 2008 - Sat, Feb 23, 2008, ORLANDO, FL

Lot 856 - 2000 JLG 3246 ELECTRIC SCISSORLIFT


PHOTOS (4)

Serial No: 0200073948
Comes With: platform ext, solid tires
Notes: UNITED GUARD WARRANTY IS AVAILABLE FOR PURCHASE ON THIS UNIT FROM UNITED RENTALS. ADDITIONAL INFORMATION AVAILABLE IN OFFICE.
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 873 - 2002 JLG 2646E2 ELECTRIC SCISSORLIFT


PHOTOS (6)

Serial No: 0200098660
Comes With: paltform ext, solid tires
Notes: UNITED GUARD WARRANTY IS AVAILABLE FOR PURCHASE ON THIS UNIT FROM UNITED RENTALS. ADDITIONAL INFORMATION AVAILABLE IN OFFICE.
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 875 - 2000 JLG 2646E2 ELECTRIC SCISSORLIFT


PHOTOS (6)

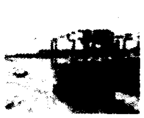
Serial No: 0200081054
Comes With: platform ext, solid tires
Notes: UNITED GUARD WARRANTY IS AVAILABLE FOR PURCHASE ON THIS UNIT FROM UNITED RENTALS. ADDITIONAL INFORMATION AVAILABLE IN OFFICE.
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 874 - 2000 JLG 2646E2 ELECTRIC SCISSORLIFT


PHOTOS (6)

Serial No: 0200072430
Comes With: platform ext, solid tires
Notes: UNITED GUARD WARRANTY IS AVAILABLE FOR PURCHASE ON THIS UNIT FROM UNITED RENTALS. ADDITIONAL INFORMATION AVAILABLE IN OFFICE.
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 876 - 2000 JLG 2646 ELECTRIC SCISSORLIFT

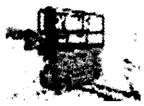

PHOTOS (5)

Serial No: 0200088033
Comes With: platform ext, solid tires
Notes: UNITED GUARD WARRANTY IS AVAILABLE FOR PURCHASE ON THIS UNIT FROM UNITED RENTALS. ADDITIONAL INFORMATION AVAILABLE IN OFFICE.
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 877 - 2003 JLG 2632E2 ELECTRIC SCISSORLIFT

Serial No: 0200111238
Comes With: platform ext, solid tires

Joseph Affidavit, Ex. 4



PHOTOS (6)

Hour meter reading: 200 H
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

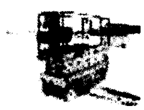
2005 JLG 2630ES ELECTRIC SCISSORLIFT

Serial No: 0200135315
Delivery status: Delivery pending
Selling on day: 1 of 5 (Tuesday)
Sale information: Tue, Feb 19, 2008 - Sat, Feb 23, 2008, ORLANDO, FL

2005 JLG 2630ES ELECTRIC SCISSORLIFT

Serial No: 0200135313
Delivery status: Delivery pending
Selling on day: 1 of 5 (Tuesday)
Sale information: Tue, Feb 19, 2008 - Sat, Feb 23, 2008, ORLANDO, FL

Lot 884 - 2000 JLG 2033E3 ELECTRIC SCISSORLIFT



PHOTOS (6)

Serial No: 020074606
Comes With: platform ext, solid tires
Notes: UNITED GUARD WARRANTY IS AVAILABLE FOR PURCHASE ON THIS UNIT FROM UNITED RENTALS. ADDITIONAL INFORMATION AVAILABLE IN OFFICE.
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 884A - JLG CM2033 ELECTRIC SCISSORLIFT

PHOTOS (6)

Serial No: 020014294
Comes With: pltaform ext, solid tires
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 881 - 2000 JLG 2032 ELECTRIC SCISSORLIFT

Serial No: 0200086443
Comes With: platform ext, solid tires
Notes: UNITED GUARD WARRANTY IS AVAILABLE FOR PURCHASE ON THIS UNIT FROM UNITED RENTALS. ADDITIONAL INFORMATION AVAILABLE IN OFFICE.
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 880 - 2000 JLG 2032 ELECTRIC SCISSORLIFT

Serial No: 0200080403
Comes With: platform ext, solid tires
Notes: UNITED GUARD WARRANTY IS AVAILABLE FOR PURCHASE ON THIS UNIT FROM UNITED RENTALS. ADDITIONAL INFORMATION AVAILABLE IN OFFICE.
Delivery status: In Yard

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Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 879 - 2000 JLG 2032 ELECTRIC SCISSORLIFT

PHOTOS (6)

Serial No: 0200080399
Comes With: platform ext, solid tires
Notes: UNITED GUARD WARRANTY IS AVAILABLE FOR PURCHASE ON THIS UNIT FROM UNITED RENTALS. ADDITIONAL INFORMATION AVAILABLE IN OFFICE.
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

2005 JLG 2030ES SCISSORLIFT

Serial No: 0200135826
Delivery status: Delivery pending
Selling on day: 1 of 5 (Tuesday)
Sale information: Tue, Feb 19, 2008 - Sat, Feb 23, 2008, ORLANDO, FL

2005 JLG 2030ES ELECTRIC SCISSORLIFT

Serial No: 0200135814
Delivery status: Delivery pending
Selling on day: 1 of 5 (Tuesday)
Sale information: Tue, Feb 19, 2008 - Sat, Feb 23, 2008, ORLANDO, FL

2005 JLG 2030ES ELECTRIC SCISSORLIFT

Serial No: 0200135805
Delivery status: Delivery pending
Selling on day: 1 of 5 (Tuesday)
Sale information: Tue, Feb 19, 2008 - Sat, Feb 23, 2008, ORLANDO, FL

Lot 892 - 2000 JLG 1932E2 ELECTRIC SCISSORLIFT

Serial No: 0200100909
Comes With: platform ext, solid tires
Notes: UNITED GUARD WARRANTY IS AVAILABLE FOR PURCHASE ON THIS UNIT FROM UNITED RENTALS. ADDITIONAL INFORMATION AVAILABLE IN OFFICE.
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 890 - 2000 JLG 1932E2 ELECTRIC SCISSORLIFT

Serial No: 0200069579
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 891 - JLG 1932E2 ELECTRIC SCISSORLIFT

Serial No: 0200069543
Comes With: platform ext, solid tires

Joseph Affidavit, Ex. 4

PHOTOS (6)

Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 893 - 2000 JLG 1932 ELECTRIC SCISSORLIFT

PHOTOS (6)

Serial No: 0200088057
Notes: UNITED GUARD WARRANTY IS AVAILABLE FOR PURCHASE ON THIS UNIT FROM UNITED RENTALS. ADDITIONAL INFORMATION AVAILABLE IN OFFICE.
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 893A - 2000 JLG 1932 ELECTRIC SCISSORLIFT

PHOTOS (6)

Serial No: 0200084704
Comes With: platform ext, solid tires
Notes: UNITED GUARD WARRANTY IS AVAILABLE FOR PURCHASE ON THIS UNIT FROM UNITED RENTALS. ADDITIONAL INFORMATION AVAILABLE IN OFFICE.
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 894 - 2005 JLG 1930ES ELECTRIC SCISSORLIFT

PHOTOS (6)

Serial No: 0200137004
Comes With: platform ext, solid tires
Hour meter reading: 68 H
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 849 - JLG 33RTS SCISSORLIFT

Serial No: 0200027448
Comes With: dual fuel, platform ext
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 853 - 1999 JLG 26MRT 4X4 SCISSORLIFT

PHOTOS (7)

Serial No: 0200052707
Comes With: dual fuel, platform ext
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

JLG 26MRT SCISSORLIFT

Serial No: 200035825
Delivery status: Delivery pending
Selling on day: 1 of 5 (Tuesday)
Sale information: Tue, Feb 19, 2008 - Sat, Feb 23, 2008, ORLANDO, FL

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JLG 26MRT SCISSORLIFT

Serial No: 200035364
Delivery status: Delivery pending
Selling on day: 1 of 5 (Tuesday)
Sale information: Tue, Feb 19, 2008 - Sat, Feb 23, 2008, ORLANDO, FL

Lifts - Scissorlifts : JLG COMMANDER

Lot 883 - JLG COMMANDER CM2033 ELECTRIC SCISSORLIFT

PHOTOS (6)

Serial No: 200014392
Comes With: solid tires
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 882 - JLG COMMANDER CM2033 ELECTRIC SCISSORLIFT

Serial No: 0200017443
Comes With: platform ext, solid tires
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lifts - Scissorlifts : MEC

Lot 855 - 1999 MEC 3247ES ELECTRIC SCISSORLIFT

PHOTOS (7)

Serial No: 10000213
Comes With: platform ext, solid tires
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 865 - 1999 MEC 3068ES ELECTRIC SCISSORLIFT

PHOTOS (6)

Serial No: A8021025
Comes With: platform ext, solid tires
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 862A - MEC 3068ES ELECTRIC SCISSORLIFT

Serial No: 8900202
Comes With: platform ext, solid tires
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

1999 MEC 3068 ELECTRIC SCISSORLIFT

Serial No: 8900364
Delivery status: Delivery pending
Selling on day: 1 of 5 (Tuesday)

Sale information: Tue, Feb 19, 2008 - Sat, Feb 23, 2008, ORLANDO, FL

Lifts - Scissorlifts : SIMON

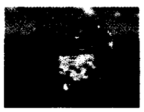
Lot 844 - SIMON 4612D 4X4 SCISSORLIFT


PHOTOS (6)

Serial No: 1551
Comes With: Deutz diesel, platform ext
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lifts - Scissorlifts : SKYJACK

SKYJACK SJ1116832 ELECTRIC SCISSORLIFT


PHOTOS (2)

Serial No: 81501
Comes With: platform ext
Delivery status: In Yard
Selling on day: 1 of 5 (Tuesday)
Sale information: Tue, Feb 19, 2008 - Sat, Feb 23, 2008, ORLANDO, FL

Lot 854 - SKYJACK SJ8841 SCISSORLIFT

Comes With: dual fuel, platform ext
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

SKYJACK SJ8841 4X4 SCISSORLIFT


PHOTO (1)

Serial No: 40599
Comes With: 3 cyl, platform ext
Delivery status: In Yard
Selling on day: 1 of 5 (Tuesday)
Sale information: Tue, Feb 19, 2008 - Sat, Feb 23, 2008, ORLANDO, FL

SKYJACK SJ8841 4X4 SCISSORLIFT


PHOTOS (2)

Serial No: 40474R
Comes With: 4 cyl, platform ext
Delivery status: In Yard
Selling on day: 1 of 5 (Tuesday)
Sale information: Tue, Feb 19, 2008 - Sat, Feb 23, 2008, ORLANDO, FL

Lot 852 - SKYJACK SJ7027 4X4 SCISSORLIFT


PHOTOS (6)

Serial No: 30614
Comes With: dual fuel, platform ext
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 861 - 2000 SKYJACK SJIII4832 ELECTRIC SCISSORLIFT

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PHOTOS (6)

Serial No: 87721

Comes With: platform ext, solid tires

Notes: UNITED GUARD WARRANTY IS AVAILABLE FOR PURCHASE ON THIS UNIT FROM UNITED RENTALS. ADDITIONAL INFORMATION AVAILABLE IN OFFICE.

Delivery status: In Yard

Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 860 - 2000 SKYJACK SJIII4832 ELECTRIC SCISSORLIFT


PHOTOS (6)

Serial No: 87659

Comes With: platform ext, solid tires

Notes: UNITED GUARD WARRANTY IS AVAILABLE FOR PURCHASE ON THIS UNIT FROM UNITED RENTALS. ADDITIONAL INFORMATION AVAILABLE IN OFFICE.

Delivery status: In Yard

Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 863 - 2000 SKYJACK SJIII4626 ELECTRIC SCISSORLIFT

Serial No: 706067

Comes With: platform ext, solid tires

Notes: UNITED GUARD WARRANTY IS AVAILABLE FOR PURCHASE ON THIS UNIT FROM UNITED RENTALS. ADDITIONAL INFORMATION AVAILABLE IN OFFICE.

Delivery status: In Yard

Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 898 - 1999 SKYJACK SJIII3015 ELECTRIC SCISSORLIFT


PHOTOS (6)

Serial No: 150468

Comes With: platform ext, solid tires

Delivery status: In Yard

Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lifts - Scissorlifts : SNORKEL

Lot 878 - SNORKEL S/P 25 ELECTRIC SCISSORLIFT


PHOTOS (6)

Serial No: JA01308

Comes With: platform ext, solid tires

Delivery status: In Yard

Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 889 - SNORKEL S/P 20 2032E ELECTRIC SCISSORLIFT


PHOTOS (6)

Serial No: DC00190

Comes With: platform ext, solid tires

Delivery status: In Yard

Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 886 - SNORKEL S/P 20 2032E ELECTRIC SCISSORLIFT

Serial No: DC00189

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Comes With: platform ext, solid tires
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 887 - SNORKEL S/P 20 2032E ELECTRIC SCISSORLIFT


PHOTOS (6)

Serial No: DC00188
Comes With: platform ext, solid tires
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 888 - SNORKEL S/P 20 2032E ELECTRIC SCISSORLIFT


PHOTOS (6)

Serial No: DC00187
Comes With: platform ext, solid tires
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lifts - Scissorlifts : UPRIGHT

UPRIGHT XRT33 4X4 SCISSORLIFT

Delivery status: Delivery pending
Selling on day: 2 of 3 (Thursday)
Sale information: Wed, Feb 27, 2008 - Fri, Feb 29, 2008, MOERDIJK, NLD

UPRIGHT XRT33 4X4 SCISSORLIFT

Comes With: extendable platform
Delivery status: Delivery pending
Selling on day: 2 of 3 (Thursday)
Sale information: Wed, Feb 27, 2008 - Fri, Feb 29, 2008, MOERDIJK, NLD

Lot 864 - 2002 UPRIGHT X31N ELECTRIC SCISSORLIFT


PHOTOS (5)

Comes With: platform ext, solid tires
Hour meter reading: 287 H
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

UPRIGHT SL26RT 4X4 SCISSORLIFT

Serial No: 8608
Delivery status: In Yard
Selling on day: 2 of 3 (Thursday)
Sale information: Wed, Feb 27, 2008 - Fri, Feb 29, 2008, MOERDIJK, NLD

2000 UPRIGHT X20N ELECTRIC SCISSORLIFT

Serial No: 13729
Comes With: platform ext

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PHOTO (1)

Delivery status: In Yard
Selling on day: 1 of 5 (Tuesday)
Sale information: Tue, Feb 19, 2008 - Sat, Feb 23, 2008, ORLANDO, FL

Result Pages: First **1** Last

All > Lifts - Scissorlifts >

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Ritchie Bros. Auctioneers - Equipment Search Result Details

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New Search

All > Pile & Hydraulic Hammers >

Search results: **1 - 12** of **12** items found on **1 page**
Result Pages: First **1** Last

Pile & Hydraulic Hammers : APE

Lot 1309 - APE 50 HYDRAULIC HAMMER

Comes With: power unit
Delivery status: Delivery pending
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Pile & Hydraulic Hammers : ATLAS COPCO

2005 ATLAS COPCO SBC410 HYDRAULIC HAMMER

Serial No: KAL006753
Comes With: to fit Skid Steer Loader, operational weight 440 lbs
Delivery status: Delivery pending
Selling on day: 1 of 5 (Tuesday)
Sale information: Tue, Feb 19, 2008 - Sat, Feb 23, 2008, ORLANDO, FL

2005 ATLAS COPCO SB300 HYDRAULIC HAMMER

Serial No: KAL001976
Comes With: to fit 4.5 ton to 9 ton Loader Backhoe, operational weight 675 lbs
Delivery status: Delivery pending
Selling on day: 1 of 5 (Tuesday)
Sale information: Tue, Feb 19, 2008 - Sat, Feb 23, 2008, ORLANDO, FL

Pile & Hydraulic Hammers : BOBCAT

Lot 1081 - BOBCAT B950 HYDRAULIC HAMMER


PHOTO (1)

Serial No: 797012686
Comes With: to fit most skid steer loaders
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

2005 BOBCAT B850 HYDRAULIC HAMMER

Serial No: 794014209
Comes With: to fit Skid Steer Loader, operational weight 823 lbs

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Delivery status: Delivery pending
Selling on day: 1 of 5 (Tuesday)
Sale information: Tue, Feb 19, 2008 - Sat, Feb 23, 2008, ORLANDO, FL

2005 BOBCAT B850 HYDRAULIC HAMMER

Serial No: 794013640
Comes With: to fit Skid Steer Loader, operational weight 823 lbs
Delivery status: Delivery pending
Selling on day: 1 of 5 (Tuesday)
Sale information: Tue, Feb 19, 2008 - Sat, Feb 23, 2008, ORLANDO, FL

Pile & Hydraulic Hammers : DYNATEC

Lot 486 - 2007 DYNATEC SB1200 HYDRAULIC HAMMER (UNUSED)

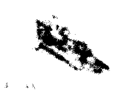
PHOTO (1)

Serial No: 1250194
Comes With: to fit Case 580, 590, 680, 690, 780, Cat 416 to 446, JD 310 to 410 and hyd excavators up to 30,500 lbs
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 485 - 2007 DYNATEC SB1200 HYDRAULIC HAMMER (UNUSED)

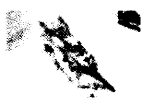
PHOTO (1)

Serial No: 1250181
Comes With: to fit Case 580, 590, 680, 690, 780, Cat 416 to 446, JD 310 to 410 and hyd excavators up to 30500 lbs
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Pile & Hydraulic Hammers : OKADA

Lot 487 - 2000 OKADA 308 HYDRAULIC HAMMER


PHOTO (1)

Serial No: 3055
Comes With: to fit hyd excavator
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 1079 - 1999 OKADA 302A 500 LB HYDRAULIC HAMMER


PHOTO (1)

Serial No: 1972
Comes With: to fit skid loader
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Pile & Hydraulic Hammers : OTHER

Lot 540 - KHB400 HYDRAULIC HAMMER

Comes With: to fit loader backhoe, moil point
Delivery status: In Yard

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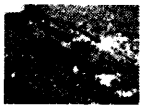

PHOTO (1)

Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Pile & Hydraulic Hammers : ROCKRAM

Lot 484 - 2007 ROCKRAM 778 STR HYDRAULIC HAMMER (UNUSED)

PHOTO (1)

Serial No: 593641
Comes With: to fit 44-77K lb hyd excavators
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Result Pages: First **1** Last

All > Pile & Hydraulic Hammers >

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New Search

All > Pull Scrapers >

Search results: **1 - 12** of **12** items found on **1 page**
Result Pages: First **1** Last

Pull Scrapers : ALLIED

ALLIED KS-1000 13 YARD PULL TYPE SCRAPER

PHOTOS (5)

Serial No: 1000KS68A
Comes With: hyd push-off
Delivery status: Delivery pending
Sale information: Thu, Apr 17, 2008, DECOCK - LANGENBURG, SK

Pull Scrapers : CATERPILLAR

CATERPILLAR 70 HYDRAULIC PULL SCRAPER

Delivery status: Delivery pending
Sale information: Fri, Apr 18, 2008, BOULET - DONNELLY, AB

CATERPILLAR 60 PULL TYPE HYDRAULIC SCRAPER

PHOTOS (4)

Serial No: PS60
Comes With: 16.00x20
Delivery status: Delivery pending
Sale information: Fri, Apr 4, 2008, NEWBROOK, AB

Pull Scrapers : CEPCO

Lot 753 - 2000 CEPCO S175 HYDRAULIC PULL SCRAPER

PHOTOS (5)

Serial No: S1750000C071
Comes With: 13.00x24
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Pull Scrapers : CROWN

CROWN 600 4-5 YARD PULL-TYPE SCRAPER

Serial No: 15730
Comes With: hyd dump

Joseph Affidavit, Ex. 4

PHOTOS (3)

Delivery status: Delivery pending

Sale information: Fri, Apr 4, 2008, CAMPBELL - WOLSELEY, SK

CROWN 600 6 YARD HYDRAULIC PULL SCRAPER

PHOTO (1)

Serial No: 0715

Delivery status: Delivery pending

Sale information: Sat, Apr 12, 2008, FISCHER - MOOSE JAW, SK

Pull Scrapers : CW ENTERPRISES

CW ENTERPRISES 16 FT PULL TYPE GRADER

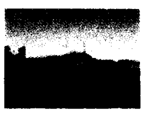

PHOTO (1)

Serial No: OBL

Comes With: hyd lift

Delivery status: Delivery pending

Sale information: Sat, Apr 5, 2008, BANGA - REGINA, SK

Pull Scrapers : LEON

LEON 580 PULL TYPE SCRAPER

PHOTOS (3)

Serial No: 643205

Comes With: hyd lift, hyd unload, 12.5Lx16

Delivery status: Delivery pending

Sale information: Fri, Apr 25, 2008, POPOWICH - WYNYARD, SK

Pull Scrapers : POWERMATIC

POWERMATIC 700-D 7 YARD PULL TYPE SCRAPER

PHOTOS (3)

Serial No: 181-76

Comes With: 10.00x20

Delivery status: Delivery pending

Sale information: Mon, Apr 28, 2008, HANNAH - WASKADA, MB

Pull Scrapers : RICHARDSON

RICHARDSON WR17 17 YARD HYD PULL SCRAPER

PHOTOS (2)

Serial No: 112

Comes With: hyd, 21.00x25

Delivery status: Delivery pending

Sale information: Thu, Apr 24, 2008, MACARA - MORTLACH, SK

Pull Scrapers : SCHULTE

SCHULTE 8.5 YARD PULL TYPE SCRAPER

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PHOTOS (3)

Serial No: OBL
Comes With: hyd dump, 40x14 rear
Delivery status: Delivery pending
Sale information: Sat, Apr 19, 2008, LINK - WINDTHORST, SK

SCHULTE 6.5 YARD PULL SCRAPER


PHOTOS (2)

Serial No: 1280108409
Delivery status: Delivery pending
Sale information: Mon, Apr 7, 2008, FERGUSON - EDGELEY, SK

Result Pages: First **1** Last

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New Search

All > Trenchers >

Search results: **1 - 22** of **22** items found on **1 page**
Result Pages: First **1** Last

Trenchers : CASE

Lot 765 - CASE 460 4X4X4 COMBO TRENCHER

PHOTOS (6)

Serial No: JAF0164105
Comes With: 3 cyl Kubota, 6 ft trencher, plow, boring attach
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Trenchers : DITCH WITCH

2004 DITCH WITCH 3700DD TRENCHER

Serial No: 3X0248
Hour meter reading: 300 H
Delivery status: Delivery pending
Selling on day: 1 of 5 (Tuesday)
Sale information: Tue, Feb 19, 2008 - Sat, Feb 23, 2008, ORLANDO, FL

Lot 763A - 2003 DITCH WITCH 3700DD 4X4 RIDE ON TRENCHER

Serial No: 3X0600
Comes With: Deutz 3 cyl, backfill blade, H314 trencher, frt weights
Hour meter reading: 546 H
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 763 - 2003 DITCH WITCH 3700DD 4X4 RIDE ON TRENCHER

PHOTOS (6)

Serial No: 3X0051
Comes With: Duetz 3 cyl, backfill blade, H314 trencher
Hour meter reading: 777 H
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 764 - 2000 DITCH WITCH 3700DD 4X4 TRENCHER

Serial No: 3V0035
Comes With: Deutz 3 cyl, backfill blade

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PHOTOS (5)

Notes: UNITED GUARD WARRANTY IS AVAILABLE FOR PURCHASE ON THIS UNIT FROM UNITED RENTALS. ADDITIONAL INFORMATION AVAILABLE IN OFFICE.
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

2004 DITCH WITCH 3610DD TRENCHER

Serial No: 3Y0794
Comes With: 3 cyl diesel
Hour meter reading: 500 H
Delivery status: Delivery pending
Selling on day: 1 of 5 (Tuesday)
Sale information: Tue, Feb 19, 2008 - Sat, Feb 23, 2008, ORLANDO, FL

Lot 771 - 2003 DITCH WITCH 1820H WALK BEHIND TRENCHER

PHOTOS (3)

Serial No: 1X0114
Comes With: Honda 18 hp, 3 ft trencher
Hour meter reading: 256 H
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 770 - 2006 DITCH WITCH 1820 TRENCHER

PHOTOS (4)

Serial No: CMW182HEE60000281
Hour meter reading: 24 H
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

DITCH WITCH 350SX ROCK SAW

Serial No: 4G0094
Comes With: Deutz 2 cyl diesel, Charles Machine Works H341 sn 2H1150 44 in rock saw
Delivery status: Delivery pending
Selling on day: 1 of 3 (Tuesday)
Sale information: Tue, Feb 26, 2008 - Thu, Feb 28, 2008, LOS ANGELES, CA

Trenchers : MASTENBROEK

2001 MASTENBROEK 60/35ME CRAWLER TRENCHER

Serial No: 010151
Comes With: side disch conv, cab
Delivery status: Delivery pending
Selling on day: 1 of 3 (Wednesday)
Sale information: Wed, Feb 27, 2008 - Fri, Feb 29, 2008, MOERDIJK, NLD

Trenchers : VERMEER

Lot 766 - 1999 VERMEER V3550A 4X4 RIDE ON TRENCHER

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PHOTOS (7)

Serial No: 1VRS072P7X1001226
Comes With: 3 cyl, backfill blade, frt weights, S03550 trencher
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 767 - 1998 VERMEER V3550A 4X4X4 RIDE ON TRENCHER


PHOTOS (10)

Serial No: 1VRS072P3W1000489
Comes With: Kubota 3 cyl, backfill blade, frt weights, S03550 6 ft trencher
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 768 - 1999 VERMEER TR2050 WALK BEHIND TRENCHER

Serial No: 1VRT040B0X1000171
Comes With: Kohler, 4 ft trencher
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 769 - VERMEER TR2050 WALK BEHIND TRENCHER


PHOTOS (5)

Serial No: 1VRT040B7X1000166
Comes With: Kohler, 4 ft trencher
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 775 - 1998 VERMEER VR1150 WALK BEHIND TRENCHER


PHOTOS (5)

Serial No: 1VRF051M6W1001875
Comes With: Honda 11 hp, 48 in. trencher
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 776 - 1998 VERMEER VR1150 WALK BEHIND TRENCHER


PHOTOS (5)

Serial No: 1VRF051M2W1001873
Comes With: Honda 11 hp, 36 in. trencher
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 773 - 1999 VERMEER V1150 WALK BEHIND TRENCHER


PHOTOS (7)

Serial No: 1VRF051M4W1002486
Comes With: Honda 11 hp, 3 ft trencher bar
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 772 - 1999 VERMEER V1150 WALK BEHIND TRENCHER

Serial No: 1VRF051M0X1002487
Delivery status: In Yard

Joseph Affidavit, Ex. 4

Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 774 - 1998 VERMEER V1150 WALK BEHIND TRENCHER

PHOTOS (6)

Serial No: 1VRF051M4W1001888
Comes With: Honda 13 hp, 3 ft trencher
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

2006 VERMEER RT650 4X4X4 COMBINATION TRENCHER

PHOTOS (2)

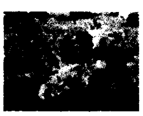
Serial No: 10RZ0821161000393
Comes With: Deutz 4 cyl, B600A backhoe, dozer, PT650 6 ft trencher, vib plow
Hour meter reading: 177 H
Delivery status: In Yard
Selling on day: 1 of 5 (Tuesday)
Sale information: Tue, Feb 19, 2008 - Sat, Feb 23, 2008, ORLANDO, FL

Lot 777 - 2006 VERMEER RT200 WALK BEHIND TRENCHER

PHOTOS (5)

Serial No: 1VRX081F051000923
Comes With: Kohler 23 hp, 4 ft 6 in. trencher bar
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Lot 778 - 2005 VERMEER RT100 WALK BEHIND TRENCHER



PHOTOS (5)

Serial No: 1VRX051E351001523
Comes With: Kohler 15 hp, 3 ft 6 in. trencher bar
Delivery status: In Yard
Sale information: Tue, Dec 18, 2007, COLUMBUS, OH

Result Pages: First **1** Last

All > Trenchers >

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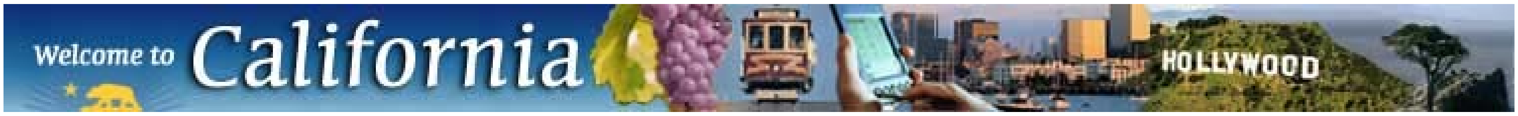
Joseph Affidavit, Ex. 4

California Home Tuesday, January 1, 2008



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- ( ) *County:* Yolo

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Lead Agency:

- ( ) *All*
- (•) *Agency* Air Resources Board

Reviewing Agency:

- (•) *All*
- ( ) *Agency* Air Resources Board, Airport

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All Types **Document Types**

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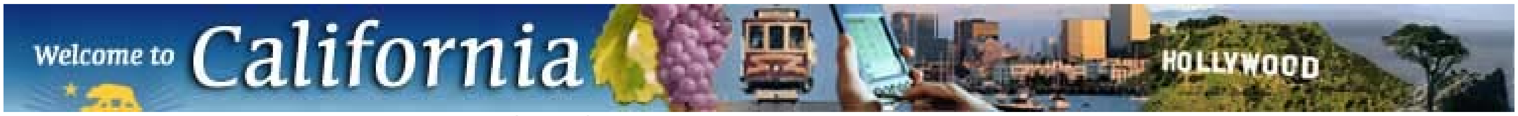
Joseph Affidavit, Ex. 5

California Home Tuesday, January 1, 2008



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Page: 1

Query Parameters: All None All **Date Range:** 2007-01-01 to 2008-01-31

SCH#	Lead Agency	Project Title	Description	Document Type	Date Received
2007082087	Air Resources Board	Proposed State Strategy for California's 2007 State Implementation Plan	Notice of Public Meeting to Consider Approval of the Proposed State Strategy for California's State Implementation Plan (SIP) for the Federal 8-Hour Ozone and PM2.5 Standards.	Oth	8/14/2007
2007081077	Air Resources Board	Modification to the Current SIP Commitment for Pesticide Emission Reductions in the Ventura County Nonattainment Area	Revised Proposed Revision and Revised Environmental Analysis to the Pesticide Element of the 1994 Ozone SIP for the Ventura County Nonattainment Area.	Oth	8/13/2007

[First] [Next] [Previous] [Last]

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Joseph Affidavit, Ex. 5

Attachment 8

STATE OF CALIFORNIA
AIR RESOURCES BOARD

PUBLIC HEARING TO CONSIDER THE ADOPTION OF A PROPOSED REGULATION FOR IN-USE OFF-ROAD DIESEL MACHINES	)))))	Agenda Item: 07-5-6 January 4, 2008

AFFIDAVIT OF GARY E. ROHMAN

I, Gary E. Rohman, hereby declare and state as follows:

1. I am over the age of 18 and otherwise competent to testify to the matters contained in this affidavit.

Construction-Industry Experience

2. I have worked in the heavy construction equipment rental industry for twenty-eight years for ECCO Equipment Corporation, located in Visalia, California. I am currently a vice president for ECCO, a position that I have held for more than twenty years. Since 2000, I have been actively involved with the Associated General Contractors of California. Currently, I serve as chairman of the San Joaquin District of AGC. In addition, I currently hold a seat on the Executive Committee of AGC of California.

3. The experience and information that I have gained while working in the equipment rental industry has given me extensive knowledge of the different types of off-road equipment, as well as the engine enhancement challenges and aftertreatment integration challenges that go along with any effort to reduce emissions from a machine after it has been manufactured and sold to industry.

ECCO Fleet

4. My position at ECCO has taught me first-hand the interplay between a

construction-related industry's fleet make-up and its economic stability. ECCO owns more than 700 pieces of heavy construction equipment. The construction equipment ECCO owns, offers an asset value that is a major component of the company's business plan. Heavy off-road construction equipment offers the equipment owner years of productive life. Construction equipment that has been well maintained and properly serviced can operate productively for twenty to thirty years. This equipment value is what ECCO uses as collateral for the loans it needs to purchase new rental and support equipment.

5. From an equipment rental company's perspective, every day that a machine is down due to an engine repower or aftertreatment installation, the machine is not available for rent, which directly affects equipment utilization and revenue. From my knowledge of the construction industry, the same applies to our customers: equipment that is not available does not contribute to a company's ability to complete its contracts.

6. The average replacement cost for a piece of equipment in ECCO's rental fleet is $546,000.00, making the accelerated turnover of equipment a very costly event.

7. ECCO has taken a proactive approach to lowering exhaust emissions from the fleet. For the most part, ECCO's emissions reduction strategy pre-2006 focused on replacing Tier 0 engines with newer Tier 1 engines because that was the "best available control technology" engine available during that time. Since 2000, ECCO has successfully reduced the unregulated (Tier 0) engines in its fleet by 76 percent. This reduction in emissions cost ECCO more than $62 million dollars.

Repowers

8. ECCO's experience has shown that diesel engine repowers are time-consuming and extremely expensive; therefore, this emissions reduction strategy is not a realistic

compliance option for most off-road machines.

9. In April 2004, ECCO requested and was granted its first grant under Carl Moyer to fund the replacement of a Tier 0 engine in a Caterpillar 950F rubber-tired loader with a Tier 1 engine. Since that time, ECCO has received additional support to finance the clean-up of 28 different pieces of off-road construction equipment, including nine (9) Caterpillar 631 scrapers, five (5) Caterpillar 623 scrapers, one (1) Caterpillar 950F loader, two (2) Caterpillar 988 loaders, four (4) Caterpillar D10 dozers, thee (3) Caterpillar 825 compactors, one (1) Caterpillar 824 Rubber-Tired dozer, one (1) Caterpillar 325 excavator, and two (2) Komatsu PC 1100 excavators. The engine repower work cost more than $4,425,191.00 to complete.

10. Every step of the repowering process—including engine availability, mechanical expertise, Verified Diesel Emission Control Systems (VDECS) compatibility, installation challenges, and product support—is complex and subject to delay. Repowering an off-road engine in a piece of construction equipment is a time consuming process that dramatically impacts the availability of your equipment. Depending on the equipment type, it easily can take six months to complete the re-power process from start to finish, even longer, in some cases.

11. For example, ECCO recently repowered a Caterpillar 988F loader from a Tier 0 engine to a Tier 2 engine. The loader was transported to an equipment dealership for a repower on June 26, 2006. Because of delays in receiving the new Tier 2 engine, as well as other funding complications, the repower was not completed until February 14, 2007. At that time, the machine was transported back to ECCO's yard where it was parked until the particulate filter, (which is required under the Carl Moyer grant program) arrived at the dealership.

12. On May 14, 2007, this loader was transported back to the dealership to have two HUSS filters installed. In part because the dealers spent additional time to remedy the safety

hazards related to the installation, the machine was not finally released to ECCO until September 11, 2007.

13. In the end, this loader was removed from ECCO's rental inventory for over 400 days. These delays occurred in the absence of a regulation. It will certainly be even more challenging to get repowers completed when the California Air Resources Board's (ARB) in-use, off-road diesel (ORD) rule takes effect, which will create a potential market of 100,000 or more noncompliant (Tier 0) engines that need to be repowered to meet the ORD regulations.

14. As adopted by CARB on July 26, 2007, the ORD rule's compliance timelines set unrealistic emissions standards for medium and large fleet owners. Completing 1200 to 1500 re-powers over a three year period was no small feat for our industry to achieve. Requiring close to 100,000 machines to be re-powered in the time frames required by the ORD rule will be an impossible challenge to fulfill. Dealerships were already at overflow capacity before the adoption of the regulation, making it next to impossible to meet the demand for repowers that the ORD rule will impose.

Used Equipment

15. Most of ECCO's equipment is purchased thorough the auction process. Based on my experience, the California used equipment market is insufficient to meet the demand that the off-road rule will create. Indeed, the used equipment market worldwide is insufficient to meet the demand for newer-tier equipment that will result from implementation of the ORD rule. Tier 2 machines (or better) are not readily available via these used-equipment markets.

16. In the past, ECCO had sold some of its newer equipment. But now, considering the replacement supply shortages, ECCO plans to hold on to all of its Tier 2 or newer equipment. As the compliance dates approach, and more and more equipment owners will realize the impact

that this regulation will have on their business, more and more older-tier equipment will flood the marketplace, creating a surplus of used equipment. This equipment surplus will continue to deteriorate equipment values, and in the process, compound a company's ability to meet the cost of compliance by purchasing newer, higher-tier equipment.

17. As industry continues to comply with the ORD regulation by selling off non-compliant equipment, the population of used Tier 0 and Tier 1 equipment will force a drop in equipment values. Many equipment owners that plan on selling older equipment to fund their emission compliance program may very well find that these values have evaporated mainly due to over-supply and lack of demand. Additionally, the asset values traditionally associated with large pieces of construction equipment, and used by many to support their bonding capacity, will diminish, resulting in lower bonding assessments.

18. Based on my observation of several equipment auctions that were held throughout California since the adoption of the ORD regulation, the supply of used Tier 2 or better equipment is very limited, and older, lower-tier used equipment is losing value. As an example, Caterpillar 657B scrapers that sold at auction for more than $100,000.00 in December of 2005 are now selling for under $50,000.00, as evidenced by a recent November 2007 auction. This reduction represents a 50 percent decrease in market value.

19. To make matters worse, the short supply of Tier 2 or better equipment that becomes available will be purchased by the highest bidder. In some cases, equipment owners that need this equipment to fulfill project requirements or rental commitments compete against each other to drive up the auction price higher than would otherwise be the case.

20. Neither I nor other construction-industry experts that I know believe ARB's reports on the availability of higher-tier used equipment. Accordingly, relying on my contacts

with Ritchie Brothers and my familiarity with its auction website and the Machinery Trader website, several construction-industry experts and I reviewed data on the availability of higher-tier versus lower-tier equipment availability versus the data reported by ARB in conjunction with its proposed rule. As part of that process, we obtained data from the Ritchie Brothers and Machinery Trader websites and historical data directly from Ritchie Brothers.

21. In collecting and comparing data, we divided equipment into two categories: (a) small, inexpensive equipment that companies would replace regularly (e.g., every five years) in the absence of any regulation, and (b) larger, more-expensive, higher-horsepower equipment integral to construction companies' ability to perform on contracts or (in ECCO's case) to meet its rental customers' needs. The small-equipment category included Skid Steer Loaders, Forklifts, Boom Lifts, and Loader Backhoes. For the larger-equipment category, we selected representative, workhorse vehicles, including Crawler Tractors such as the Cat D7, D8, D9, and Cat D10; Motor Scrapers such as the Cat 621, 623, 633, 631, 627, 637, 651, and 657; Wheel Loaders such as the Cat 980, 988, and 992; Motor Graders such as the Cat 12, 120, 140, 14, 160, and 16; and Rock Trucks such as the Cat 769, 773, and 777. We selected these examples of larger equipment as representative of the type of equipment necessary for the California construction industry to function, but expensive to replace.

Tier 4 Engines

22. The off-road engines needed to bring ECCO into final compliance with the rule do not exist in today's marketplace, and we will not see them for a minimum of another six years. ECCO is concerned by the fact that Tier 4 engines will not be available in time to serve as a viable compliance strategy. In fact, new off-road diesel machines being sold today, in many cases, are not even equipped with Tier 3 engines. During 2007, some models were still being

manufactured with Tier 1 engines.

23. During 2006-07, ECCO staff were aware of instances where equipment owners had to wait up to a year to take delivery of new equipment because the demand exceeded the supply. In our view, new equipment supplies will not be adequate to meet the demands of the California marketplace under the ORD rule.

Verified Diesel Emission Control Systems

24. There are not enough VDECS available in the California marketplace to meet the demand for approved, reliable aftertreatment devices that will result from implementation of the ORD rule. To date, there are only three VDECS available in the California marketplace, and only one of these products can operate without the requirement of electrical current, something that is not feasible at most jobsite locations. All three VDECS will be unsuitable for most existing applications, due to space constraints, diminished visibility, and safety considerations. Additionally, there are no VDECS available that are capable of reducing emissions of nitrogen oxides from off-road engines.

25. To meet Tier 4 emissions levels, the construction industry needs additional time for Tier 4 engines to enter the marketplace, which will not happen in the higher horsepower ranges until 2013 to 2014. Without the option to buy Tier 4 equipment, companies will be forced to evaluate and implement other less-effective emissions reduction strategies. These “band-aid” approaches include engine modifications that will cost the industry billions of dollars, but (in the end) will likely prove to be insufficient for many companies struggling to meet the rule’s fleet emissions averages. Further, the ORD rule’s stringent compliance schedule, coupled with the lack of VDECS and Tier 4 engines in the marketplace, will forces equipment owners to remove otherwise-lawful equipment from their inventory before the end of its useful life.

26. As currently written, the ORD rule requires very aggressive action on industry's part—both in schedule and expense. In ECCO's case, based on my understanding of ARB's fleet average approach to compliance, most of our prior retrofit work unfortunately will do little to help us comply with the ORD rule. The emission timetables contained in the ORD regulation force an early retirement of all unregulated (Tier 0) and Tier 1 engines. In retrospect, it would have made better business sense for ECCO to have done nothing to voluntarily reduce air emissions, to have kept its money in the bank, and to have sat back and waited for a legal mandate before taking steps to achieve a cleaner-burning fleet.

27. I have personal knowledge of the foregoing and am competent to testify to it before the California Air Resources Board or at trial.

I certify under penalty of perjury under the laws of the State of California that the foregoing is true and correct. Executed on this 4th day of January 2008, at Visalia, California .

Gary E. Rohman

Attachment 9

Estimating the Construction Industry Compliance Costs for CARB's Off-Road Diesel Vehicle Rule

Technical Supplement

Prepared by
M.Cubed

On behalf of
the Construction Industry Air Quality Coalition

January 2008

Technical Supplement

This Technical Supplement supplements the July 2007 report entitled "Estimating the Construction Industry Compliance Costs for CARB's Off-Road Diesel Vehicle Rule" (July Report) that M.Cubed prepared for the Construction Industry Air Quality Coalition (CIAQC). The Technical Supplement consists of two components: (1) an elaboration of the technical methodology discussed in the July Report; and (2) two errata pages that correct incorrect data from a table and the text discussing that data.

Technical Methodology

We derived the Construction Industry Cost Model (CICM) based on two ARB Staff models: (1) the OFFROAD2007 emission inventory model that ARB Staff have prepared and updated over time to estimate the population, activity, and emissions estimate of the varied types of off-road equipment; and (2) the Statewide Off-road Regulatory Cost/Benefit Model (ORM) firm survey financial model that ARB prepared in conjunction with the proposed in-use off-road diesel vehicle rule. The CICM model relies on the fleet turnover and retrofit rates implied from the analysis in the ORM model as applied to the OFFROAD2007 projections. The CICM then used specific documented parameters, such as new vehicle prices from firm surveys rather than regression estimates, and actual historic equipment sales data, to estimate how total statewide costs would change under the proposed regulation.

The current version of OFFROAD2007 (dated December 15, 2006) is available at http://www.arb.ca.gov/msei/offroad/offroad.htm. The current version of ORM (dated May 17, 2007) is available at http://www.arb.ca.gov/msprog/ordiesel/documents.htm. OFFROAD2007 is a computer program coded in FORTRAN, a computer language that most programmers and even ARB Staff consider obsolete. ORM is a Visual Basic module that runs within a Microsoft Access database based on Access queries.

Modeling Parameters and Data Uncertainties

This section supplements the July Report's discussion of modeling parameter and data uncertainties (pp.19-20). Using local sensitivity analysis (changing one parameter value while holding all others constant), we identified several variables with significant influence on results. This section discusses our approach and the ARB Staff models and empirical data on which we based our approach.

- *Tier 0 Composition of sample fleets.* We reviewed the sample fleets in the ORM used to compute regulatory costs, which included 49% Tier 0 equipment. By contrast, the OFFROAD2007 emission inventory model shows 39% Tier 0 vehicles in the vehicle population for 2008. By assuming a higher number of Tier 0 vehicles in its ORM cost model, the Staff has estimated lower regulatory costs because a larger number of older vehicles lowers the apparent costs of replacement. We used the OFFROAD2007 population with fewer Tier 0 vehicles to be consistent with the emission projections.
- *Fleet growth rate due to industry growth.* We used ARB Staff's suggested growth rate of 1.95% per year.
- *Fleet natural retirement rate.* We analyzed the OFFROAD2007 emission inventory model and found it to demonstrate an underlying (or natural) vehicle retirement rate of 6.2%, in the absence of the proposed regulation. Although ARB Staff's Technical Support Document (p. 177) shows a natural retirement rate of 5.0%, we did not find any source for that reported value.

  We compared this turnover rate to empirical data on equipment sales in California. We acquired new equipment sales data in California for 1998 to 2006 from the Equipment

Manufacturers Association.[1] The average of the sales for this period was 8,215 pieces of equipment. We computed the amount of sales required to achieve both a 6.2% turnover rate and 1.5% growth rate by comparing the growth in vehicle inventory in the OFFROAD2007 model over that period and calculating the implied sales given those parameters. This amount was then compared to the average actual sales over the same period. Using the state construction industry gross state product and the Staff's emission inventory, we were able to estimate the actual annual sales growth and equipment retirement rates that match the total equipment inventory used by the Staff. To achieve both a 6.2% turnover rate and the historic 1.5% growth rate for 1998 to 2006 would have required that actual sales be 47% (i.e., 3,860 more new vehicles) higher than recorded, increasing the average sales figure to 12,075 new vehicles for that period. Under these implicit Staff assumptions, the projected total sales in 2010 would be 13,939 vehicles.

In this cost analysis, we used the OFFROAD2007 inventory and computed the total new equipment additions based on trend-forecasted equipment sales from the manufacturers' sales data. We used the Staff's projected growth rate of 1.95% and solved for the implied turnover rate that would make annual sales equal the projected data from actual sales. With a sales growth rate of 2.6%, which matches the 1.95% growth rate in the fleet size assumed by the Staff,[2] the implied equipment turnover rate based on sales net of growth is 3.7% for a total projected sales of 10,114 vehicles in 2010.

This turnover rate computed with historical sales data and the OFFROAD2007 inventory is 40% lower and the projected sales in 2010 are 27.4% less than what is implied in the ARB Staff's Technical Support Document and ORM analysis. A lower turnover rate implies that fewer vehicles are replaced through the course of business, and increases the cost of the regulation.

- *Vintage of replaced equipment.* As a conservative representative of the vintage of equipment that will be retired under the proposed regulation, the CICM model uses the average replacement cost per horsepower as a weighted average of the portion of the fleet that was retired under normal conditions in a particular year. In actuality, the regulation will push forward the retirement of newer vehicles so that the cost per vehicle retired will increase under the regulation.
- *New equipment prices.* The July Report explains the methodology used for estimating new equipment prices based on a survey of actual new vehicle bids rather than a regression analysis based on used vehicles as done by the Staff.
- *Repowering Rate.* Because not all vehicles can undergo repowering, the scenarios considered included an assumption that 25% of the fleet could be repowered. Existing data indicate that the actual rate may be substantially lower.[3]

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[1] Declaration of Michael Lewis, Construction Industry Air Quality Coalition, July 25, 2007. (See Associated General Contractors of America Comments to CARB dated July 25, 2007.)

[2] The 2.6% sales growth rate equals the 1.95% fleet growth rate plus sales to replace increasing numbers of retired vehicles as the fleet grows.

[3] Declaration of Michael Buckantz, Justice & Associates, July 17, 2007. (See Associated General Contractors of America Comments to CARB, dated July 25, 2007.)

- *Discount Rate.* Consistent with ARB Staff's analysis, we used a discount rate of 7.0% for benefits that occur in the future. The ARB Staff did not document whether the discount rate is nominal or real (i.e., including or excluding inflation). To the extent that that rate is nominal, the real rate should be 4.5% (7.0% minus a 2.5% inflation rate), which would increase projected costs (and decrease cost effective) commensurately. We selected a 2.5% inflation rate, based on the embedded forecast in 20-year U.S. Treasury bond yield rates.[4]

[4] U.S. Department of the Treasury, retrieved July 11, 2007, http://www.treas.gov/offices/domestic-finance/debt-management/interest-rate/ltcompositeindex.shtml, http://www.treas.gov/offices/domestic-finance/debt-management/interest-rate/real_yield.shtml, http://www.treas.gov/offices/domestic-finance/debt-management/interest-rate/yield.html.

Errata Pages to “Estimating the Construction Industry Compliance Costs for CARB’s Off-Road Diesel Vehicle Rule” (July 2007)

On page 16 of the July Report, Table 1 contains data misreported from a spreadsheet. The attached change pages dated December 2007 replace pages 15-16 (Table 1 and the text discussing it) in the July Report.

determine the cumulative impacts of recently enacted and proposed regulations on the industry.

The Analytic Steps for Estimating Compliance Costs

The objective research question is: What is the net present value of the fiscal costs to the construction industry from complying with ARB's proposed in-use off-road diesel vehicle rule? We estimated compliance costs by constructing an Excel spreadsheet model and then simulating several scenarios determined by values chosen for input parameters.

Construction Industry Cost Model Composition

The CICM relies on the same underlying data used by the ARB Staff in its analysis. However, the CICM analyzes the statewide fleet as a whole, rather than looking at individual fleets and then aggregating up as the Staff did. In this way, the CICM is able to determine accurately the incremental statewide changes in the fleet. Rather than trying to trace through every transaction by individual firms, the CICM assesses the difference between the "first" and "last" transactions in the compliance sequence triggered by the regulation. This difference represents the incremental equipment additions that must occur to decrease the number of Tier 0 and 1 vehicles and replace them with Tier 2, 3 and 4 ones. We do *not* assume that all turnover actions require purchase of a new piece of equipment—we simply ignore used market transactions because the net effect has little or no impact on statewide costs.

The CICM begins with the statewide emission inventory database and culls it down to construction equipment (which represents over 90% of the affected fleet). We added the new vehicle prices and retrofit costs developed by the Staff. In addition, we acquired the Staff's Access database model for its sample of fleets. This latter model was used by the Staff to simulate potential compliance strategies for specific fleets and then extrapolated to the statewide fleet.

We extracted from the Staff's database model the turnover and retrofit rates under the baseline (without regulation) and regulatory scenarios and calculated the net impacts from the regulation embedded in the Staff modeling. **This net turnover rate represents new equipment additions to the statewide fleet—the inverse interpretation is that this is the retirement rate for existing equipment.** The net additional turnover and retrofit rates implied from the Staff's model are shown in Table 1 below. For 2010 to 2016, the net turnover rate is accelerated to an average of 3.4%, which represents a 55% increase over the underlying turnover rate of 6.2% assumed in the Staff's emission inventory model, implying a total turnover of 9.8% (i.e., a 3.4% increase over both the 100% baseline and the 6.2% turnover). The average turnover rate decreases slightly to 2.5% for 2017 to 2020, and further to 2.0% for 2021 to 2030. The increase over the entire program is 2.5%, which translates to an implied total turnover rate of 8.9% (i.e., a 2.5% increase over both the 100% baseline and the 6.2% turnover), which is a 40% increase over the ARB's assumed historic rate. The retrofit rate is highest in the first year, and within three years, almost half of the statewide fleet is presumed to be retrofitted.

Table 1 Fleet Changes Implied from ARB Staff Analysis Year	Net Added Turnover	Retrofitted
2010	3.4%	16.5%
2011	3.4%	12.7%
2012	3.4%	12.0%
2013	3.8%	1.5%
2014	3.9%	3.0%
2015	1.5%	1.3%
2016	4.5%	1.1%
2017	2.7%	0.6%
2018	2.5%	0.5%
2019	2.7%	0.4%
2020	2.0%	0.4%
2021	2.6%	2.6%
2022	2.6%	5.1%
2023	2.4%	5.9%
2024	2.6%	0.8%
2025	2.6%	0.0%
2026	2.1%	0.0%
2027	1.9%	0.0%
2028	1.4%	0.0%
2029	1.0%	0.0%
2030	0.5%	0.0%

Problems with the ARB Staff Report Methodology

An important issue not discussed adequately in the ARB Staff Report or its Technical Support Document is how the model extrapolates from the individual 22 fleets up to the statewide fleet. At least two salient issues are unanswered:

- The Technical Support Document's cost analysis (p. 163) assumes that fleets will continue their prior purchasing practices on new versus used equipment. To meet the lower emission targets, however, the statewide fleet must add more *new* Tier 3 and 4 equipment, which means that individual fleets will have to buy a higher proportion of new equipment than in the past. The 55% acceleration in new-equipment turnover in the emissions analysis is inconsistent with the assumption of continued purchasing of used equipment in the economic analysis.
- The sample fleets composition appears to be weighted toward being older, with a higher proportion of Tier 0 equipment, than the emission inventory shows. The fleet sample has 49% of the vehicles in Tier 0 for 2008, while the emission inventory shows 39%--a difference of one-quarter more older vehicles in the sample fleet.[18] Because the samples were not weighted for their relative shares of the statewide fleet, this introduces a significant bias toward overestimating the age of the fleets, and thus underestimating potential costs statewide since premature

[18] Note that this higher proportion of Tier 0 vehicles is more consistent with the slower turnover rate derived using equipment sales data discussed below.