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07-5-6
May 24-25, 2007

An Examination of the Construction Industry Compliance Costs for CARB's Off-Road Diesel Vehicle Rule

Submitted to
Environmental Defense
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May 20, 2007

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Introduction

This report examines a number of issues significant to the assessment of the impact of adopting the regulations currently proposed for off-road construction equipment. The objective of the regulations is to minimize air pollution in California that is caused by large construction equipment powered by diesel engines of 25+ hp.

In particular, this report addresses the following issues:

1. Assessment of the possibility of cost increase in construction projects.
2. Assessment of the possibility of job losses in the construction sector.
3. Assessment of the contractors' ability to pass additional costs to project owners.
4. Assessment of the possibility of devaluation of contractors' assets and bonding capacities.

The discussions offered in this report represent my expert opinion on the above issues. My opinion is based on over 30 years of professional experience in the field of construction engineering and management, my formal education as a licensed professional civil engineer, my industry practicing years, my consulting practices, and my extensive research activities in the construction field (see attached Bio for more details).

Assessment of Construction Cost Increase

The following discussion suggests that the cost impact of enforcing the proposed regulations is not prohibitive:

1. Generally speaking, one can claim that the cost of heavy duty construction equipment is on average about 25% of the total cost of construction projects (see supporting data in the 5/25/06 report by Eldin). Of course, equipment cost in some projects is in the range of 5-10% and in others at the range of 40-50%. With the acceptance of this general rule-of-thumb, the anticipated increase in the total cost of a project will be a multiplier of this fraction (25%).

2. Table 1 below is provided to numerically illustrate the possible increase in total construction cost as a result of possible increases in equipment cost on any construction project. As shown in the table, the possible increase in total cost ranges between 2.5% and 25% depending on the percentage of equipment cost increase.

Table 1- Relationship between Equipment Cost and Project Total Cost

If Equipment Cost Increases by…%	Project Total Cost Increases by…%
10%	2.5%
20%	5%
30%	7.5%
40%	10%
50%	12.5%
60%	15%
70%	17.5%
80%	20%
90%	22.5%
100%	25%

3. Many have attempted to estimate the percentage of equipment cost increase as a result of demanding cleaner equipment. The highest of these estimates is 60% (M. Cubed- April 25, 2007). Such an increase in equipment cost translates into 15% increase in project cost, as seen in Table 1. However, this high percentage (60%) has not been justified or substantiated. The possibility of such a high increase (60%) in equipment cost is limited to only a few pieces of equipment and should not be used as a general multiplier.

4. A more justified and substantiated estimate of 20% was presented in 2006 (Eldin- July 25, 2006). This estimate translates into an increase in project cost of 5%, as seen in Table 1.

5. One can take a macro approach to assess the impact of the proposed regulations on the total construction cost in California by multiplying this percentage (5%) by the ~$60 Billion total annual expenditures reported in 2006 (California Department of Finance- 2006). On this basis, the total cost impact is estimated to be ~$3 Billion. A similar figure ($3.4 Billion) has been independently determined by the California Air Resources Board (CARB).

6. It should be emphasized that such expenditure ($3 Billion) is not reoccurring. In other words, it is one-time initial capital investment to upgrade the equipment fleets. To elaborate, operators/owners/rentals are not going to repeatedly pay for the costs of retrofit, repower, replacement every year. Once the upgrade is done for any piece of equipment, the equipment will be set for its useful life (10-20 years). Such expenditure (capital investment in equipment upgrade) is customarily recovered over a number of years (3-10 years). This is no different than the manner in which operators/owners/rentals have always recovered expenses incurred when they purchase a new piece of equipment or encounter other major charges.

7. More importantly, it should be noted that the proposed regulations allow for a period of time over which the equipment upgrades (retrofit/repower/ replacement) occur. In other words, the anticipated additional expenditure of $3 Billion will not be required in one year; rather, it will spread over a number of years. This will make the impact on the annual budget/cost of construction projects even smaller. For example, allowing the equipment upgrades to occur over 6 years will require an increase in the annual budget/cost of construction projects of $500 million. This mount translates into an increase in the annual budget/cost of less than 1% for the next 6 years.

8. It is also noteworthy to examine the distribution of the total construction expenditures among the industry's various sectors. The residential sector made about 60% of total construction expenditure last year, which is typical. This sector is known to be labor intensive, not equipment intensive. In other words, 60% of the construction projects will incur less than 20% increase of their equipment cost. Applying the 60%-40% distribution to the total construction expenditure ($60 Billion) would reduce the total cost from $3 Billion to ~$2 Billion. Spreading this amount over 6-year conformance grace period, would result in about one-half of one percent of budget/cost annual increase for the next 6 years.

9. From the preliminary data available, it appears that the prices of new clean equipment would not be too different from the Tier-0 prices. If this is true (i.e., no noticeable change in equipment price), then there is no need for concern over replacement strategies. Replacement of nonconforming equipment will automatically happen as the equipment age. Since operators/owners/rentals replace their equipment based on economy, once a piece of equipment reaches a certain age it becomes non-profitable because of competition with newer models. The profitability/competition is affected by productivity/accuracy/ease of handling/added features/frequent breakdowns, etc. Therefore, it is fairly safe to assume that replacement with cleaner equipment has started already. It should be understood, however, that it may take ~10 years for the large operators/owners/rentals to reach the ~100% clean equipment status (no Tier-0). For small operators/owners/rentals, it may take 30 years to reach the ~100% clean equipment status as the infrequent use of these older equipment allows their owners to keep them for longer time periods. Nonetheless, such a phasing period (10-30 years) does not meet the pollution reduction timeframe set by the State of California. Therefore, a comprehensive incentives program should be developed in order to accelerate the natural replacement cycle of existing equipment.

By taking a more comprehensive view of the subject, one could see that the price of the new technology required for cleaner equipment is expected to fall as more equipment gets retrofitted and more manufacturers/vendors/researchers are drawn to this new market. In addition, the realized taxpayers' savings as a result of eliminating/minimizing

the medical/health problems related to air pollution should be taken in account. It should be note here that air monitoring shows that over 90% of Californians breathe unhealthy levels of one or more air pollutants during some part of the year (http://www.arb.ca.gov/research/health/health.htm).

Possibility of Losing Construction Jobs

The following discussion suggests that the fear of losing construction jobs as a result of adopting the new regulations is unfounded:

1. An examination of the construction industry size, growth, and projection suggests that the industry is strong and the demands (opportunities) are high for both management and workers positions.

2. Measures of such strength and such high demands include job placement, staring salary, and salary growth for the fresh graduates from all accredited construction programs. For over 10 years, the job placement has been close to 100% nationwide, and openings are advertised continuously. The starting annual salary of the construction fresh graduates has been $45,000 to $55,000 for the last few years. On the top of such a high starting salary, many employers offer signing bonuses ($2,000-$5,000) and other incentives (vehicles, per dim, etc) to entice new graduates to join their companies. With 10-15 years of experience, the annual compensation of construction management staff is in the range of $100,000-$150,000.

3. It is well documented in many government and private studies that the construction industry is suffering from serious shortage of labor. The industry has been seeking solutions including automation of many construction processes so that it could meet the high demand with a workforce smaller than required.

4. It is logical to expect that the new technologies developed for the cleaner equipment would lead to the creation of new job opportunities. In addition, the activities associated with retrofitting and repowering of equipment to meet the proposed regulations should create additional jobs.

Possibility of Contractors' Inability to Pass Additional Cost to Project Owners

The following discussion suggests that claiming that contractors may have to solely bear the additional cost and may not be able to pass such additional expenses to project owners is unfounded:

1. The additional cost resulting from the cleaner equipment regulations is no different than increases that have happened in other costs (increased rates of

insurance, bonds, utilities, labor, materials, fuel, etc). There is nothing unique about the additional cost of cleaner equipment to prevent contractors from passing such a cost to project owners. It is pure common sense to expect project owners to bear all direct and indirect costs associated with their projects. The cost of equipment (before and after the proposed regulations) is undoubtedly a direct cost item.

2. The regulations are enforced equally on all contractors. Therefore, they all have to recover the additional equipment cost in their bids/rates. In other words, they will pass it to project owners/customers as they have always done in the past. The proposed regulations should have no impact on the contractors' profit margins at all. Contractors have always competed on wining contracts and such competition may or may not include accepting smaller profit. The fact is the regulations do not have any direct bearing on contractors' profit margins.

Possibility of Devaluation of Contractors' Assets and Bonding Capacity

The following discussion suggests that claiming that contractors may lose the value of their assets and their bonding capacity as a result of adopting the new regulations is unfounded:

1. The proposed clean air regulations are phased over a reasonable period of time (several years). This allows gradual upgrade (retrofit/repower/replacement) of fleets. The regulations also allow for certain mixes among the equipment tiers and do not require immediate replacement of an entire fleet. During such phasing, the salvage value of the current nonconforming equipment is unchanged.

2. As the nonconforming equipment get retrofitted/repowered/replaced, the contractors' worth will keep increasing as the value of the assets keep increasing due to the additional capital being invested in their upgrade.

3. As the upgraded equipment age, they will be passed from the large operators/owners/rentals to the smaller…following the same historical path and will maintain the same balance the industry has known all along.

4. The fear of decreased bonding capacity is unsubstantiated. The regulations do not affect the factors that determine contractors' bonding capacity. Bonding capacity is based on the contractors worth and capabilities. The worth is measured by assets, on-going contracts, and potential earnings. The capabilities are measured by records of successfully completed projects and strength of key personnel.

Concluding Remarks

The aforementioned discussions suggest that the impact of the proposed regulations on the cost of total construction in California is not prohibitive. The cost of such regulations

could add 1% to construction cost. Savings related to reduction in health/medical problems of air pollution should also be considered in the regulations economics and decision making. The regulations should have no negative effects on the availability of construction jobs, contractors' worth, or contractors' bonding capacity.

Resistance to change is understandable and should be viewed positively as a part of the system of checks and balances. However, such resistance could be minimized by educating the affected parties, dissemination of supporting facts, and assuring all parties of the regulations' positive intentions and outcomes.

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SUMMARY

Dr. Eldin is a civil engineer with over 30 years of professional experience in the area of construction engineering and management. His industrial experience involved design, procurement, and construction of various structures including power plants, petrochemical plants, offshore facilities, and buildings. In his recent assignment as project manager for NEPCO/ENRON, he was responsible for the design, procurement, and construction of two LNG power plants amounting to over $350 million. His duties included site operations, safety planning, QAQC reviews, preparation of cost estimates, development of EPC schedules, implementation of productivity improvement processes, client relations, preparation of bid documents, bid evaluations, and value engineering programs.

Dr. Eldin also gained instructional and training experience as he taught scheduling, estimating, contact administration, equipment management, field supervision, and design of concrete and wood structures at undergraduate and graduate level courses at prestigious universities. He received a number of teaching excellence awards as a result of his teaching dedication and style. Dr. Eldin has over 50 peer-reviewed publications recording his interest and effort in advancing the state-of-the-art in construction management; especially in project controls tools, schedule reduction techniques, cost-schedule integration, and construction automation. His recent research resulted in filing a US patent No. 60/528,814 (Method and Apparatus for Optimizing Field Supervision for Repetitive Construction Projects).

Dr. Eldin is a Professional Engineer (PE) and Certified Professional Constructor (CPC). He is a consultant to private and public entities including the USAID. He received the US Presidential Award for his services in 2004. He possesses an extensive background in computer-aided techniques in project management and engineering design applications. He is a certified trainer for several computer systems (e.g., Primavera, MS-Project, and Timberline). Dr. Eldin developed computer-aided project controls systems for major engineering-construction corporations and oil companies.

EDUCATION

- Ph.D. Civil Engineering (Construction Eng and Mgt), Oklahoma State University- 1987
- MS Geotechnical Engineering, McGill University - 1978
- MS Building Science, Concordia University - 1977
- BS Civil Engineering, Cairo University - 1972

EMPLOYMENT HISTORY

Purdue School of Eng & Tech, Indianapolis, IN – Department Head	2005-Present
Texas A&M University, College Station, TX – Prog. Coordinator (Assist Dept Head)	2002-2005
Oregon State University, Corvallis, OR – Associate Professor	1992 - 2002
University of Wisconsin, Madison, WI - Assistant Professor	1987 - 1992
ENRON-NEPCO, Redmond, WA - Project Manager (sabbatical leave)	1999 - 2000
Oklahoma State University, Stillwater, OK – Instructor	1985 - 1987
ARAMCO, Houston/Dhahran - Project Engineer/Controls Manager	1980 - 1985
Bechtel, Inc., Houston, TX - Project Engineer	1979 - 1980
Brown & Root, Inc., Houston, TX - Project Engineer	1977 - 1979
Cegeco Design & Construction, Montreal, QUE- Field Engineer	1975 - 1977
McGill University, Montreal, Que. - Research Assistant	1974 - 1975
United Engineers– Structural Engineer	1972 - 1974