



December 2, 2019

Mary Nichols, Chair California Air Resources Board
1001 I Street Sacramento, CA 95814

RE: Support for a Stronger Advanced Clean Trucks Rule

Dear Chair Nichols and Members of the Board,

We commend you for initiating this groundbreaking rulemaking process to “enable a large-scale transition to zero-emission technology”¹ and appreciate the opportunity to provide these comments.

Zero-emission (ZE) battery electric trucks are technically and economically feasible in many applications today and by the initiation of this proposed rule in 2024, will be feasible for the majority of truck applications in the state. (Zero-emission fuel cell electric trucks are not far

¹ CARB ACT Regulatory Workshop 4/2/2019, Slide 7: <https://ww2.arb.ca.gov/sites/default/files/2019-03/190402actpres.pdf>

behind.) But it will be essential that truck makers are manufacturing sufficient volumes of vehicles to meet the growing demands of truck operators to put zero-emission vehicles in service and to take advantage of their many benefits. This is the primary purpose of this proposed rule. And yet it falls far short of meeting this goal. Only 4% of trucks by 2030 would be zero-emission under the proposed rule. This would be about 75,000 trucks out of the 1.9 million trucks on California's roads today. Normal annual increases in truck volumes—as estimated by the California Air Resources Board (CARB)—would outweigh this small number of ZE trucks such that California would actually have more internal combustion engine (ICE) trucks on the roads in 2030 than there are today. We propose that CARB strengthen the rule so that at least 15% of trucks (about 280,000) on the road are zero-emission by 2030.

Zero-Emission Trucks are Technically Feasible

Based on CARB's assessment of *current* suitability for zero-emission vehicles, 80% of vehicles needed to meet our proposed 15% on-road target could come from categories of vehicles ranked by CARB as most ready for electrification.² With conservatively forecasted improvements in electric trucks, even more vehicle applications will be suited for electrification over the next 10 years, making this goal even more achievable.

A growing number of companies are placing significant orders for ZE trucks and would not be doing so unless they believed ZE trucks could meet their needs. A few examples of demand for ZE trucks today include the following:

Delivery Vans

1. **Amazon** has placed an order for 100,000 delivery vans from Rivian beginning in 2021 and to be completed by 2024.³
2. **FedEx** has ordered 1,000 delivery vans from Chanje.⁴
3. **UPS** has ordered 1,000 delivery vans from Workhorse.
4. **IKEA** announced a commitment to using EVs for the last-mile portion of all of its product shipments by 2025. It has already electrified all its local delivery vehicles in Shanghai, and plans to do the same in Los Angeles, New York, Paris and Amsterdam by 2020.⁵
5. DHL will begin using 100 fuel cell electric panel vans starting in 2020.⁶

² Based on survey of truck sales in California by the Engine Manufacturers, CARB rated the suitability of vehicle types for electrification ("1" being most suitable, "10" least). In one example of a sales standard that would achieve electrification of 15% of on-road trucks, 220,000 of 280,000 vehicle sales needed to achieve this level of adoption (80%) could be met through electrification of just vehicles in the Score 1 and 2 categories today.

³ https://ww2.arb.ca.gov/sites/default/files/2018-11/181204emaanalysis_0.xlsx

⁴ <https://www.trucks.com/2019/09/19/amazon-orders-rivian-electric-trucksvian-electric-delivery-trucks>

⁵ <https://www.trucks.com/2018/11/20/electric-van-maker-chanje-fedex-order/>

⁶ <https://chargedevs.com/newswire/ikea-and-delivery-partners-electrify-last-mile-delivery-around-the-world>

⁶ <https://www.forbes.com/sites/alanohnsman/2019/05/29/hauling-with-hydrogen-dhl-adding-fuel-cell-vans-to-its-delivery-fleet/#1c5468ad79d8>

Class 7 & 8 Tractor Trucks

1. **Anheuser-Busch InBev.** Announced orders for over 860 electric and hydrogen semitrailers as part of its commitment to power 100% of its directly operated delivery vehicles with renewable energy by 2025.⁷ It completed its first zero-emission beer delivery using battery-electric and fuel-cell electric trucks on November 21st.⁸
2. **PepsiCo.** Announced that it will deploy 15 heavy-duty Tesla battery electric tractors, six Peterbilt 220EV battery electric box trucks, and three BYD 8Y battery electric yard tractors as part of its goal to replace all of its existing diesel-powered freight equipment with zero- and near-zero emission technologies at its Modesto, California site.⁹
3. Building on what was learned from proof of concept work under Project Portal,¹⁰ **UPS** along with the **Ports of LA and Long Beach**, is due to soon begin using 10 Kenworth/Toyota Class 8 fuel cell electric trucks with a 300-mile trip range.¹¹
4. A report prepared by Atlas Public Policy found that as of early 2019, there were already over 16,000 electric trucks on order or pre-order in the U.S. (14,000 for Nikola's Class 8 fuel cell electric semi-truck).¹²

Refuse Trucks

1. **The City of Los Angeles** has set a goal to have 100% of its trash and recycling trucks be ZE by 2028 (more than 600)¹³
2. BYD has delivered an electric refuse truck to **Waste Resources Inc.** to serve **Carson** and three more trucks have been ordered.
3. **Palo Alto** has contracted with BYD for three additional electric refuse trucks to join the electric refuse truck it began operating in 2017.¹⁴
4. The development and testing of fuel cell powered electric refuse trucks is also underway at a growing number of venues.¹⁵

⁷ <https://www.truckinginfo.com/143345/anheuser-busch-orders-40-tesla-semi-tractors>,

<https://www.truckinginfo.com/300803/anheuser-busch-orders-800-nikola-hydrogen-electric-trucks>,

⁸ <https://www.ttnews.com/articles/anheuser-busch-nikola-byd-complete-first-zero-emission-beer-run>,
<https://www.trucknews.com/sustainability/anheuser-busch-adds-electric-byd-trucks/1003094293>

⁹ <https://www.trucks.com/2019/10/07/anheuser-busch-frito-lay-start-building-electric-trucks-fleets>

¹⁰ <https://pressroom.toyota.com/album/2017-2018-toyota-project-portal-concept>

¹¹ <https://www.trucks.com/2019/04/22/kenworth-toyota-first-production-fuel-cell-truck-ports>,
<https://pressroom.toyota.com/the-future-of-zero-emission-trucking-takes-another-leap-forward>

¹² <https://www.atlasevhub.com/resource/electric-trucks-and-buses-overview/>

¹³ http://plan.lamayor.org/sites/default/files/pLAn_2019_final.pdf Page 145

¹⁴ <https://en.byd.com/news-posts/press-release-public-private-partnership-to-electrify-waste-expo>

¹⁵ <https://www.scania.com/group/en/scania-delivers-fuel-cell-refuse-truck/>, <https://fuelcelltrucks.eu/project/e-trucks-revive/>, <https://www.waterstofnet.eu/en/news/europes-first-hydrogen-powered-garbage-trucks-with-licence-plate-proudly-presented-in-brabant-nl>, <https://www.sciencedirect.com/science/article/pii/S1464285919301841>

Electric Trucks are Cost-Effective and Have a Positive Total Cost of Ownership (TCO)

CARB completed a total cost of ownership (TCO) study for three common types of trucks including a Class 3 passenger van, a Class 6 walk-in step van and a Class 8 day cab tractor used in regional operation.¹⁶ In all three cases, these electric trucks will have a neutral to positive TCO by 2024, when the proposed rule would go into effect, and the step van has a positive TCO today.

In a recent September 2019 analysis of long-haul battery electric trucks, researchers at the **Lawrence Berkeley National Laboratory** concluded, “We estimate the TCO of a Class 8 truck with a 400-mile operating range electric truck to be \$1.27/mile--20% lower than the comparable diesel truck TCO of \$1.60/mile.”¹⁷

In another recent study (October 2019) of ZE drayage trucks at the San Pedro Bay Ports the **UCLA Luskin Center for Innovation** concluded, “BETs [battery electric trucks] can be financially viable in the 2020s. With purchase incentives, the total cost of ownership for BETs in both LADWP and SCE territory are lower than even the cost of used diesel trucks.”¹⁸

In its August 2019 analysis the International Council on Clean Transportation (**ICCT**) provides estimates for the TCO for long haul, drayage and delivery trucks in 2020, 2025 and 2030 similar to CARB’s TCO analysis. This is a national study that does not include California incentives such as the Low Carbon Fuel Standard (LCFS) program. Including just the LCFS incentive, all three vehicle types show a positive TCO compared to diesel in all three time periods (2020, 2025 and 2030) except for drayage trucks in the 2020 case.¹⁹

Finally, there are several financial support programs that can help with both operating and capital costs. LCFS credits can substantially reduce electricity fuel costs and in some cases cover all the costs. It can also help pay for charging infrastructure for publicly available chargers. There are other financial incentives that can help pay for the trucks and infrastructure including the California Energy Commission’s (CEC) Clean Transportation Program, AB 617 grants, local Air Quality Management District (AQMD) grants, and others.²⁰

The TCO Will Continue to Improve with Time

The cost of batteries is the largest contributor to the incrementally higher cost of battery electric trucks compared to diesels. But battery costs are declining rapidly. Battery costs have already decreased 85% from 2010 to 2018.²¹ According to the Rocky Mountain Institute’s “Breakthrough Batteries” report,²²

¹⁶ https://ww2.arb.ca.gov/sites/default/files/2019-02/190225tco_0.pdf

<https://ww3.arb.ca.gov/regact/2019/act2019/apph.pdf>

¹⁷ http://eta-publications.lbl.gov/sites/default/files/working_paper_005_battery_electric_trucks_906_0.pdf

¹⁸ https://innovation.luskin.ucla.edu/wp-content/uploads/2019/10/Zero_Emission_Drayage_Trucks.pdf

¹⁹ https://theicct.org/sites/default/files/publications/ICCT_EV_HDVs_Infrastructure_20190809.pdf

²⁰ https://gspp.berkeley.edu/assets/uploads/page/Funding_Programs_Summary_final_August_29.pdf

²¹ <https://about.bnef.com/blog/behind-scenes-take-lithium-ion-battery-prices/> 3/9/2019

²² <https://rmi.org/insight/breakthrough-batteries> 2019

“Venture capital firms invested over \$1.4 billion in battery tech in the first half of 2019 alone. Total manufacturing investment – both previous and planned through 2023, amounts to around \$150 billion dollars. By 2023, the capital cost for new battery manufacturing capacity is expected to decline by more than half compared to 2018. Battery costs could drop to \$87/kWh by 2025 (in March, Bloomberg estimated the current average cost at \$187/kwh).”²³

Similarly, forecast increases in battery density will reduce both the weight and space for batteries further improving the TCO. Just the increase in manufactured volumes of batteries alone, even without any technical improvements, can result in large reductions in battery costs, as described by James Miller of Argonne National Laboratory:

“The ANL [Argonne National Laboratory] 2009 study showed that an increase in production level from 10,000 batteries/year to a production level of 100,000 batteries/year would result in a 37-44% reduction in battery cost. This level of cost reduction is consistent with publicly presented material by Ford Motor Company, which indicated a cost reduction of 20-40%. The ANL 2010 study indicated that a further increase in production level, from 100,000 to 500,000 batteries per year, would achieve an additional 25-30% cost reduction.”²⁴

A Stronger Rule Will Stimulate California’s Economy

California is already home to a number of ZE truck makers and related suppliers such as BYD, Green Power Motors, Motiv, Phoenix Motorcars, XOS Trucks and others. A stronger rule will more rapidly grow these businesses.

Electrifying trucks generates new opportunities for high-quality jobs and skilled training. For example, statewide initiatives like the Electric Vehicle Infrastructure Training Program (EVITP) are already preparing California electricians for the shift to clean transportation technologies. From infrastructure to manufacturing and maintenance to new upgrades and investments in the electrical grid, a stronger rule places California at the center of economic expansion and job growth in clean transportation and further establishes California as a cutting-edge leader in the green economy.

By requiring the production of higher volumes of ZE trucks, a stronger rule will reduce truck costs sooner by increasing economies of scale and sending a signal to the markets that will incentivize the investments needed to accelerate technical innovation; thereby lowering battery, fuel cell stack and other costs associated with the successful commercialization of ZE

²³ <https://about.bnef.com/blog/battery-powers-latest-plunge-costs-threatens-coal-gas>

²⁴ Miller, J. F. (2010), Analysis of current and projected battery manufacturing costs of electric, hybrid, and plug-in hybrid electric vehicle, EVS25, Shenzhen, China, Nov 5-9, 2010
<http://www.evs24.org/wevjournal/php/download.php?f=vol4/WEVA4-4050.pdf>

transportation technologies. It will make a market that lowers costs and increases demand in a virtuous cycle. This will especially benefit related California-based businesses.

Charging Infrastructure Will be Available to Meet Battery Electric Truck Needs

The California Public Utilities commission has now approved proposals from SCE, PG&E and SDG&E to invest in "make ready" infrastructure and charging equipment.²⁵ Through the CPUC infrastructure programs alone, there is approved funding to supply the charging needs for *at least* 18,000 electric trucks and buses on the road as the Advanced Clean Truck standard begins to take effect. This number of chargers would meet the needs of the amount of zero-emission trucks we are proposing for 2024 and far exceeds the charging needs for the much lower number of trucks proposed by CARB. The utilities may also apply to the CPUC for authority to make further investments in infrastructure if demand warrants.

All three utilities have new tariffs or have proposed new tariffs that will reduce the cost of demand charges, which when implemented, will lower electricity costs and further improve the TCO.

Charging standards are in place today supporting interoperability among different truck and charging infrastructure hardware makers. The most important is the depot charging standard - CCS Type 1 up to 350 kW and the standard setting body is working on increasing the capacity of that standard up to 2 MW.

There are many companies experienced in the design, installation and maintenance of small and large charging infrastructure projects. They are able to install proven smart charging systems that can manage the charging process automatically while minimizing electricity costs and ensuring that the vehicles are charged and ready for their next duty cycle. The only caveat here is that truck operators should insure that they contact their utility and/or Electric Vehicle Supply Equipment (EVSE) contractor well in advance of truck delivery since it can take some time to design, gain approvals and install the infrastructure depending on the project size.

Our Proposal is Feasible

For those trucks rated at a suitability of "1" or "2" in CARB's feasibility study, there are sales of 38,315 trucks per year or 268,205 trucks in total over the 7-year duration of the rule; a total similar to what our proposal would achieve and 3.5 times the number of trucks CARB's proposed rule would produce by 2030.

And this assumes that there are no improvements in the suitability for electrification in other types of trucks during these 7 years due to reduced battery or fuel cell system costs, increased battery density or fuel cell catalyst efficiency, lower truck cost due to economies of scale, continuing technological innovation, etc. All of which will certainly occur, significantly

²⁵ In concordance with SB 350 (De León, Chapter 547, Statutes of 2015), <https://www.cpuc.ca.gov/sb350te>

increasing truck range, lowering truck costs, increasing suitability ratings and improving the TCO.

The Standardized Regulatory Impact Assessment (SRIA) report found that a stronger rule would result in \$4.5 billion in savings across the California economy from 2020 to 2040.

Combined with the greater emission reductions, a stronger rule was found to be more cost effective than CARB's proposed rule. In the SRIA, CARB acknowledged that strengthening the proposal to achieve a 10% target for zero-emission trucks on the road in 2030 would nearly double the nitrogen oxide and fine particulate matter emission reductions in 2031 compared to the proposed rule, and would result in an additional \$3 billion in avoided health costs (\$8.6 billion versus \$5.5 billion).²⁶ These significant benefits outweigh the incremental cost differential between this stronger alternative and the proposed rule—and both instances result in billions of dollars in savings to the California economy.²⁷

Why We Need a Stronger Rule Now

We know that every day that passes, more children are developing asthma and more elderly are developing life-threatening respiratory diseases due to the toxic pollution created by medium- and heavy-duty vehicles (MD/HD). We have a moral obligation to eliminate these impacts for those living along polluted high-traffic corridors as soon as possible. The best way to save lives is to reduce the hourly count of people-choking trucks that pass by their homes and schools by replacing them with zero-emission vehicles.

Recent studies continue to underscore the enormous air quality and health benefits that come from transitioning to zero-emission technologies. An economy wide²⁸ high electrification scenario, which includes significant electrification of heavy-duty vehicles (i.e. 66-93% of on-road heavy duty vehicles depending on type), is estimated to provide health benefits valued at \$108 billion, or more than 12,000 avoided mortalities *annually*.²⁹ Substantial reductions in PM_{2.5} and ozone come from high levels of electrification for trucks, the largest source of NO_x in the state, and these reductions are highest in disadvantaged communities.³⁰ Only a large-scale transition to zero-emission technologies can bring about this vision for clean air and a decarbonized economy. Yet the current proposal fails to demonstrate how it can hope to meet the magnitude of that transition.

As CARB notes, California must meet several federal and state climate change and criteria pollutant reduction mandates including but not limited to:

²⁶ http://www.dof.ca.gov/Forecasting/Economics/Major_Regulations/Major_Regulations_Table/documents/SRIA-Advanced_Clean_Truck_080819_DOE.pdf / <https://ww3.arb.ca.gov/regact/2019/act2019/appc.pdf>

²⁷ *Id.* at 81.

²⁸ <https://ww2.energy.ca.gov/2019publications/CEC-500-2019-049/CEC-500-2019-049.pdf> Appendix B

²⁹ EPRI, Air Quality Implications of an Energy Scenario for California Using High Levels of Electrification (June 2019) at 27 <https://ww2.energy.ca.gov/2019publications/CEC-500-2019-049/CEC-500-2019-049.pdf>

³⁰ EPRI, Air Quality Implications of an Energy Scenario for California Using High Levels of Electrification (June 2019) at 4 <https://ww2.energy.ca.gov/2019publications/CEC-500-2019-049/CEC-500-2019-049.pdf>

- Federal health-based ambient air quality standards (key dates in 2023 and 2031);
- 40% reduction in greenhouse gases (GHG) by 2030;
- Carbon neutrality by 2045; and
- 80% reduction in GHGs by 2050

CARB's proposed rule would prevent the state from having any chance at achieving these mandates. From the time the regulatory process started on this rule in late 2016 to the time this rule is set to be implemented in 2024, seven years will have passed. CARB cannot miss the opportunity to pass a strong rule now.

According to the UN IPCC, we have only about 12 years to cut our GHGs in half by 2030 if we are to avoid disastrous/catastrophic climate change. This cannot be achieved without aggressive and bold action in transportation – especially in the MD/HD sector. We are out of time. This is our last best chance to set in motion a rule that can accomplish what it needs to do.

We agree with both truck makers and staff on the need for a strong subsequent fleet rule to drive demand, but it will not be successful if there are insufficient volumes of zero-emission trucks being manufactured. We need both a strong truck manufacturing rule and a strong fleet purchase rule to accelerate the transition to zero-emission transportation.

Finally, if we don't have a stronger rule, it could be gamed by non-producing manufacturers meeting low volume deficits by buying cheaper credits from a few zero-emission OEMs similar to what has happened with the ZEV mandate for light-duty vehicles. We need production across multiple legacy and new zero-emission OEMs to create the diversity and volumes of products needed to support this transition.

Shenzhen is Electrifying Faster Than This Proposal

A recent report from the Rocky Mountain Institute³¹ found that from the beginning of 2015 to the end of 2018, Shenzhen's fleet of electric logistics vehicles, vans, and light/medium trucks expanded from 300 to approximately 61,857, representing approximately 35% of the city's overall fleet of urban delivery vehicles. The rate of future adoption we recommend in order to achieve the target of 15% zero-emission trucks on the road by 2030 is much slower than rates already achieved in Shenzhen, a city with a population less than one third of California's. In Shenzhen alone, 25,000 electric trucks were added to the fleet in 2018. CARB's current proposal doesn't reach this level of annual sales until 2030.

Our Recommendations

- 1. Increase the percentage of sales requirements so that at least 15% of trucks on the road in 2030 are zero-emission.**

In addition to being too low overall, CARB's proposed percentage requirements

³¹ <https://rmi.org/insight/a-new-ev-horizon> June 2019

are strongly backloaded in the Class 4-8 Category so that the percentage increases in the early years are small. This category should be designed to at least have a linear increase from the first to last year similar to what CARB did for the other two categories. This is necessary so that there are enough vehicles produced in 2024, 2025 and 2026 especially in the Class 4-8 vehicles where demand is expected to be large.

The following represents one structure that would result in 15% of trucks being zero-emission by 2030. The first column in each class is CARB's proposal while the second with **Bold** numbers and in a light green background is our proposal.

CARB's vs Our Proposal Comparison with Percentages of Sales / Year

Model Year	Class 2b-3		Class 4-8		Class 7-8	
	Excludes pickups trucks until 2027	Includes pickup trucks from 2024	Vocational/Straight Trucks		Tractors	
2024	3%	15%	7%	30%	3%	10%
2025	5%	23%	9%	38%	5%	13%
2026	7%	30%	11%	45%	7%	17%
2027	9%	38%	13%	53%	9%	20%
2028	11%	45%	24%	60%	11%	23%
2029	13%	53%	37%	68%	13%	27%
2030	15%	60%	50%	75%	15%	30%

CARB's vs Our Proposal in Numbers of Trucks

Model Year	Class 2b-3		Class 4-8		Class 7-8			
	Excludes pickups trucks until 2027	Includes pickup trucks from 2024	Vocational/Straight Trucks		Tractors		Total for the Year	
2024	747	11,235	1,464	6,275	182	608	2,393	18,118
2025	1,245	16,852	1,883	7,844	304	810	3,432	25,506
2026	1,743	22,469	2,301	9,413	425	1,013	4,469	32,895
2027	6,741	28,086	2,719	10,982	547	1,215	10,007	40,283
2028	8,239	33,704	5,020	12,551	668	1,418	13,927	47,673
2029	9,737	39,321	7,740	14,120	790	1,620	18,267	55,061
2030	11,235	44,938	10,459	15,689	911	1,823	22,605	62,450
Total	39,685	196,605	31,586	76,874	3,827	8,505	75,098	281,984
Percent of total population of California trucks in 2018 =							4%	15%
Annual sales	74,897		20,918		6,075			101,890
Population 2018	1,045,426		621,026		197,048			1,863,501

2. **Sales targets for class 2b-3 pickup trucks should begin in 2024.** Class 2b-3 pickup trucks represent over 50% of all trucks in this category and nearly 40% of all trucks sold each year. CARB's proposal would delay requiring any pickup trucks until 2027. Recent announcements by Rivian, Tesla, Ford, GM, Lordstown and Bollinger indicate interest in electric pickup trucks as personal vehicles (even if many of these are expected to be in the Class 2a category), and many Class 2b pickups are owned and operated in the commercial and public sectors with high suitability for electrification by electric utilities, contractors of all kinds, government fleets, etc.
3. **Clearly articulate CARB's goal for when all trucks must be zero-emission.**

CARB has not articulated its long-term policy goals regarding when various categories of trucks must be 100% zero-emission, let alone a long-term trajectory of how CARB would get there. In the Innovative Clean Transit rule, CARB had a stated goal of 100% zero-emission buses by 2040, which guided the 100% purchase standard in 2029, and the recently adopted Zero-Emission Shuttle Bus rule requires all of these vehicles to be zero-emission by 2035.

CARB should articulate its goals to achieve when 100% of trucks should be zero-emission e.g. by 2040. It should also consider setting dates certain by which all classes of truck sales must be 100% zero-emission e.g. 2033. CARB should also show how achieving these goals will ensure compliance with and mapping to federal and state criteria pollutant and GHG reduction requirements.

4. **Accelerate the development and implementation of the fleet rule.**

CARB staff has stated that they do not plan to propose a fleet rule for Board consideration until 2022. CARB should accelerate this timeline so that the proposed subsequent fleet rule is adopted by December 31, 2021 and will become effective simultaneously with this sales requirement rule. Earlier adoption is necessary to support and drive the sales rule.

This is a historic opportunity for California to take leadership on implementing a regulation that could truly make a significant difference in reducing toxic air pollution and GHGs. We cannot waste this opportunity. This letter documents why a stronger rule is needed and feasible. We would greatly appreciate your consideration of strengthening this rule now.

Sincerely

Sierra Club

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Research and Policy Analyst

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Shayda Azamian

Climate Policy Coordinator

Attachments:

We have previously sent two letters to CARB Staff on this rule making this year and have attached them so they can be included in the docket for your review. These letters contain significant well documented facts testifying to both the need and feasibility of implementing a much stronger rule. They are:

1. Letter to CARB staff, October 15, 2019, Re: Comments on Proposed Advanced Clean Trucks (ACT) Regulation
2. Letter to CARB staff, June 11, 2019 Re: Comments on Proposed Clean Truck Rule