FREEMAN SIGNS & ELECTRIC
A SIGN OF GOOD BUSINESS

TO: Town of Commerce City Planning Department / Zoning Board

Subject: Nothbound - Variance Request for Signage – Applegreen / Petrogas Limited (E-470 Travel Plaza)

Dear Planning Department / Zoning Board,

Applegreen / Petrogas Limited is formally submitting this letter and the accompanying documentation to request a variance for the proposed monument sign at our E-470 Travel Plaza location.

This site presents a unique set of circumstances not adequately addressed by the current sign code, particularly concerning highway-type signage where the vehicle speed is 75 MPH. Our primary concern, and the basis for this variance request, is driver safety. To ensure adequate Viewer Reaction Time (VRT) for motorists traveling at high speeds on E-470 to safely identify and exit for our facility, an increase in both the size and height of our proposed joint identification sign is essential.

Specifically, we are requesting a variance for:

1. Sign Size: An increase to proposed sign area of 250 sq ft.

2. Overall Height (OAH): An increase to proposed sign height of 30 ft.

The enclosed documentation details our justification for these requests, utilizing established industry standards from the Manual of Uniform Traffic Control Devices (MUTCD) and the U.S. Sign Council (USSC). These resources support that for highway conditions at 75 MPH, a sign significantly larger than what the current code permits is necessary for optimal legibility and driver safety. The USSC's calculations, for instance, recommend a sign size between 450 and 850 sq ft for these conditions, underscoring the conservative nature of our requested 250 sq ft request.

We believe that granting this variance is critical for the safe and efficient operation of the Applegreen Travel Plaza on E-470. We appreciate your careful review of this request and are available to provide any further information or clarification needed.

Thank you for your time and consideration.

Sincerely,

FREEMAN SIGNS, INC.

Applegreen / Petrogas Limited is requesting a variance for signage on E-470 for overall height (OAH) and total size of a monument sign. This location is unique in functionality and location; the existing sign code does not address Highway type signage with speeds in excess of 75 MPH. As a safety requirement to afford drivers enough Viewer Reaction Time (VRT) to exit for the facility, we are submitting the following information for your review.

Variance request:

1. An increase in sign size to 250 sq ft.
2. An increase in sign height to 30'OAH.

Project Description:

One joint Identification sign for Applegreen Travel Plaza.
The location is only visible to the private highway (E-470) and the primary function is to identify Entrance to Travel Plaza and Services within. As we will explain for safety reasons, size and height need to be increased.

Diagram 1 : Proposed Applegreen Monument Sign - Highway Visibility and Tenant Identification

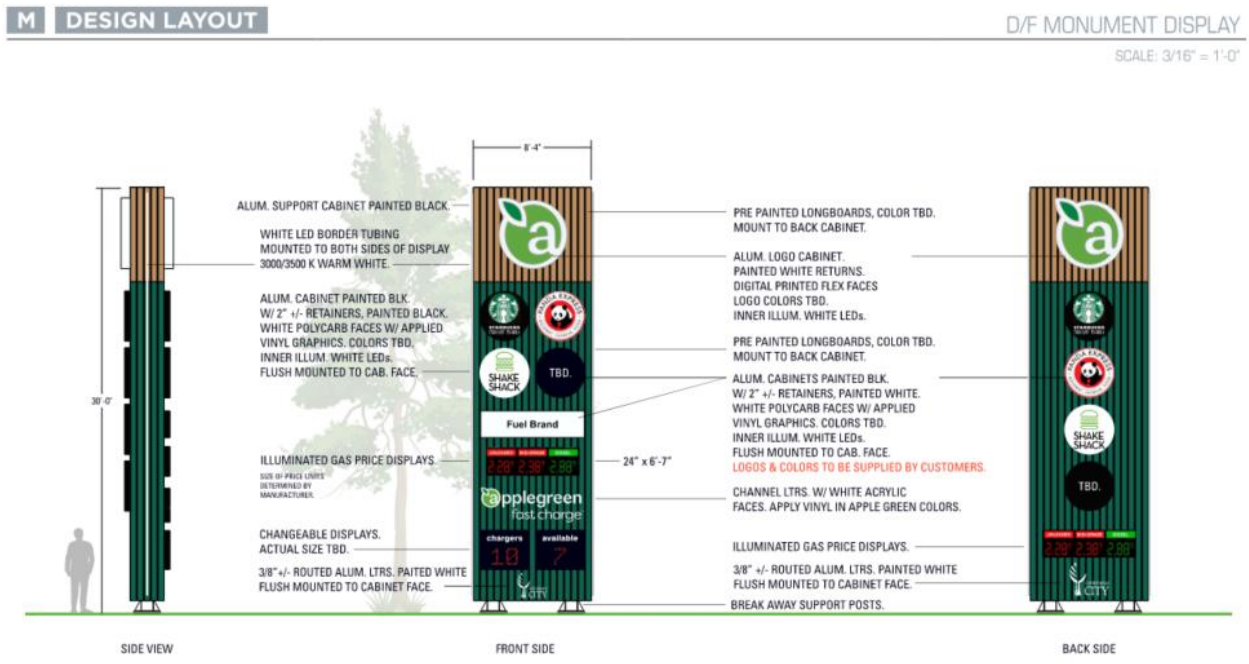


Diagram 1 Description: This diagram illustrates the proposed monument sign, detailing its dimensions, tenant panels, illumination methods, and overall design. The sign stands at a proposed 30 feet in overall height, with a prominent Applegreen logo at the top, followed by individual panels for various dining and service tenants, a fuel price display, and the Commerce City Colorado identifier at the base. This design is optimized for clear visibility and branding on a highway setting.

Diagram 2: Applegreen Monument Sign Site Plan: Location and Highway Setbacks

Diagram 2 Description: This site plan shows the precise location of the proposed monument sign within the Applegreen Travel Plaza property. It highlights the sign's strategic positioning relative to the E-470 highway, demonstrating the substantial setbacks from the road and property lines. The diagram confirms that the sign is situated to maximize its visibility to highway traffic while adhering to general setback principles for safety and aesthetics.

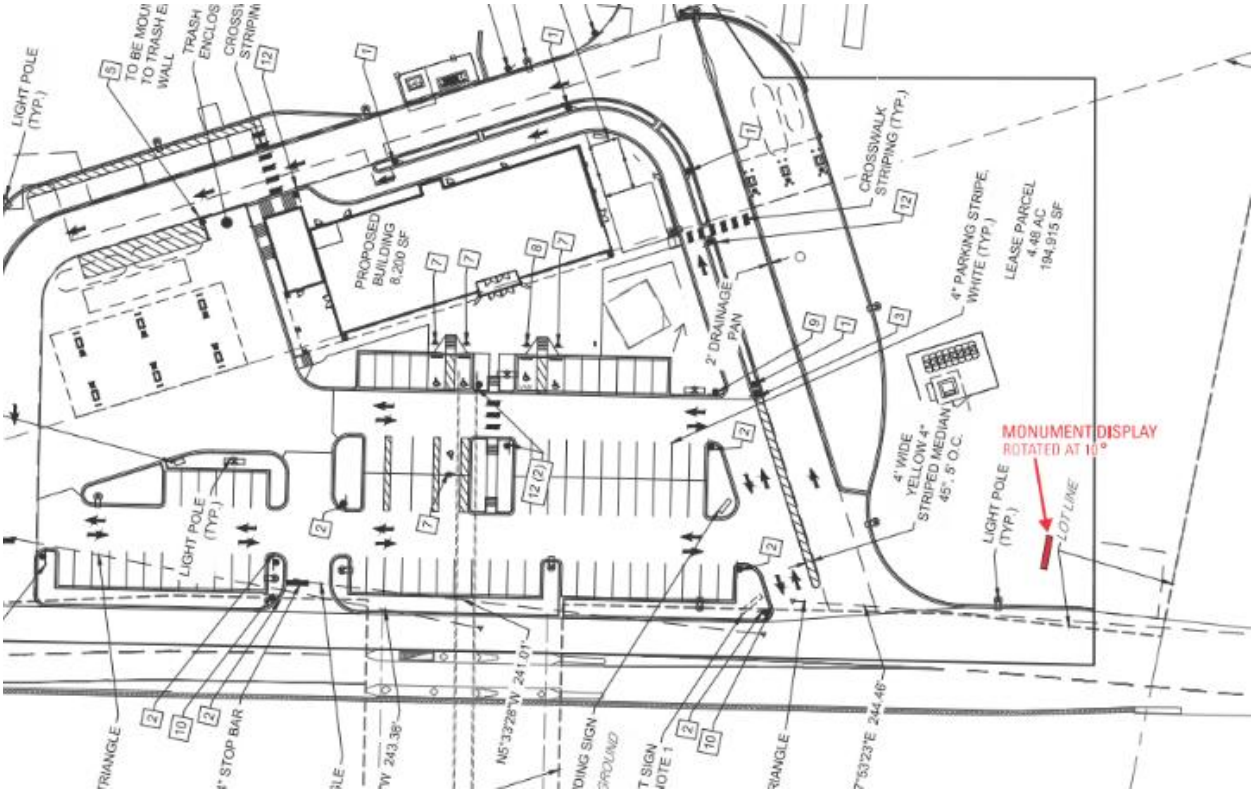


Diagram 3: Aerial View: Applegreen Travel Plaza and E-470 Viewer Reaction Distance Analysis

Diagram 3 Description: This aerial view provides a crucial perspective of the Applegreen Travel Plaza's location in relation to E-470. It clearly depicts the considerable Viewer Reaction Distance (VRD) required for drivers approaching the plaza at highway speeds. The red line extending from the sign location illustrates the minimum visibility corridor needed for safe decision-making, emphasizing the scale of visibility challenges on this high-speed corridor.

The MUTCD provides standards for signs, signals, and pavement markings on all public roads. While primarily focused on traffic control, its principles on legibility and driver comprehension are highly relevant to on-premise signage designed for highway visibility. The MUTCD emphasizes the need for clear, unambiguous information presented in a timely manner to drivers.

The USSC is a leading authority on signage standards, conducting extensive research on sign legibility, visibility, and optimal sizing based on various factors including vehicle speed, viewing distance, and environmental conditions. Their "Master Calculation System" and associated research are directly applicable to determining appropriate sign dimensions for highway scenarios.

Justification for Overall Height (OAH)

The request for a 30-foot OAH is equally critical for ensuring safety and legibility on E-470:

- As supported by MUTCD (Figure 3.2a), a minimum height of 7 feet from the grade of the highway is recommended to account for visual blockage by multi-lane traffic (as further illustrated in Fig 3.2A). On E-470, with its multiple lanes and high volume of large vehicles (trucks, SUVs), a standard low-profile monument sign would be frequently obscured, rendering it ineffective and potentially dangerous. The 30-foot height (as depicted in Diagram 1) elevates the sign above this common line of sight obstruction. While the site plan ensures proper setbacks, natural and constructed features common along highway corridors can impact sightlines. The increased height ensures the sign is visible over these potential obstacles.
- A taller sign, especially when combined with appropriate setbacks, can be sighted earlier by drivers, contributing to the necessary Viewer Reaction Distance calculated above (as determined by calculations referenced in Fig 1.4a and Fig 1.4b, and visually represented in Diagram 3). This provides the driver more time to identify the sign, comprehend its message, and safely execute any required maneuvers to exit the highway (a critical benefit for Viewer Reaction Time as detailed in Fig 1.2A, Fig 1.2B, and Fig 1.2C).

Aesthetic Considerations and Mitigation Strategies

Applegreen / Petrogas Limited understands the importance of visual aesthetics and the City of Commerce City's commitment to maintaining its character. The proposed sign has been designed with these considerations in mind:

- The sign will be constructed using durable, high-quality materials that ensure longevity and a refined appearance. The design incorporates modern aesthetics with clean lines and integrated branding (as depicted in Diagram 1), designed to be visually appealing and complementary to the architecture of the new Applegreen Travel Plaza.

- The sign will feature internal, energy-efficient LED illumination (also shown in Diagram 1). This method ensures optimal legibility during nighttime and low-light conditions without causing light spill or glare that could distract or affect drivers on E-470 or adjacent properties. The illumination levels will be carefully calibrated to meet safety requirements while minimizing environmental impact..

The variance request for the Applegreen / Petrogas Limited monument sign on E-470 is not a matter of preference or commercial advantage, but a fundamental requirement for public safety on a unique, high-speed transportation corridor. The existing sign code, while appropriate for typical municipal roads, does not adequately address the dynamic and demanding conditions of a major toll highway where the speed limit is 75 MPH and driver reaction time is paramount.

We are committed to being a responsible and contributing member of the Commerce City community. Granting this variance will allow Applegreen / Petrogas Limited to provide essential and safe services to the traveling public on E-470, reducing potential hazards associated with inadequate signage related to Viewer Reaction Distances (VRD) for Highway visibility. We respectfully request your approval of this variance and are available to discuss any aspect of this submission further.

Table 1: Calculation Table

Metric / Speed (MPH)	Formula / Derivation	75 MPH (Original)	55 MPH (Calculated)	45 MPH (Calculated)	Significance
Speed in Feet Per Second (FPS)	FPS = MPH × 1.47	110.25	80.85	66.15	A vehicle covers this many feet every second, highlighting the limited reaction window.
Viewer Reaction Time (VRT)	Multi-lane (over 35 MPH): 11 seconds	11 seconds	11 seconds	11 seconds	This critical safety buffer represents the time drivers need to process information and prepare for a maneuver.
Viewer Reaction Distance (VRD)	VRD = MPH × VRT × 1.47	1212.8’	889.35’	727.65’	The minimum distance from which the sign must be legible to provide adequate reaction time.

Table 1 Description: This table presents a comprehensive analysis of the proposed Applegreen Monument Sign's visibility and legibility requirements across varying highway speeds (45 MPH, 55 MPH, and 75 MPH). It details the interdependencies between vehicle speed, required Viewer Reaction Distance, and optimal Letter

Height, demonstrating how the calculated Copy Area, Negative Space, and overall Sign Area dynamically adjust to ensure safe and timely driver comprehension in high-speed environments.

Fig A. USSC Exhibit: Comprehensive Factors in Sign Legibility and Sizing Calculations

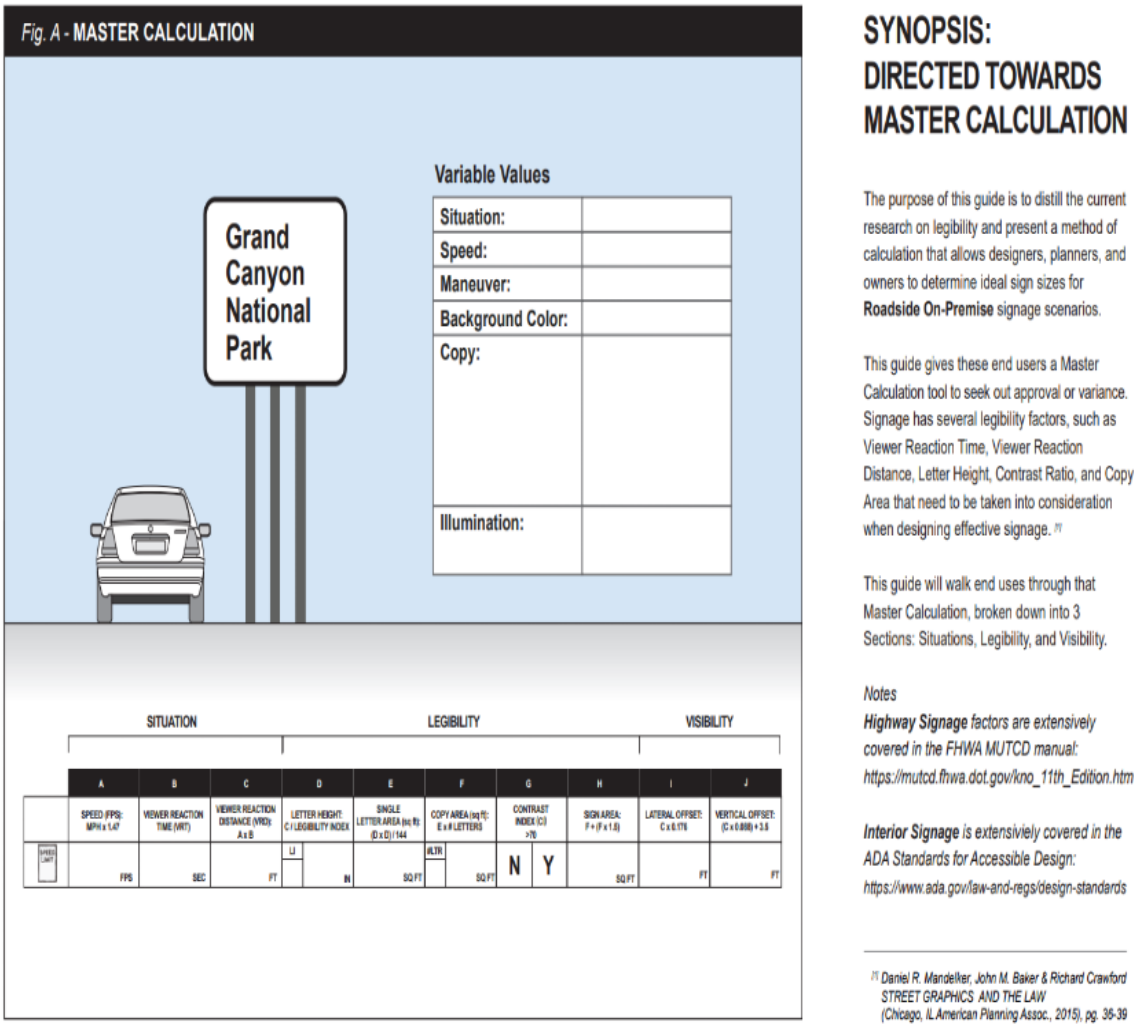
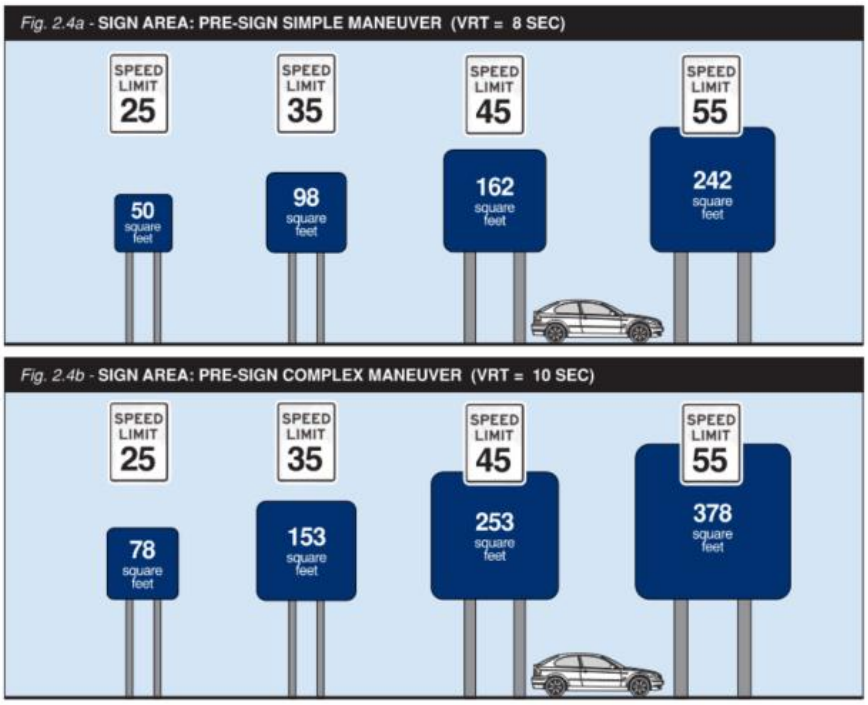


Fig A Description: This USSC exhibit outlines the comprehensive factors considered in the Master Calculation System for determining optimal sign legibility and sizing. It underscores the multi-faceted approach required, acknowledging that factors like vehicle speed, driver maneuver, and visual environment

significantly impact how quickly and effectively a sign can be perceived and understood by motorists. This rigorous methodology supports the need for tailored sign solutions in unique conditions like E-470.

Fig 2.4 USSC Data: E-470 Speeds and Recommended Sign Areas (450-850 sq ft)



2.4
SIGN AREA CALCULATION

Sign size can greatly affect the driver's ability to detect and read the messaging. This size can be calculated by assigning a numerical value to the five contributing factors: Viewer Reaction Time, Viewer Reaction Distance, Letter Height, Copy Area, and Negative Space. [N]

Area of Sign Computation:

1) Determine speed in feet per second (FPS) (MPH x 1.47)
2) Determine Viewer Reaction Time (VRT) Reference Sections 1.2 - 1.3
3) Determine Viewer Reaction Distance (VRD) (VRT x FPS)
4) Determine Letter Height in inches through Legibility Index (LI) - Reference Section 2.3 (VRD / LI)
5) Determine Copy Area - Single Letter Sq.ft. x total number of letters + symbol area
6) Determine Negative Space (Copy Area x 1.5)
7) Area of Sign = Copy Area + Negative Space

A sample walk-through of how to work this equation is demonstrated in Section 4.1.

[N] Daniel R. Mandelker, John M. Baker & Richard Crawford STREET GRAPHICS AND THE LAW (Chicago, IL American Planning Assoc., 2015), pg. 33

© Sign Research Foundation I On-Premise Signage: Situations, Legibility, and Visibility - Guidelines for Traffic Safety - v.1.0 (06/24)

Fig 2.4A and 2.4B Description: This USSC chart demonstrates the recommended sign area calculations based on varying speeds and maneuver complexities. Importantly, for speeds comparable to E-470 (which exceeds the 55 MPH shown), the recommended sign sizes escalate significantly, ranging from 450 to 850 square feet. This highlights that our requested 242sq ft, while a substantial increase over typical code, remains a conservative figure well within the established safety-based recommendations for high-seed highway environments. Below we have extended to 75 MPH for sign area requirements.

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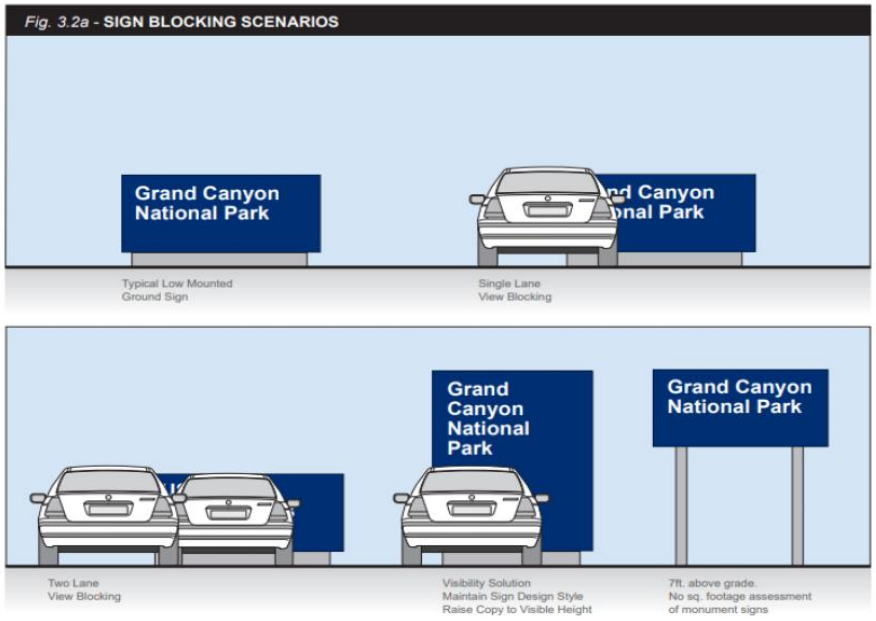
Sign Area Calculation							
SIGN AREA = [(VRT) (MPH)]$_2$ / 800							
Sign Area	=	VRT	MPH	SQd	/	800	
162.00	=	8	45	SQd	/	800	
253.13	=	10	45	SQd	/	800	
306.28	=	11	45	SQd	/	800	
242.00	=	8	55	SQd	/	800	
378.13	=	10	55	SQd	/	800	
457.53	=	11	55	SQd	/	800	
639.03	=	11	65	SQd	/	800	
450.00	=	8	75	SQd	/	800	
703.13	=	10	75	SQd	/	800	
850.78	=	11	75	SQd	/	800	< E-470 - (VRT & MPH)

MUTCD: Recommends that the sign be placed at a minimum of 7' from the grade of the highway to allow for blockage that occurs with multi lane highways.



3.2 SIGN BLOCKING

The Federal Highway Administration's Manual of Uniform Traffic Control Devices (MUTCD) notes a standard 7 feet height above grade for official roadside directional and wayfinding signs utilized along urban roadways in the United States.

Based on research, the minimum height standard for copy on signs placed on roads with characteristics as detailed in the charts is no less than 5 feet above grade. That said, it is strongly recommended to use the MUTCD standard of 7 feet above grade in order to ensure adequate visibility and a reasonable viewer reaction time considering the sign blocking examples shown.

On-premise (private property) signage is not governed by MUTCD and therefore is not subject to the 7 foot requirement. This may also contradict community sign code regulations and/or create issues with copy blocking in ground monument scenarios. It is recommended that where possible:

1) Design should consider copy placement at 7 foot above grade.

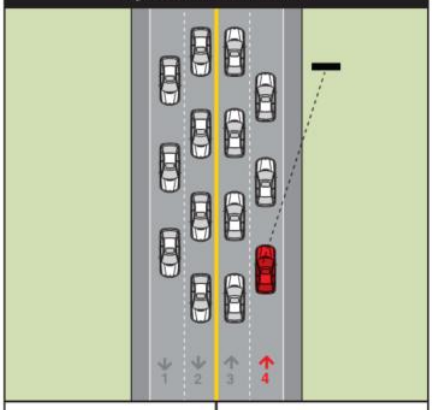
2) No square footage assesment should be imposed below 7 feet if no primary copy is placed within that area.

[n] *Daniel R. Mandelker, John M. Baker & Richard Crawford STREET GRAPHICS AND THE LAW (Chicago, IL American Planning Assoc., 2015), pg. 35*

Fig 3.2A Description: This MUTCD graphic illustrates common sign blocking scenarios, particularly on multi-lane highways. It explicitly recommends a minimum sign height of 7 feet above grade to counteract visual obstructions caused by adjacent vehicles. Given the nature of E-470 as a multi-lane, high-volume highway, ensuring the sign's visibility above traffic is critical. Our proposed 30' OAH directly addresses this by elevating the sign to a height where its critical messaging remains clear and unobstructed for drivers in all lanes.

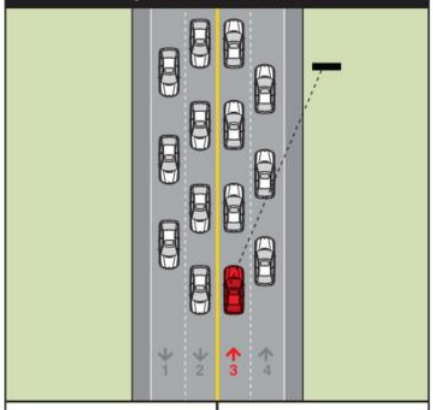
USSC: Recommends a 20' setback to allow for better visibility for multi-lane viewing.

Fig. 3.4a - **45 MPH / LANE 4**



Sign Setback at 10 ft		Sign Setback at 20 ft	
Flow Rate	% Blocking	Flow Rate	% Blocking
200	9	200	6
400	17	400	12
600	24	600	17
800	31	800	23
1000	37	1000	27
1200	42	1200	42

Fig. 3.4b - **45 MPH / LANE 3**



Sign Setback at 10 ft		Sign Setback at 20 ft	
Flow Rate	% Blocking	Flow Rate	% Blocking
200	16	200	12
400	29	400	23
600	40	600	32
800	49	800	41
1000	57	1000	48
1200	64	1200	54

3.4
SIGN BLOCKING
45 MPH STUDY

Tables indicate percent of time sign is blocked from view of subject vehicle depending on the Flow Rate and sign setback.

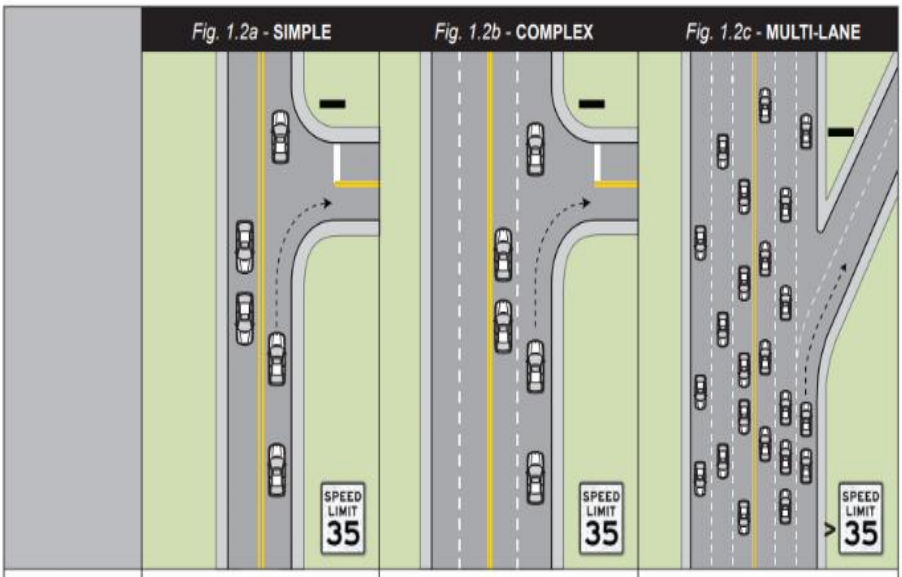
Flow Rate represents number of vehicles traveling in both lanes in one direction for a period of 1 hour. [1]

Continued on following page »

[1] *Daniel R. Mandelker, John M. Baker & Richard Crawford STREET GRAPHICS AND THE LAW (Chicago, IL American Planning Assoc., 2015), pg. 36-39*

Fig 3.4 and 3.4B Description: This USSC study on sign blocking emphasizes the importance of adequate setbacks for optimal visibility, especially in multi-lane traffic conditions. It demonstrates how increasing setbacks from the roadway can significantly reduce the percentage of time a sign is blocked by other vehicles. Our proposed sign location incorporates appropriate setbacks, further enhancing its legibility for drivers, which complements the necessity for increased height and size.

Fig 1.2 viewer reaction time for different complexities



ROAD CONDITION	SIMPLE	COMPLEX	MULTI-LANE
DESCRIPTION	Town or suburban residential areas Single lane travel under 35 mph	Developed town or city commercial areas. Single or multi-lane travel under 35 mph	Developed urban/suburban commercial areas. Multi-lane travel over 35 mph
SIGN DETECTION	0.5 Second	1 Second	1 Second
MESSAGE SCAN	0.1 Sec / Letter 0.5 Sec / Symbol	0.1 Sec / Letter 0.5 Sec / Symbol	0.1 Sec / Letter 0.5 Sec / Symbol
RE-ORIENTATION SCAN	0.02 Sec / Letter 0.1 Sec / Symbol	0.04 Sec / Letter 0.2 Sec / Symbol	0.04 Sec / Letter 0.2 Sec / Symbol
REACTION TIME PRE-SIGN	8 Seconds	10 Seconds	11 Seconds

1.2 VRT PRE-SIGN MANEUVER

The Driving Maneuver can require as much as 4 to 6 seconds post-detection based on the complexity of the driving environment. This may include signaling, changing lanes, braking, and turning the necessary direction.

Whether the Driving Maneuver *needs* to be included as a factor in the VRT is dependent on when the maneuver must be made, ie. before (pre-sign) or after (post-sign).

In most sign scenarios, the sign is located at or near the entity or turn, meaning any driving maneuver required is conducted pre-sign and *should* be included in VRT.

An exception to this might be a Stop sign scenario at the decision point in which the sign can be scanned and then acted upon as necessary. [1]

[1] *Daniel R. Mandelker, John M. Baker & Richard Crawford STREET GRAPHICS AND THE LAW*

USSC: Viewer Reaction Time (VRT) in our case before (Pre-Sign) for a Multi-Lane road.

Fig 1.2A, Fig 1.2B, and Fig 1.2C Description: These USSC figures detail the Viewer Reaction Time (VRT) needed for drivers to process information before a decision point, particularly for complex and multi-lane maneuvers. For multi-lane travel over 35 MPH, the pre-sign reaction time is identified as 11 seconds. The accompanying VRD calculation table demonstrates how vehicle speed directly impacts the required visibility distance, serving as the foundational data for our subsequent calculations and ultimately justifying the need for a larger and taller sign.

Fig 1.4 Viewer Reaction Example Calculations

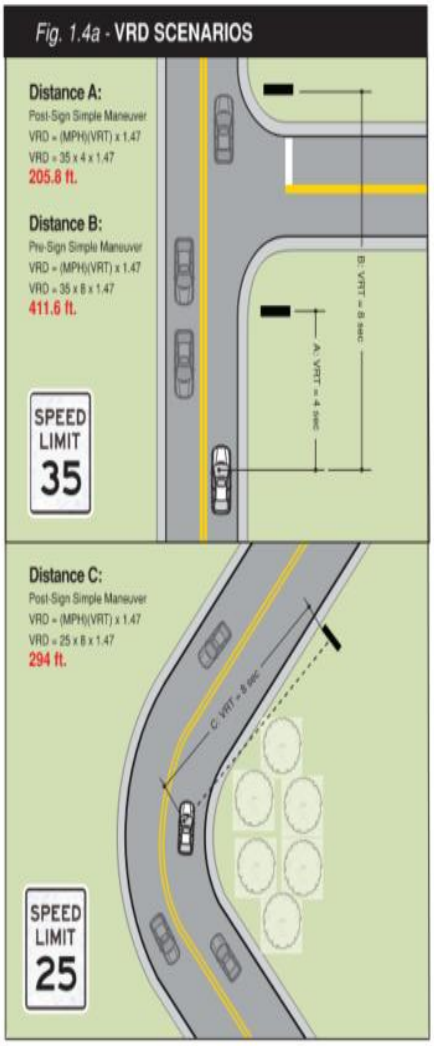


Fig. 1.4b - VRD CALCULATION TABLE

Simple = 2 lane | Complex = 4 lane | Legibilty Index = 30 | Letters = 30

MPH	SITUATION	VRT (Sec)	VRD
SPEED LIMIT 25	Post-Sign Simple	4	171 ft.
	Post-Sign Complex	5	213 ft.
	Pre-Sign Simple	8	341 ft.
	Pre-Sign Complex	10	426 ft.
SPEED LIMIT 35	Post-Sign Simple	4	206 ft.
	Post-Sign Complex	5	257 ft.
	Pre-Sign Simple	8	412 ft.
	Pre-Sign Complex	10	515 ft.
SPEED LIMIT 45	Post-Sign Simple	4	265 ft.
	Post-Sign Complex	5	331 ft.
	Pre-Sign Simple	8	529 ft.
	Pre-Sign Complex	10	662 ft.
SPEED LIMIT 55	Post-Sign Complex	5	404 ft.
	Pre-Sign Complex	10	809 ft.
SPEED LIMIT 65	Multi-Lane	11	1051 ft.

1.4 VIEWER REACTION DISTANCE (VRD)

Viewer Reaction Distance (VRD) is an important factor in determining sign legibility and size. The distance from the viewer to the sign at point of detection will ultimately determine the necessary letter height. Where Viewer Reaction Time (VRT) is measured in seconds, VRD is measured in feet

VRT can be converted to VRD when necessary to determine the distance of first detection (and therefore required letter height). You can find the environmental metrics for pre- and post- sign maneuvers on sections 1.2 and 1.3

The equation is as follows:

VRD = (MPH) (VRT) x 1.47

Travel speed in miles per hour (MPH) to is converted to feet per second (FPS) by using the multiplier, 1.47 [1]

NOTE:
There may be an instance where the distance is an enforced value - for example, when rounding a curve with obscured visibilty. Knowing the VRD, and MPH we can work backward to calculate the sign requirements.

[1] *Daniel R. Mandelker, John M. Baker & Richard Crawford STREET GRAPHICS AND THE LAW (Chicago, IL American Planning Assoc., 2015), pg. 30*

Fig 1.4a and Fig 1.4b Description: These USSC figures illustrate various Viewer Reaction Distance (VRD) scenarios and provide a comprehensive VRD calculation table. The figures demonstrate how the required legibility distance for a sign varies based on speed limits (MPH) and the complexity of the maneuver (Simple vs. Complex, Pre-Sign vs. Post-Sign, and Multi-Lane). Notably, the table specifically calculates VRD using a fixed Legibility Index of 30, underscoring the significant distances needed for drivers to perceive and react to information under different driving conditions. This data is critical for determining the necessary sign visibility and size, reinforcing the need for appropriately scaled signage to ensure driver safety and comprehension

Our calculations(75 MPH), based on the aforementioned USSC and MUTCD standards, conclusively demonstrate the necessity of the requested variance for driver safety on E-470.

In conclusion, the variance requested for the Applegreen / Petrogas Limited monument sign is not merely a matter of aesthetic preference or commercial advantage. It is a critical safety imperative driven by the unique and demanding high-speed conditions of the E-470 corridor, where speeds regularly exceed 75 MPH. The rigorous calculations, based on established MUTCD and USSC standards, unequivocally demonstrate that the proposed 250 sq ft sign, with its 30-foot OAH, is the minimum necessary to provide drivers with the crucial Viewer Reaction Time and Distance required for safe navigation and exit decisions.

The existing sign code, designed for typical municipal roads, does not account for these specific highway dynamics. By granting this variance, the Town of Commerce City Planning Department / Zoning Board will enable Applegreen / Petrogas Limited to operate responsibly, enhancing public safety by mitigating hazards associated with inadequate signage in such a high-speed environment. We respectfully urge your approval, confident that this variance represents the safest and most effective solution for the traveling public on E-470.