LED Menu Board- Prototype build Parameters

Background

The Drive through, exterior menu board business is essential for fast food restaurants in the United States and Canada **as upwards of 70% of all purchase transactions are done through drive throughs**. It is estimated that there are at least 1.5 million exterior menu boards in the United states with approximately 150,000 being digital. Digital penetration after 10+ years is approximately 10%.

Currently the digital menu board business is 100% LCD, consisting of high bright screens from Samsung, LG, Peerless and others with NIT ratings of 2500-3000 and weather proof ratings of IP56-65. These LCD's are challenged in hot environments, suffering from Isotropic failure where the LCD dims to the point where after 2-3 years it's no longer sunlight readable. The most common size for menu board screens is 55".

LED's have not been able to make any inroads for two reasons;

1. The pixel pitch has not be fine enough for the smaller type sizes used on Menu boards. At minimum, a sub 1.5mm pitch is necessary for copy clarity
2. Finer pitch LED's (sub 1.5mm) are primarily COB and have light output limited to 800-1000 NITs and do not provide adequate weatherproofing

LAN Displays are proposing to develop a 1.25mm pitch, SMD product that is fully outdoor rated. LED's offer significant advantages over LCD's in terms of brightness and longevity. We believe the 1.25mm pitch is adequate for most menu board applications and the time is right to introduce an exterior LED menu board to the market.

Project Parameters

To build a sample menu board using a 1.25 mm LED module. The goal is to showcase the product in a menu board format with appropriate menu board copy and introduce this at the restaurant show in Chicago in May.

The product would have a similar look and feel to an exterior menu board. An enclosure with a glass front (camera and speaker are optional) to allow the attendant to talk and or see the customer

The vast majority of menu boards use two vertical LCD's (primarily 55") Because they are mounted side by side, there is a vertical seam between the displays. There will be no break with the LED product

Display Build Prototype

- A single sided bus menu board display that offers a similar look, feel and size to existing double sided menu boards. See Peerless display with Samsung 55" screens. This is what a typical menu board looks like

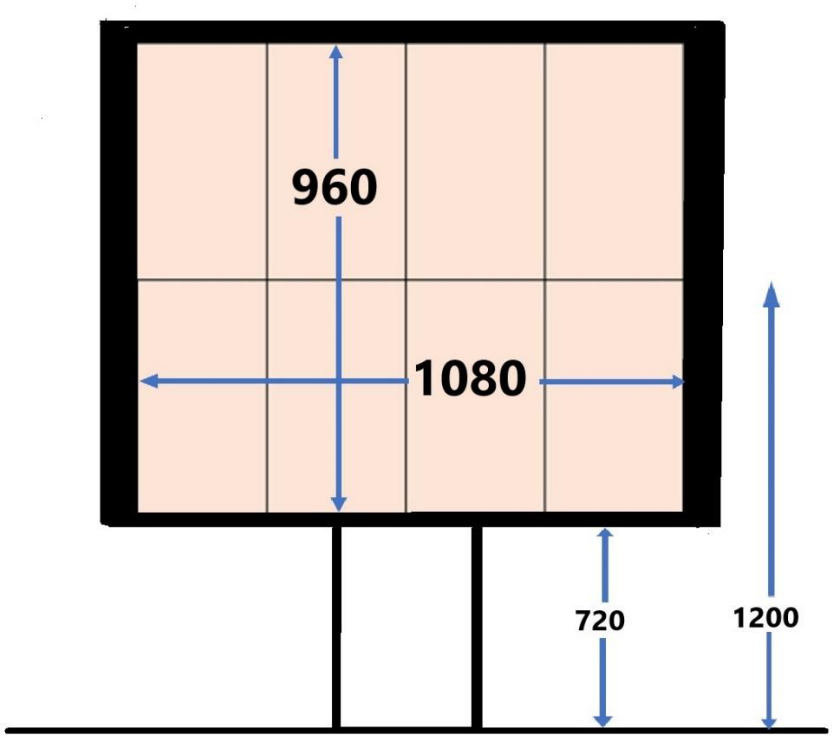
- The display will use eight (8) 1.25mm module with the following matrix size 950mm high, 1080mm wide. **NOTE this is a portrait module configuration**

Display Matrix

	270mm	270mm	270mm	270mm
480mm				
480mm				

We do not want to simply showcase the modules. **It will be necessary to build an enclosure to house the modules including a glass front**.

Here is a preliminary drawing of what the enclosure dimensions would be and the approximate height of the display from the ground.



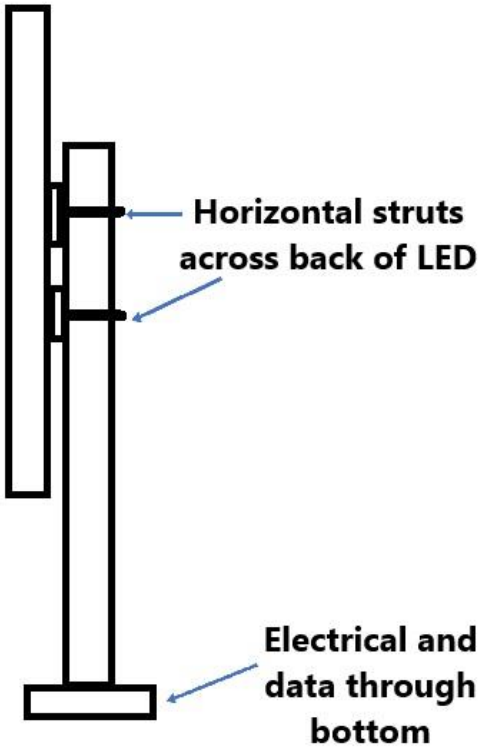
Here are the recommended parameters;

- Metal enclosure surround and metal FRIT around the exterior (see drawing above)
- Color- dark brown including the base
- A glass front with Piston doors to enable front access to the modules. A glass front is deemed necessary to minimize vandalism. See drawings

The bottom can swing open to allow access to the LED's for servicing. You want to be able to show the LED's behind the glass front so you replicate what the consumer sees when they drive up. You also want to be able to open and close the display at the show. You do not want customers directly touching the display as they would be prone to damage. A front glass cover is essential

- We will run real menu board copy on the display for the show that will be sized correctly for the display
- Can offer "optional" speaker system to attach to bottom- **<u>not necessary for the show</u>**

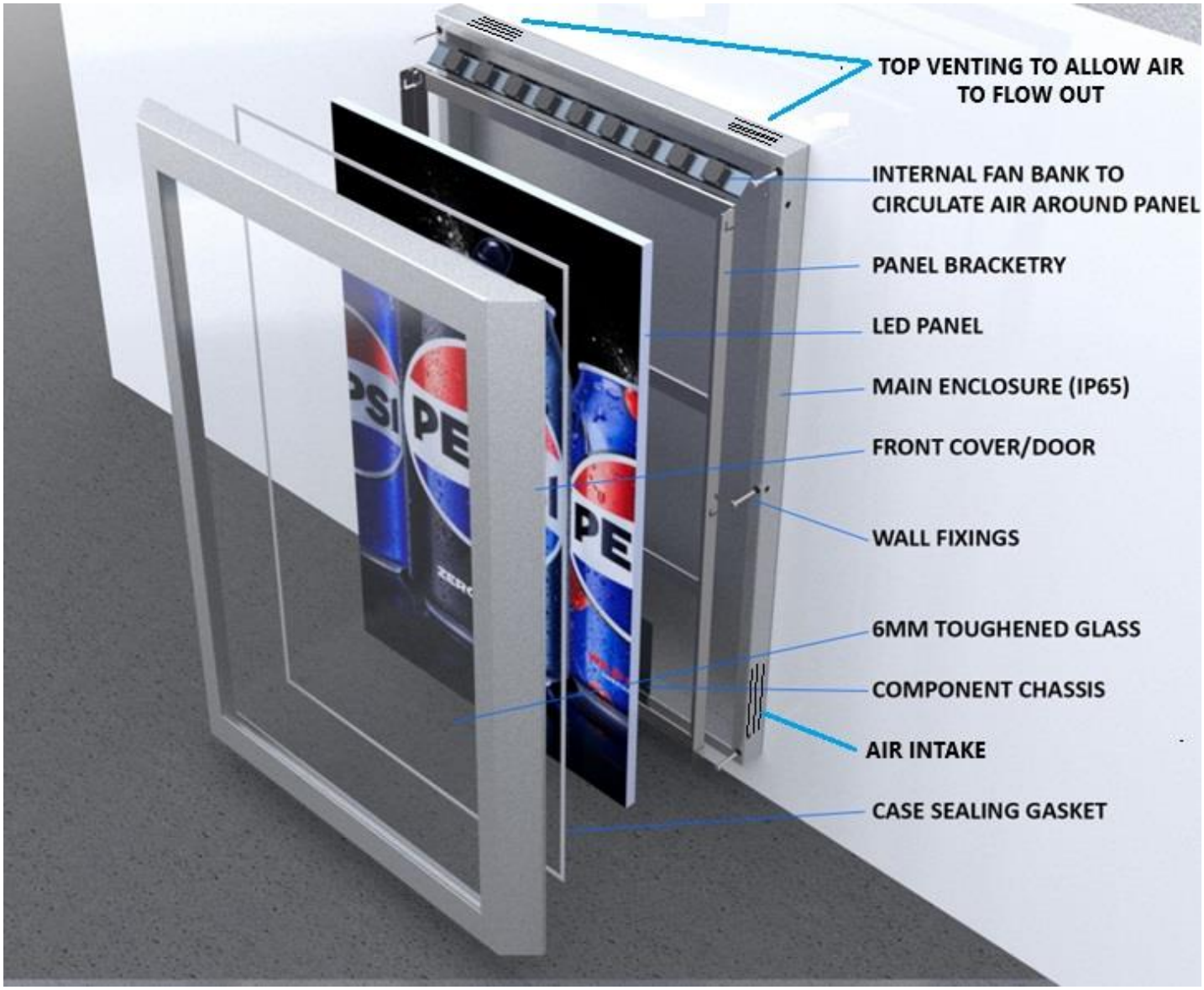
- We will add a media player to the display to control content
- Display structural support- the display would be attached to the base post which is anchored onto a concrete pad as shown



Heat, Moisture and Dust Management

The LEDs are rated at IP65 and are designed to be open to the environment. Putting an enclosure around the LED's changes their thermal dynamics. Despite the robustness of the LED's, there needs to be a thermal management system to keep the LED's cool. If they get too hot, they shut down or degrade rapidly.

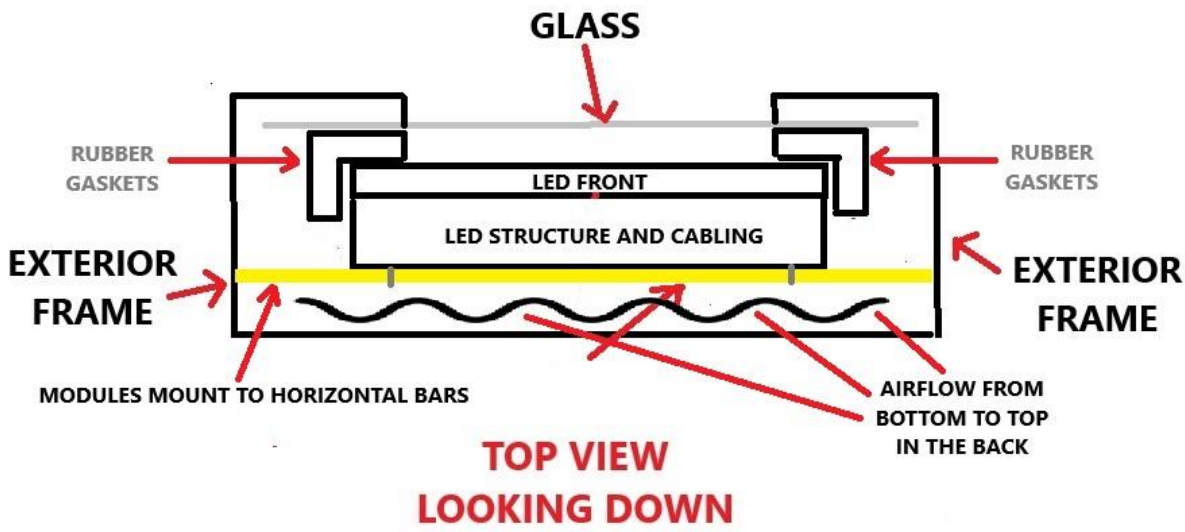
Based on my experience with LCD's, we are recommending a DAC (air only) cooling system. This is the design we did for a wall mount displays. The menu board would have the same heat management system



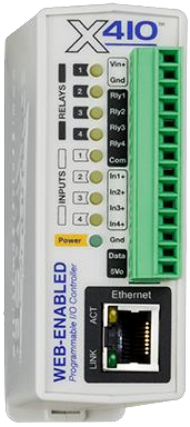
- Venting top and bottom to allow air to enter and exit the display. Intake on sides, exhaust on top
- There is a 4-6mm gap between the glass and the LED. **We do not want outside air to get in between the glass and the LED as static debris will build up quickly on the glass and the modules and will need to be cleaned constantly**. Instead the air flow cools the BACK of the LEDs where we are not as

concerned about dust and static build up. This pulls the heat off the LED's and allows the front display space to remain clear with no static build up

- If necessary, we can apply and IR coating to the inside of the glass for hot climates
- To seal the LED's we are proposing a rubber gasket seal around the perimeter of the LED so when the glass door closes the rubber seal exactly fits around the edge of the LED's. See diagram below



- DC fans (top) pull cooler air from the outside from the vents on the side. Air flow speed controls the rate of cooling, the faster the air flow the better the heat dissipation. This is controlled by the telemetry device
- There would be a gap between the back of the display and the LED's to enable air flow front and back
- High impact tempered glass (IK10 glass is optional but not required for the prototype)
- IR coatings on the glass (not necessary for the prototype)
- Cameras (not necessary for the prototype)
    - Display can operate off of 120 V on a 15 Amp circuit
    - Critical functions can be monitored and controlled using a web based sensor like an x-410 Control by web device. A temperature sensor monitors the heat in the displays and is monitored through the X-410. When the heat starts to go up the fans speed up
- Media player and controller can be housed outside the display for purposes of the prototype



Conclusions

We need to ensure that the LED's offer strong contrast as consumers will be reading the type on the display in various weather conditions

There is an opportunity to build thousands of these displays if we can create a weatherproofed and durable menu board