METRO ADVISORY COMMITTEE (MAC) MEETING AGENDA

OCTOBER 20, 2021 – 6:00 PM

DUE TO COVID-19, THE OCTOBER 20, 2021 METRO ADVISORY COMMITTEE (MAC) MEETING WILL BE CONDUCTED VIA TELECONFERENCE ONLY (No Physical Location) PURSUANT TO ASSEMBLY BILL 361 (Government Code Section 54953)

MEMBERS OF THE PUBLIC MAY NOT ATTEND THIS MEETING IN PERSON.

Staff and the public may participate remotely via the Zoom website at this link or by calling 1-669-900-9128, Meeting ID 857 5471 3858.

Public comment may be submitted via email to mac@scmtd.com. Please indicate in your email the agenda item to which your comment applies. Comments submitted before the meeting will be provided to the staff before or during the meeting. Comments submitted after the meeting is called to order will be included in the correspondence that is posted online at the meeting packet link.

The METRO Advisory Committee (MAC) Meeting Agenda Packet can be found online at www.scmtd.com.

Committee recommendations are subject to action and/or change by the Board of Directors.

COMMITTEE ROSTER

James Von Hendy, Chair
Joseph Martinez, Vice Chair
James Cruse
Jessica de Wit
Veronica Elsea
Michael Pisano
Becky Taylor

NOTICE TO PUBLIC
At each meeting, every effort will be made to conclude MAC business by 8:00 PM. If there is concern that an item may not be adequately addressed in the time allowed, Committee members may choose to table the item until the next meeting, move the item earlier in the agenda or to extend the meeting if necessary.

MEETING TIME: 6:00 PM

NOTE: THE COMMITTEE CHAIR MAY TAKE ITEMS OUT OF ORDER

1. **CALL TO ORDER**

2. **ROLL CALL**

3. **COMMUNICATIONS TO THE METRO ADVISORY COMMITTEE**
   3.1 Barry Scott email dated 10/2/2021 with staff response
   3.2 Rick Longinotti letter dated 10/6/2021 with staff response
   3.3 Richard Masoner email dated 10/12/2021 with staff response

4. **RECEIVE AND FILE MINUTES FROM THE METRO ADVISORY COMMITTEE MEETING OF AUGUST 18, 2021**
   James Von Hendy, Chair

5. **COMMUNICATIONS FROM METRO ADVISORY COMMITTEE**

6. **COVID-19 UPDATE**
   Alex Clifford, CEO/General Manager

7. **INFORMATION TECHNOLOGY SYSTEMS (ITS) UPDATE**
   Isaac Holly, IT and ITS Director

8. **SERVICE PLANNING UPDATE**
   John Urgo, Planning & Development Director

   a. Quarterly Ridership Report
   b. Stops
      i. Bus Stop Sign Improvements
      ii. Maintenance of Simme-Seats at Bus Stops
   c. Other Projects
      i. ParaCruz and On-Demand Microtransit Trips

9. **ESTABLISH AND APPROVE THE METRO ADVISORY COMMITTEE 2022 MEETING SCHEDULE**
   James Von Hendy, Chair

10. **ELECT THE METRO ADVISORY COMMITTEE CHAIR AND VICE CHAIR FOR 2022 TERM**
    James Von Hendy, Chair

11. **COMMUNICATIONS TO THE METRO CEO**

12. **COMMUNICATIONS TO THE METRO BOARD OF DIRECTORS**

13. **ITEMS FOR NEXT MEETING AGENDA**

14. DISTRIBUTION OF VOUCHERS - WILL BE MAILED ON OCTOBER 21, 2021
Donna Bauer, Administrative Specialist

15. ADJOURNMENT

Accessibility for Individuals with Disabilities

This document has been created with accessibility in mind. With the exception of certain 3rd party and other attachments, it passes the Adobe Acrobat XI Accessibility Full Check. If you have any questions about the accessibility of this document, please email your inquiry to accessibility@scmtd.com. Upon request, Santa Cruz METRO will provide for written agenda materials in appropriate alternative formats, or disability-related modification or accommodation, including auxiliary aids or services, to enable individuals with disabilities to participate in and provide comments at/related to public meetings. Please submit a request, including your name, phone number and/or email address, and a description of the modification, accommodation, auxiliary aid, service or alternative format requested at least two days before the meeting. Requests should be emailed to mac@scmtd.com or submitted by phone to the Adminitrative Specialist at 831.426.6080. Requests made by mail (sent to the Administrative Specialist, Santa Cruz METRO, 110 Vernon Street, Santa Cruz, CA 95060) must be received at least two days before the meeting. Requests will be granted whenever possible and resolved in favor of accessibility.

Public Comment

If you wish to address the Committee, please follow the directions at the top of the agenda. If you have anything that you wish distributed to the Committee and included for the official record, please include it in your email. Comments that require a response may be deferred for staff reply.

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Donna Bauer

From: Barry Scott [redacted]
Sent: Friday, October 01, 2021 11:17 AM
To: mac@scmtd.com; boardinquiries@scmtd.com
Subject: Please Support for a Bus Stop at the ETC in Scotts Valley

Dear Metro Advisory Committee and Metro Board members,

I support adding a Metro Bus Stop at The Enterprise Technology Center (ETC) in Scotts Valley!

Background:
The ETC has about 1000 cars a day parking in its parking lots. I have been a single voice, for over 5 years, trying to convince 13 Metro Board members to add a bus stop at ETC. I currently work at the UC Scotts Valley Center at the ETC, and I am asking for support as a local citizen. I use the Metro regularly. The nearest bus stop to the ETC is by the Kaiser on Scotts Valley Drive - which is a 15-minute hilly walk and deters many from using our Metro to get to the ETC. This bus stop at the ETC may help take cars off of our roads.

Warm regards,

Barry
--
Barry Scott
[redacted]

From: John Urgo <JUrgo@scmtd.com>
Sent: Friday, October 15, 2021 10:17 AM
To: [redacted]
Cc: Donna Bauer <DBauer@scmtd.com>
Subject: RE: Please Support for a Bus Stop at the ETC in Scotts Valley

Dear Mr. Scott,

Thank you for your comment. There are a couple of factors that make this request challenging to fulfill.

First, adding service to the Enterprise Technology Center would require a deviation on Route 35 of about five minutes in each direction, inconveniencing the majority of passengers traveling between Santa Cruz and Scotts Valley/San Lorenzo Valley. While this may not seem like much, it would require adding operators and vehicles to the route and METRO unfortunately does not have the workforce available to expand service at this time.

Second, routing through a private parking lot presents its own challenges. Besides the delay added to the route by having to negotiate a bus through a constrained parking lot with 1,000 cars, METRO would need to negotiate an indemnity agreement with the owner for any damage to pavement not designed for heavy vehicles like METRO buses.

There is an ADA accessible bus stop traveling northbound on Santas Village Road, but this stop can only be served in one direction by buses that then continue northbound on Highway 17. This type of single direction service is not best practice and still inconvenient for those who need to travel roundtrip from this location.

I visited the ETC on multiple occasions this week during the morning and afternoon peak periods. I counted about 50 cars parked in the structured parking lot (some had been parked overnight for multiple days) and about 10 on the surface lot. These numbers do not equate to the level of demand that your email would suggest (see photos attached).

Staff will continue to investigate the issue. As an alternative, METRO's Cruz On-Demand service is available to the general public for service to this location from any address within a three-mile radius. Trips can be booked on-demand online up to 24 hours in advance: https://www.scmtd.com/en/metro-paracruz/cruz-on-demand.

Please feel free to follow up with additional questions or concerns.

Thanks,

John

JOHN URGO
Director, Planning & Development
T: (831) 420-2537| jurgo@scmtd.com
Santa Cruz METRO
110 Vernon Street, Santa Cruz, CA 95060

Attachment

3.1.2.Attachment.1

Attachment

3.1.2.Attachment.2

Attachment

3.1.2.Attachment.3

Attachment

3.1.2.Attachment.4

Attachment

3.1.2.Attachment.5

Attachment

3.1.2.Attachment.6

Attachment

3.1.2.Attachment.7

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Donna Bauer

From: John Urgo
Sent: Wednesday, October 06, 2021 4:18 PM
To: 'Rick Longinotti'
Cc: Donna Bauer
Subject: RE: bus stop @ ETC Scotts Valley Dr.

Hi Rick,

Thank you for your comment. Adding service to the Enterprise Technology Center would involve a route extension or deviation and METRO unfortunately does not have the workforce available to add service at this time.

In addition, the only ADA accessible location to stop a bus is a pullout traveling northbound on Santas Village Road. After servicing this location, the bus would have to reenter Highway 17 going northbound. This means the only way to serve the Enterprise Technology Center is in one direction on Highway 17 buses traveling northbound to San Jose. This type of single direction deviation is not considered best practice by METRO because it is confusing to the general public and inconvenient for those who need to travel roundtrip to/from this location.

As an alternative, METRO's Cruz On-Demand service is available to the general public for service to this location from any address within a three-mile radius. Trips can be booked on-demand online up to 24 hours in advance: https://www.scmtd.com/en/metro-paracruz/cruz-on-demand.

Please feel free to follow up with additional questions or concerns.

Thanks,

John

JOHN URGO
Director, Planning & Development
T: (831) 420-2537| jurgo@scmtd.com
Santa Cruz METRO
110 Vernon Street, Santa Cruz, CA 95060

-----Original Message-----
From: Rick Longinotti [redacted]
Sent: Wednesday, October 06, 2021 11:44 AM
To: boardinquiries@scmtd.com; mac@scmtd.com
Cc: Mike Pisano [redacted] James Sandoval [redacted]
Subject: bus stop @ ETC Scotts Valley Dr.

Please see my attached correspondence.
Thanks,
Rick

Attachment

Campaign for Sustainable Transportation

Rick Longinotti, Co-chair Rick@sustainabletransportationSC.org

October 6, 2021

METRO Board of Directors
cc. METRO Advisory Committee

Dear Board Members,

This is to support the addition of a bus stop at the Enterprise Technology Center on Scotts Valley Dr. Currently the closest bus stop is a 15 minute walk for the many employees and visitors at ETC. There are 1000 vehicles per day parked at the ETC lots. A new bus stop would provide another option for these people, contributing to our County's social equity and climate goals.

Thank you,

Rick Longinotti

Donna Bauer

From: Richard M[redacted]
Sent: Tuesday, October 12, 2021 4:57 PM
To: mac@scmtd.com
Subject: Public comment for Santa Cruz Metro Advisory Committee

Hi,

I appreciate the hard work Santa Cruz Metro staff have done to keep the buses rolling over this past 19 months.

With capacity limits gone, can Santa Cruz Metro can update Covid safety best practices to include ventilation, given that US EPA, CDC, and OSHA all recommend ventilation to reduce risk of Covid exposure for both operator and passenger safety. I ask because a driver refused my request to open the roof hatches for ventilation on a Highway 17 trip.

Several peer-reviewed studies show the importance of ventilation. See, for example, this study showing a clear link between poor ventilation and covid transmission on public transportation. https://www.sciencedirect.com/science/article/pii/S0360132321008118

Other supporting documentation:

- CDC https://www.cdc.gov/coronavirus/2019-ncov/community/organizations/bus-transit-operator.html
- OSHA https://www.osha.gov/sites/default/files/publications/OSHA4103.pdf
- EPA https://www.epa.gov/coronavirus/ventilation-and-coronavirus-covid-19

Thank you for your consideration.

Richard Masoner
Scotts Valley, CA

From: Margo Ross
To: [redacted]
Cc: Donna Bauer; Eddie Benson; Curtis Moses
Subject: Ventilation
Date: Friday, October 15, 2021 8:59:43 AM
Attachments: image001.png

Good morning Mr. Mason,
Here is information regarding METRO's filter system; I have included Eddie our maintenance manager in the discussion. METRO currently uses a MERV-7 rated filter which provides the maximum allowed for indoor filtration. This filter is a higher rated filter than the maintenance department used previously. The new system was procured to assist in combating COVID-19.
Again if you have any questions or concerns please reach out to myself, Eddie.
Margo

Margo Ross
Chief Operations Officer
Santa Cruz Metropolitan Transit District
831-425-2577
www.scmtd.com

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Review Date: November 12, 2020

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Transit HVAC Return Air MERV Rating Considerations

Transit HVAC Return Air MERV Rating Considerations

Purpose: The purpose of this document is to provide data and information regarding the impact of utilizing return air filters with improved MERV ratings. Higher rated MERV filters have been increasingly requested to improve air quality in transport HVAC.

Summary: The following data and information is provided to assist transit agencies in their efforts to establish improved air filtration practices in a pandemic environment. This document provides an overview of filter MERV ratings, how higher rated MERV filters can eliminate more contaminants, the associated increase in maintenance and filter replacement costs. In addition, this paper explores HVAC system factors to show the importance of matching improved filtration to the appropriate HVAC system to avoid reduction in performance that can ultimately damage components within the system.

Section 1 – MERV Ratings

Health organizations, such as the CDC, have provided recommendations to improve air filtration by using higher MERV rated air filters. Although, these higher MERV filters provide increased particle capture, they can also restrict airflow. The allowable airflow restriction for transit HVAC applications are much different from building HVAC applications. Understanding the differences is critical to the performance and long-term condition of the HVAC systems in transit applications.

An overview of the definition of MERV ratings as presented by American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)[1] and an analysis of testing conducted by Thermo King Corporation using various MERV rated filters are provided here. Specifically, the impact on the “Houston Pull-Down Method” as described in the APTA recommended practice for “Capacity and Performance Requirements” is discussed. The results and conclusions drawn pertaining to the impact to driver and passenger comfort, and the trade-offs that may need to be considered are explained in the “Test Results and Observations” section of this document.

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Transit agencies should consider how the information provided in this document apply to their specific policies and specification requirements.

MERV Rating Definition:

Minimum Efficiency Reporting Value or MERV is based on ASHRAE Standard 52.2-2017. The fraction of particles removed from air passing through a filter is termed “filter efficiency” and is provided by the “Minimum Efficiency Reporting Value” (MERV) under standard conditions.[1] (Figure 1).

Figure 1. ASHRAE Standard 52.2-2017[1]

Standard 52.2 Minimum Efficiency Reporting Value (MERV)	Composite Average Particle Size Efficiency, % in Size Range, µm			
	Range 1 0.30 to 1.0	Range 2 1.0 to 3.0	Range 3 3.0 to 10.0	Average Arrestance, %
1	N/A	N/A	E_3 <20	A_{avg}<65
2	N/A	N/A	E_3 <20	65 ≤ A_{avg}
3	N/A	N/A	E_3 <20	70 ≤ A_{avg}
4	N/A	N/A	E_3 <20	75 ≤ A_{avg}
5	N/A	N/A	20 ≤ E_3	N/A
6	N/A	N/A	35 ≤ E_3	N/A
7	N/A	N/A	50 ≤ E_3	N/A
8	N/A	20≤ E_2	70 ≤ E_3	N/A
9	N/A	35≤ E_2	75 ≤ E_3	N/A
10	N/A	50≤ E_2	80 ≤ E_3	N/A
11	20≤ E_1	65≤ E_2	85 ≤ E_3	N/A
12	35≤ E_1	80≤ E_2	90 ≤ E_3	N/A
13	50≤ E_1	85≤ E_2	90 ≤ E_3	N/A
14	75≤ E_1	90≤ E_2	95 ≤ E_3	N/A
15	85≤ E_1	90≤ E_2	95 ≤ E_3	N/A
16	95≤ E_1	95≤ E_2	95 ≤ E_3	N/A

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Understanding MERV Definitions and Application:

MERV ratings have a range from 1 to 20. According to the MERV ratings, MERV ≥ 13 filters are efficient at capturing air borne viruses.

It should be noted that while higher efficiency filters provide increased particle capture and better levels of indoor air quality, some can also be damaging to the HVAC system. Not all higher MERV rated filters are appropriate for use with transport HVAC systems and applications. Therefore, the HVAC manufacturer must be consulted before moving to a higher rated MERV filter.

Higher MERV Rated Filters - Impact to HVAC Systems:

Increased filter efficiency typically results in increased pressure drop through the filter. Ensuring the HVAC system can tolerate higher rated MERV filters without negative impacts to pressure differentials and airflow is essential to the performance and long-term health of the system. The cause and effect of the impact is presented in the “Test Results and Observations” section of this document.

Higher MERV Rated Filters – Cost and Replacement Frequency

In general, filter costs increase along the MERV spectrum. The higher the MERV rating, the higher the quality of materials used to capture smaller particulates, which will translate to higher price. The same can be true for the filter replacement frequency. Higher MERV rated filters capture smaller particles and will “load” faster which may increase filter replacement intervals.

Recommended PPE:

Technicians performing maintenance and/or replacing filters on HVAC systems with the potential of viral contamination should wear appropriate personal protective equipment (PPE).[1] Appropriate PPE includes, but may not be limited to:

- A properly fitted respirator (N95 or higher)
- Eye protection (safety glasses, goggles, or face shield)
- Disposable gloves

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Transit HVAC Return Air MERV Rating Considerations

Section 2 – Filter Analysis - Set-up and Test Parameters

The analysis presented is based on testing conducted at the Thermo King testing facility in Minneapolis, MN August 12 – August 25, 2020.

Test Set-Up:

The testing performed utilized a 60’ all-electric articulated bus equipped with a Thermo King electric roof mount and electric rear mount HVAC system.

The filter comparison criteria utilized two filters currently offered by Thermo King, a MERV 7, 1” diameter Dacron filter media, and a MERV 4, 1” diameter Blue Polyester filter media. The base line drawn was using the MERV 4, 1” diameter Blue Polyester filter.

Test Filters:

The filters tested were:

MERV 10, 1” Dacron,
MERV 10, 2” Pleated,
MERV 13, 4” Pleated.

In order to accommodate the deeper depth of the 2” and 4” diameter filters, the filter was installed using temporary framing to hold the filter in place. The current roof mount grill design does not have room to accommodate the 2” and 4” diameter filters. The testing for these filters was performed on the roof mount system only. All filter samples used in the analysis were new and unused.

NOTE: The return air filter media used in testing does not contain properties that actively treat or destroy the COVID-19 virus or other viruses. The MERV 10, 1” inch Dacron filters contain anti-microbial properties for mitigation of mold growth only.

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Test Parameters:

The base line test chosen was the “Houston Pull-Down” method requirement of 110°F 70°F +/- 3°F in 30 minutes, after a heat soak at 110°F. This test was chosen because it is a test performed on all buses regardless of a transits unique specifications and requirements and is applicable to past bus test data.

Additional readings recorded were air speed in CFM (cubic feet per minute) of the fans at low, medium, and high speeds on both the front and rear units. In order to compare impact to air velocity. The last data points reviewed were air resistance specific to each of the filter material and MERV rating at one inch of water column as stated by the material manufacturer.

Section 3 – Test Results and Observations

Pull-Down Test Results:

Figure 2. Shown below, is a comparison of the test results using the various media, MERV ratings, time to reach pull-down, ambient temperature, interior average temperature and the percentage difference in time to reach pull-down.

Figure 2.

Average Temperature During the Profile Test Period				
Filter Type	Time to Pull down	Percent difference in time (Based on Dacron 1" MERV 7)	Ambient Temperature	Interior Average Temperature
Base line Blue Polyester 1" (MERV 4)	26.0 min	1.2%	110.24 °F	73.02 °F
Dacron 1" (MERV 7)	25.7 min	-	110.07 °F	73.00 °F
Dacron 1" (MERV 10)	28.0 min	-8.9%	110.20 °F	73.03 °F
Pleated 2" (MERV 10)	25.8 min	-0.4%	109.98 °F	72.96 °F
Pleated 4" (MERV 13)	27.1 min	-5.4%	109.75 °F	73.04 °F

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Transit HVAC Return Air MERV Rating Considerations

Test Observations - Time to Pull-Down:

The first area of focus based on the test results, is understanding the impact to system performance, specifically in terms of meeting specification requirements of “Houston Pull-Down Method” as described in the APTA recommended practice for “Capacity and Performance Requirements”. The Houston Pull-Down method requirement specifies the system can reach a set point of 70°F +/- 3°F within 30 minutes at an ambient temperature of 110°F after a heat soak at 110°F. The results shown in Figure 2 show all sample filter types exceeded this requirement, the MERV 7, 1” diameter Dacron filter media showing the best results by reaching pull-down in 25.7 minutes. However, the MERV 10, 2” diameter Pleated filter media shows a nominal difference in time to pull-down as compared to the MERV 7, 1” diameter Dacron filter.

Conclusion: All filters tested passed the “Houston Pull-Down” requirements. Transit locations that require more stringent pull-down specifications will need to consider this if choosing to move to a higher MERV rated filter. If a higher MERV rated filter is desired, adjusting or modifying the specification may be an alternative. Each transit will need to weigh the trade-off between current specifications and the need for increased filtering.

For existing buses in a transit fleet, achieving pull-down may not be as relevant of a data point. Air filtration, driver and passenger comfort, and equipment longevity may be of higher priority. However, the data provided in figure 2 is relevant in terms of driver and passenger comfort if considering a higher MERV rated filter. If for instance, a MERV 10, 1” diameter Dacron filter is used, figure 2 demonstrates it will take 9% longer to reach set-point. In a typical daily route, door openings occur frequently. Each door opening acts like a mini pull-down or pull-up, depending upon the frequency and the ambient temperature. The system may be working to recover throughout the day. In this case, there may be an observed difference in the cabin temperature. This again, may need to be considered by the transit. Understanding the trade-off between impact to driver and passenger comfort, and the need for increased filtering will be an important aspect to consider.

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Airflow and its Importance:

Why is airflow important to the function of an HVAC system? A proper flow of air in a transport HVAC is the foundation of the entire function of the system. It provides the ability for the system to reach set-point, or a desired temperature, whether the desired set-point is heating, cooling or ventilation. Without proper airflow, the function of the coils and compressor can be adversely affected. This can take the form of coil freeze or premature compressor wear. Airflow is required to keep refrigerant cycling through the system and oil flowing through the compressor. This process is illustrated as follows:

As refrigerant travels through the system, oil from the compressor also moves through the system, but at a lower volume. When the mixture of refrigerant and oil enters the evaporator, both are in a liquid state. As the air travels across the evaporator, the refrigerant changes from a liquid state to a vapor. Since the air is warm, the compressor oil flows back freely to the compressor, along with the refrigerant vapor. When the air traveling across the evaporator is reduced, much of the refrigerant will remain in a liquid form. This can cause an extreme temperature drop in the evaporator. This temperature drop will cause the oil in the evaporator to thicken, also minimizing the return of oil to the compressor, thereby reducing the oil level. If this condition continues for an extended period, a significant amount of compressor oil can remain in the refrigeration system. This allows the compressor to operate at a reduced oil level, potentially causing significant wear of internal components and resulting in premature failure. Coils and compressors are major components that are costly to replace or repair, reinforcing the importance of maintaining proper airflow to the system.

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Transit HVAC Return Air MERV Rating Considerations

Test Observations Air Speed:

The second area of focus based on test results, is looking at the airflow observed. Figure 3 shows the air speed in CFM for the different filters tested and the volume difference with fans operating at low, medium, and high speed. The lower portion of figure 3 is the recorded air speed difference when comparing to the MERV 7, 1" Dacron filter.

Figure 3.

Air Speed and Air Speed Difference (%) High-Medium-Low Fan Speed

Dacron 1" (MERV 7)				Dacron 1" (MERV 10)				Pleated 2" (MERV 10)				Pleated 4" (MERV 13)			
Front unit	CFM	Rear Unit	CFM	Front unit	CFM	Rear Unit	CFM	Front unit	CFM	Rear Unit	CFM	Front unit	CFM	Rear Unit	CFM
High	1946	High	2025	High	1938	High	2029	High	1971	High	2186	High	1891	High	2015
Med	1590	Med	1586	Med	1553	Med	1533	Med	1608	Med	1725	Med	1565	Med	1570
Low	999	Low	969	Low	945	Low	946	Low	986	Low	1079	Low	977	Low	964
				Front unit	CFM	Rear Unit	CFM	Front unit	CFM	Rear Unit	CFM	Front unit	CFM	Rear Unit	CFM
				High	-0.4%	High	0.2%	High	1.3%	High	8.0%	High	-2.8%	High	-0.5%
				Med	-2.3%	Med	-3.3%	Med	1.1%	Med	8.8%	Med	-1.6%	Med	-1.0%
				Low	-5.4%	Low	-2.4%	Low	-1.3%	Low	11.4%	Low	-2.2%	Low	-0.5%

Conclusion: The most notable percentage reduction in air speed is associated with the Dacron 1" MERV 10 filter. The Pleated 2" MERV 10 rendered the best results, with improved air speed in both the front and rear units. The results demonstrated by all the filters tested show no significant reduction in airflow.

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Air Resistance, Static Pressure and Pressure Drop:

Air resistance and static pressure are both defined as the resistance to air flow in the HVAC system created by components within the system. Static pressure can also be referred to as pressure drop. The terms are all synonymous with each other. For the purpose of this discussion, the pressure drop is the calculated difference between air pressure before and after air moves through the air filter. Generally, lower pressure drop is better, as high static pressure results in lower airflow.

Test Observations Pressure Drop:

The last area of focus based on the test results is considering the static pressure or pressure drop for all four of the filter samples. Figure 4 shows the pressure drop in FPM (feet per minute) at one inch of water column. It is important to note the pressure drop numbers provided are not constant. Pressure drop increases as filters become dirty. Therefore, maintaining a regimented filter replacement program is also key in maintaining proper airflow for the HVAC system.

Figure 4.

Pressure Drop and Pressure Drop Difference (%)							
Dacron 1" (MERV 7)		**Dacron 1" (MERV 10)**		**Pleated 2" (MERV 10)**		**Pleated 4" (MERV 13)**	
Pressure Drop		**Pressure Drop**		**Pressure Drop**		**Pressure Drop**	
FPM	Inch W.C.	FPM	Inch W.C.	FPM	Inch W.C.	FPM	Inch W.C.
200	0.105	200	0.175	250	0.100	250	0.110
300	0.190	300	0.260	375	0.160	375	0.180
400	0.296	400	0.360	500	0.240	500	0.290
		Pressure Drop		**Pressure Drop**		**Pressure Drop**	
		200	66.7%	250	-4.8%	250	4.8%
		300	36.8%	375	-15.8%	375	-5.3%
		400	21.6%	500	-18.9%	500	-2.0%

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Transit HVAC Return Air MERV Rating Considerations

Conclusion: The filter observed that provides the lowest pressure drop is the MERV 10, 2" Pleated filter. It provides a lower pressure drop or air resistance than the MERV 7, 1" Dacron filter. The reason for this is at a 2" thickness the filter provides more surface area for air to flow. Nevertheless, with more surface area, the down side is it also provides more area for dust and particles to adhere to the filter. A filter that "loads" quicker may also require more frequent filter changes. As stated in the Test Parameters section, the tests conducted using the 2" and 4" thick filter were made possible, in part, by using temporary framing to hold the filter in place. Most HVAC configurations existing in the field today do not have the available space within the grill for modifications to move to a thicker filter. Using thicker framed filters that do not have the allowable space are not recommended. The resulting air by-pass will defeat the purpose of using higher MERV rated filters as it will not form a tight seal and not all air will be filtered.

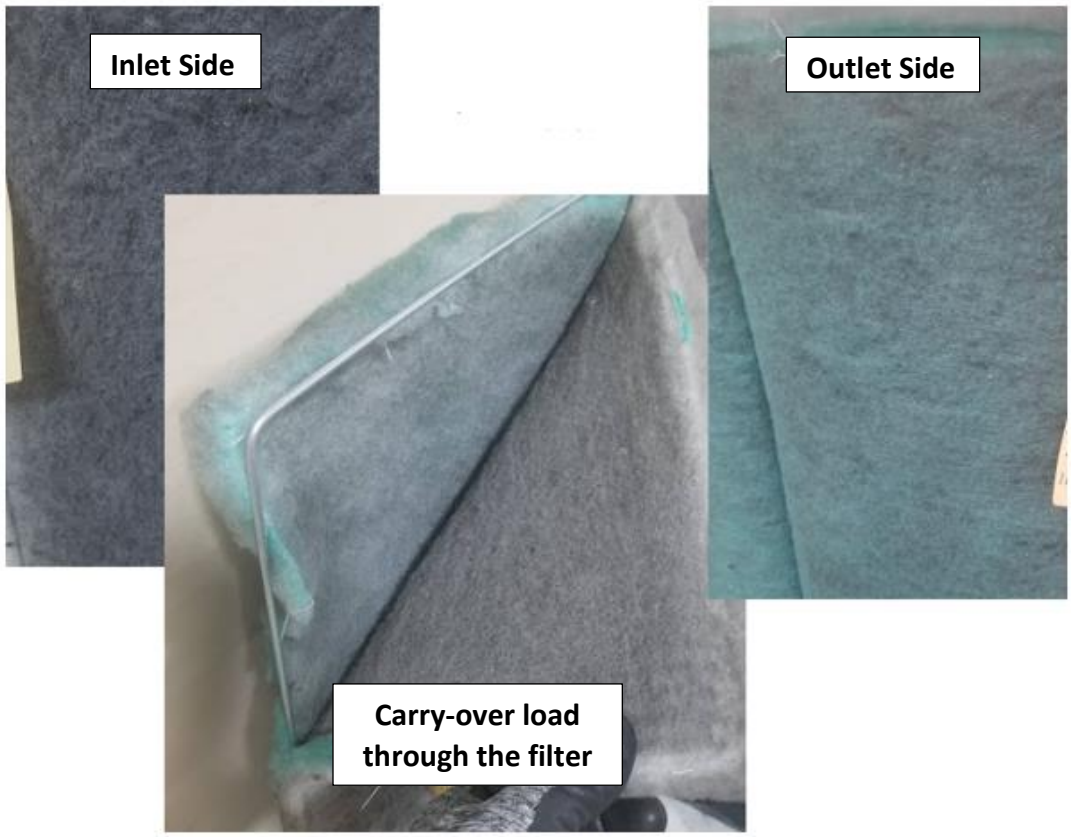
While the MERV 10, 1" Dacron filter shows the highest pressure drop amongst all filters tested, if the desire is to move to higher MERV rated filter, the MERV 10, 1" Dacron can be used as long as the user understands the trade-offs. The MERV 10, 1" Dacron is a drop in replacement and can be used to replace current filters in Thermo King HVAC systems. However, with the additional pressure drop, the frequency of filter replacement will increase and filter replacement will be critical to maintaining proper airflow and to not impeding the performance of the system.

Filter Replacement Frequency - MERV 10, 1" Dacron Filter

The potential of more frequent filter replacement is covered briefly in the "Cost and Replacement Frequency" section above. In order to have a true understanding of the recommended filter replacement frequency, additional airflow pressure tests were conducted on the MERV 10, 1" Dacron filter. MERV 10, 1" Dacron filter samples were installed on Thermo King HVAC systems on buses at a transit location that were in operation for 30 days. Both visual and airflow pressure tests were conducted to understand the impact of pressure drop on a loaded filter and to determine the recommended change frequency required for the Higher MERV rated filter. Figure 5 shows the visible load on the inlet side, outlet side and carry-over through the inside of the filter. Based on the particulate load in the samples tested, the results of the airflow pressure test demonstrated that to remain within a tolerable pressure drop range that will not affect the performance of the HVAC, 30 days is the recommended replacement frequency of the MERV 10, 1" Dacron. This recommendation is based on the results of

one transit location. Depending on the environment, the amount of particulate load can vary by location and by route, A field test was not conducted on the MERV 10, 2" or the MERV 13, 4" Pleated filters due to the space limitations described in the Pressure Drop Test Observation section above.

Figure 4.



THERMO KING

Thermo King Corporation
314 W. 90th St.
Bloomington, MN 55420

Review Date: November 12, 2020

Publish Date: November 12, 2020

Transit HVAC Return Air MERV Rating Considerations

Final Observations:

This paper has provided an overview of test results for the purpose of understanding the impacts of using higher MERV rated filters in transit HVAC applications as many transit agencies strive to provide better filtered air for their passengers in a pandemic environment. This paper has provided detailed definitions and information regarding MERV ratings, the impact to airflow, air speed, air restrictions, and aspects of potential cost considerations and the potential trade-offs. Each transit agency will need to weigh all of the information to determine what is best specific to their policies, specifications, and application needs.

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Review Date: November 12, 2020

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Transit HVAC Return Air MERV Rating Considerations

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[1] American Society of Heating, Refrigerating and Air-Conditioning Engineers. (2020, October 6). ASHRAE Standard 52.2-2017 -- *Minimum Efficiency Reporting Value (MERV)*

https://www.ashrae.org/technical-resources/filtration-disinfection#modes

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STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

ROY COOPER
GOVERNOR

J. ERIC BOYETTE
SECRETARY

February 11, 2021

To North Carolina Transit Agencies:

The following HVAC Technology Reference Document is intended to help transit agencies understand the real opportunities and risks associated with HVAC upgrades and other air management products in the wake of the COVID-19 pandemic. This document was developed in collaboration with one of the nation's leading Hospital HVAC engineering firms and faculty at the University of North Carolina Gillings School of Global Public Health.

Despite a lot of media attention on products that claim to make the air safer to breathe during the pandemic, it is important that transit agencies make sure their investment decisions are based on credible facts. This document provides a high-level overview of 17 different HVAC technologies, of which:

- Four are recommended to help reduce the risk of airborne diseases like COVID-19
- Four are helpful for overall air quality, but not reducing the risk of airborne diseases like COVID-19
- Nine should be avoided because they pose unintended safety risks or are an emerging technology with insufficient evidence to support an evaluation of the technology.

Readers of this document should understand that **there are no bolt-on HVAC technologies that will significantly reduce the risk of airborne disease transmission by themselves**. In the transit industry, HVAC systems have been historically designed for thermal comfort and energy efficiency; not as a means to control the spread of human disease. Accordingly, the biggest airborne disease risk reductions can only be achieved through a complete redesign of vehicle and facility HVAC systems. Such HVAC redesigns can borrow design principles from the healthcare sector and include improved air distribution, filtration, and air cleaning systems.

HVAC system redesigns do not necessarily have to be more expensive than conventional HVAC design and construction costs. Agencies can consider the technologies in this document to incrementally help with risk reduction on existing vehicles and facilities. Agencies should also consider these technologies as part of an HVAC redesign when procuring new transit vehicles and renovating/constructing transit facilities.

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North Carolina DOT HVAC Technology Reference Document

The COVID-19 pandemic has prompted a flood of products into the marketplace that claim to make the air safe to breathe. Some of these products may be helpful while others may pose unintended health risks to employees and customers. This document was created to help transit agency managers take the guesswork out of considering HVAC upgrades. North Carolina DOT commissioned the development of this document by one of the nation's leading Hospital HVAC engineering firms, and had it reviewed and endorsed by faculty at the University of North Carolina Gillings School of Public Health. None of these technologies serve as a replacement for mask usage and physical distancing during the COVID-19 pandemic, but targeted investments may be incrementally helpful in critical facilities and vehicles.

Indoor Air Management Technology	Application	How it Works	Important Considerations	Potential Funding Sources/ROM Cost
TECHNOLOGIES TO CONSIDER FOR REDUCING THE RISK OF AIRBORNE DISEASES LIKE COVID-19				
Higher MERV rated or HEPA filters (In-line) 	**Filtration Efficiency** (Facilities and Vehicles)	MERV-13 and higher rated filters, including HEPA filters (MERV-17 and 18), mechanically remove a vast majority of potentially harmful particles from the air.	* Higher MERV rated filters are a reliable way of removing potentially infectious particles from the air. Any upgrade – even from a MERV-6 to a MERV-7 filter – can be beneficial. * ASHRAE states here that "Research has shown that the particle size of the SARS-CoV-2 virus is around 0.1 µm (micrometer). However, the virus does not travel through the air by itself. Since it is human generated, the virus is trapped in respiratory droplets and droplet nuclei (dried respiratory droplets) that are predominantly 1.0 µm in size and larger." * According to ASHRAE standard 52.2, MERV-13 and better filters can remove more than 98% of particles between 0.3 µm and 1.0 µm on the first pass; HEPA filters (MERV-17 and better) can remove more than 99.97% of particles 0.3 µm in size on the first pass. * According to ASHRAE, "HEPA filters may not be an appropriate option for some into HVAC systems due to high pressure drops and the likelihood that systems will need new filter racks to allow sufficient sealing to prevent filter bypass"- check with your HVAC provider to evaluate feasibility, airflow reductions due to pressure drops, and potential noise concerns. *** In-Line HEPA filters, if properly sized to the HVAC system, can be very effective at removing potentially harmful particles from the air. NCDOT endorses their use in critical facility spaces and vehicles. NCDOT recommends working with your HVAC contractor and/or vehicle manufacturer to determine the highest MERV rated filter than can be used without putting unacceptable strain on your HVAC equipment and/or voiding its warranty.**	Operating $30 - $400 each

3.3.2.Attachment.15

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Indoor Air Management Technology	Application	How it Works	Important Considerations	Potential Funding Sources/ROM Cost
TECHNOLOGIES TO CONSIDER FOR REDUCING THE RISK OF AIRBORNE DISEASES LIKE COVID-19				
HEPA Filters (Portable) 	**Personal Air Filtration** (Primarily for facility use)	Portable HEPA filters mechanically remove potentially harmful particles from the air within a small radius of the device.	* ASHRAE states here that "Research has shown that the particle size of the SARS-CoV-2 virus is around 0.1 µm (micrometer). However, the virus does not travel through the air by itself. Since it is human generated, the virus is trapped in respiratory droplets and droplet nuclei (dried respiratory droplets) that are predominantly 1.0 µm in size and larger." * According to ASHRAE standard 52.2, MERV-13 and better filters can remove more than 98% of particles between 0.3 µm and 1.0 µm on the first pass; HEPA filters (MERV-17 and better) can remove virtually all infectious respiratory droplets on the first pass. * The manufacturer should state the maximum spatial coverage provided by their portable HEPA filtration devices. * The placement of portable HEPA filters in a room is critical to minimize how air currents might draw "dirty" air across the faces of other building occupants. * **Portable HEPA filters, if properly sized to the space to be treated, can be very effective at removing potentially harmful particles from the air. NCDOT endorses their use at workstations in critical spaces.**	Operating/Capital $100 - $2500 each

3.3.2.Attachment.16

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Indoor Air Management Technology	Application	How it Works	Important Considerations	Potential Funding Sources/ROM Cost
TECHNOLOGIES TO CONSIDER FOR REDUCING THE RISK OF AIRBORNE DISEASES LIKE COVID-19				
Ionization Devices (In-line and UL 2998 certified) 	**Filtration Efficiency** (Primarily for facility use)	In-line ionizing devices use static electricity to get smaller particles (like a respiratory droplet) to stick to larger particles (like a piece of dust) so they can be more easily captured in filter material.	* Because ionization devices incrementally improve filtration efficiency, they are most useful in facilities where MERV-13 (or better) filters are not feasible. Transit vehicle air change rates are likely high enough to negate benefits provided by an ionization device. * The highest-rated MERV filter practicable should be used in conjunction with this technology to maximize its health benefits and serve as a fail-safe (to the degree possible). Filters used in conjunction with ionizing devices should be sealed at the edges so no air can bypass the filter media. * According to ASHRAE, there are many variations of this technology, and "studies of ionizers have shown results ranging from no benefit to some benefit for acute health symptoms." * Claims that these devices can safely kill microbes (bacteria, fungus, and virus) require further study. * Some of these devices can generate ozone as a byproduct of operations. ASHRAE has taken a position that devices that generate any level of ozone should be avoided: "Studies of ionizers have shown results ranging from no benefit to some benefit for acute health symptoms… Negative health effects arise from exposure to ozone and its reaction products. Consequently, devices that use the reactivity of ozone for cleaning the air should not be used in occupied spaces. Extreme caution is warranted when using devices in which ozone is not used for the purpose of air cleaning but is emitted unintentionally during the air-cleaning process as a by-product of their operation." * Devices with UL-2998 certification were evaluated according to industry standards and determined to produce virtually zero ozone during their operation. * According the CDC, the "needlepoint bi-polar ionization [variant] has a less-documented track record in regards to cleaning/disinfecting large and fast volumes of moving air within heating, ventilation, and air conditioning (HVAC) systems. [This technology] is still considered by many to be an 'emerging technology.'" ASHRAE also states "Convincing scientifically-rigorous, peer-reviewed studies do not currently exist on this emerging technology; manufacturer data should be carefully considered." *** NCDOT supports the use of ionization devices only with UL 2998 certification and where MERV-13 and higher rated filters are not possible, though the highest practical MERV filters should be used in conjunction with this technology.**	Operating/Capital $250 - $1200 each

Indoor Air Management Technology	Application	How it Works	Important Considerations	Potential Funding Sources/ROM Cost
TECHNOLOGIES TO CONSIDER FOR REDUCING THE RISK OF AIRBORNE DISEASES LIKE COVID-19				
Upper Room Ultraviolet Germicidal Irradiation (UVGI)  	**Air Cleaning (Disinfection)** (Facilities Only)	Upper room UVGI devices create an irradiation zone with UV-C light (200 to 280 nm) in high-ceiling areas that can slowly disinfect air as it is naturally cycled to/from the ceiling area via convection.	* The CDC recommends upper room UVGI "as a supplement to help inactivate SARS-CoV-2, especially if options for increasing room ventilation are limited." * The CDC stated in their 2009 publication, Environmental Control for Tuberculosis, "when mechanical ventilation is increased in a room where an upper-room UVGI system has been deployed, the effectiveness of the UVGI system may be reduced because the residence time of the [pathogen] in the irradiated zone decreases." * UV-C light is harmful to human tissues; therefore, upper room UVGI devices must be installed at the proper height within a room, as mentioned in this NIH Journal. * *Upper room UVGI should not be confused with other UV light technologies described in this document.* * **Based on ASHRAE's advice, NCDOT suggests this technology will only add significant value in facility spaces where mechanical ventilation and filtration is limited, and should only be used in spaces where walls and ceilings have low UV reflectivity. NCDOT does not recommend upper room UVGI in vehicles where significant air changes occur.**	Capital $1000 - $2000 each

3.3.2.Attachment.18

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Indoor Air Management Technology	Application	How it Works	Important Considerations	
TECHNOLOGIES THAT ARE HELPFUL FOR OVERALL AIR QUALITY, BUT NOT REDUCING THE RISK OF AIRBORNE DISEASES LIKE COVID-19				
Humidification and Dehumidification Devices (Portable and HVAC In-line) 	**Humidity Regulation** (Primarily for facility use)	Humidification devices add water vapor or steam into the air to increase its relative humidity. Dehumidification devices remove water vapor from the air to decrease its relative humidity.	* There is no specific humidity target for indoor spaces during the COVID-19 pandemic. * According to the CDC, SARS-CoV-2 "is more stable at low-temperature and low-humidity conditions, whereas warmer temperature and higher humidity shortened half-life." * However, ASHRAE' Position Document on Infectious Aerosols states that for an indoor space, "scientific literature generally reflects the most unfavorable survival for microorganisms when the RH [Relative Humidity] is between 40% and 60%...studies showed that RH below 40% is associated with three factors that increase infections." This ASHRAE document further illustrates the optimum RH zone and a variety of health considerations including the risk of mold or fungal growth above 60% RH. * Building envelope construction is critical. Analysis of the building envelope is recommended prior to implementing added humidification to avoid mold growth. *** Targeting the proper humidity range for a space will be beneficial for general indoor air quality, however, airborne disease transmission can occur regardless of humidity levels. Therefore, NCDOT does not support the adjustment of humidity in a space as a means of reducing transmission of airborne diseases like COVID-19.**	Attachment
HVAC In-Line Ultraviolet Germicidal Irradiation (UVGI) Devices 	**Surface Disinfection** (Facilities Only)	HVAC in-line UVGI devices are used to continuously shine UV-C light (200 to 280 nm) onto ductwork, coil, or filter media surfaces to irradiate and disinfect those surfaces over time.	* In-line UVGI devices are primarily used to control the growth of mold and bacteria on surfaces inside an HVAC system; not to disinfect the air. ASHRAE's Position Document on Filtration and Air Cleaning states "experience suggests that control of a moving airstream does not provide favorable killing rates because of the short dwell time [of the air in range of the UV light]." * UV lights can be located at a final filter position which will slow air velocities and increase effectiveness; however, filter material must be safe for UV light exposure. * ASHRAE recommends that in-line UV-C devices "should always be coupled with mechanical filtration; MERV-8 filter for dust control [or the] highest practical MERV filter recommended". *** UVGI devices are effective at inhibiting mold and bacterial growth in damp areas within the HVAC system, resulting in better general indoor air quality. However, NCDOT does not recommend this technology for reducing transmission of airborne diseases like COVID-19.**	

Indoor Air Management Technology	Application	How it Works	Important Considerations	
TECHNOLOGIES THAT ARE HELPFUL FOR OVERALL AIR QUALITY, BUT NOT REDUCING THE RISK OF AIRBORNE DISEASES LIKE COVID-19				
Sorbent Air Cleaners 	**Air Cleaning (Removal of VOCs)** (Facilities Only)	Sorbent air cleaners remove contaminants from the airstream via physical adsorption and chemisorption onto a sorbent surface.	* Most sorbent air cleaners are effective at removing gaseous contaminants from the air, but as stated by ASHRAE: "While there may be exceptions, most sorbent beds alone are not generally efficient at removing viruses from airstreams." * In EPA's 2018 Residential Air Cleaners Technical Summary document, "regular replacement is required because its adsorption capacity is exhausted and physical adsorption is a reversible process, meaning pollutants may not be permanently captured." Therefore, this technology is not economically feasible for large scale HVAC integration. *** This technology, while effective at removing VOCs from the air, is not well known nor studied on its abilities to remove pathogens from airstreams. Accordingly, NCDOT does not recommend this technology for reducing transmission of airborne diseases like COVID-19.**	
Demand Control Ventilation (DCV) 	**Outdoor Air Ventilation** (Facilities Only)	DCV devices use a computer and an array of CO_2 sensors to dynamically adjust for more or less outdoor air ventilation based on occupancy (i.e. more humans in the space generate greater quantities of exhaled CO_2); this helps balance indoor air quality and energy efficiency.	* The CDC recommends increased outdoor ventilation as a helpful COVID-19 mitigation strategy, however, the CDC released a statement in October of 2020 for building or HVAC operators to "Disable Demand-Control Ventilation (DCV) controls that reduce air supply based on temperature or occupancy." *** DCV systems can be valuable tools to balance HVAC performance and energy efficiency under normal circumstances. However, because they can restrict outdoor air ventilation, NCDOT does not endorse the use of this technology during the COVID-19 pandemic or a future health emergency involving an airborne disease.**	

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3.3.2.Attachment.20

Indoor Air Management Technology	Application	How it Works	Important Considerations	
TECHNOLOGIES TO AVOID				
Photocatalytic Oxidization (PCO) and Dry Hydrogen-Peroxide Devices 	**Air Cleaning (Disinfection)**	PCO devices use UV light and a catalyst (usually titanium dioxide) to cause a "redox" chemical reaction in which oxidative gases can break- down pathogens. Some of these devices generate gaseous hydrogen peroxide as a byproduct of the redox process.	* According to ASHRAE, "Nearly all organic, gaseous indoor air contaminants and microbes are subject to PCO decomposition… [however, there exists] potential of an incomplete oxidizing process, which produces by-products of reaction that can be more toxic or harmful than the original constituents (e.g., formaldehyde)." * EPA's 2018 Residential Air Cleaners Technical Summary document corroborates that PCO devices "can generate harmful byproduct such as formaldehyde, and acetaldehyde, and ozone". *** Due to the harmful byproducts that can be generated by PCO devices, NCDOT does not recommend the use of these devices in facilities or vehicles.**	Attachment
Vaporized Hydrogen Peroxide (VHP)  	**Air Cleaning (Disinfection)**	Liquid Hydrogen-Peroxide is diffused into the space via a nebulizing device to disinfect the air.	* There has been limited research on the effectiveness and safety of VHP when generated inside active HVAC ducts and occupied spaces. * OSHA's permissible exposure limit (PEL) for hydrogen peroxide is "1 part per million (ppm) as an 8-hr Time Weighted Average (TWA)," which is what most VHP device manufacturers cite as a basis for safety of their product. However, those devices typically aim to maintain a constant 1ppm ambient concentration of VHP. And according to OSHA, "TWA is the employee's average airborne exposure in any 8-hour work shift of a 40-hour work week which shall not be exceeded." Pending any credible, peer-reviewed, and published scientific studies to the contrary, the concentration of VHP required to inactivate airborne viruses will likely be unsafe for workers to inhale. * ASHRAE mentions that for VHP treatment to be safe, "the space MUST be unoccupied during VHP treatment. Requires spaces to be sealed, including all doorways, plumbing/electrical penetrations and HVAC supply and return vents, to prevent vapor from escaping. After prescribed exposure times, remaining H_2O_2 vapor is scrubbed from the space." *** Due to the hazards associated with breathing hydrogen peroxide and the lack of research on VHP treatment for safely disinfecting the air in occupied spaces, NCDOT recommends against the use of these devices in facilities or vehicles.**	

Indoor Air Management Technology	Application	How it Works	Important Considerations	
TECHNOLOGIES TO AVOID				
Intentional Ozone Generation  	**Air Cleaning (Disinfection)**	Intentional generation of ozone using corona discharge, UV, or other methods to oxidize odorous compounds, gases, and microbes.	* According to ASHRAE, "Ozone is harmful for health and exposure to ozone creates risk for a variety of symptoms and diseases associated with the respiratory tract… [and] should only be considered for disinfection on unoccupied spaces." * The EPA also states "If used at concentrations that do not exceed public health standards, ozone applied to indoor air does not effectively remove viruses, bacteria, mold, or other biological pollutants." *** Due to the hazards associated with the use of ozone in occupied spaces, NCDOT does not recommend the use of these devices in facilities or vehicles.**	
Chemical Air Treatment *Photo not available*	**Air Cleaning (Disinfection)**	A proprietary chemical solution is diffused into occupied spaces via a mister or nebulizing device to disinfect the air.	* New products are coming into the marketplace at the time of this writing, including one that is "an airborne virucide used with water-based haze and fog machines" that claim to kill SARS-CoV-2 in the air. * Despite claims of key ingredients being non-toxic, further study is needed to determine if chronic exposure to the fog might perform and/or cause unintended health effects in a field environment. Such studies would include peer-reviewed analysis of virucidal activity in field conditions, impacts of air change rate on effectiveness, and unintentional generation of irritants when the chemical is heated. *** Further research is needed before NCDOT can consider endorsing this technology; until that research is performed and evaluated by NCDOT and its partners, NCODT does not recommend the adoption of such technology.**	Attachment
Plasma Devices 	**Air Cleaning (Disinfection)**	An electric arc is created which ionizes incoming gases and molecular bonds are broken down to transform pollutants	* In EPA's 2018 Residential Air Cleaners Technical Summary document, "[A] wide variety of plasma generation types yields confusion on how a product actually works. Byproducts are formed from many plasma technologies, including particles, ozone, formaldehyde, carbon monoxide, chloroform, nitrogen oxides, and a large number of other organic gases. Most studies have investigated gaseous removal while fewer have evaluated particle removal." *** Due to the harmful byproducts that can be generated by Plasma devices, NCDOT does not recommend the use of these devices in facilities or vehicles.**	

Indoor Air Management Technology	Application	How it Works	Important Considerations	
TECHNOLOGIES TO AVOID				
Ionization Devices (Portable and/or <u>Not</u> UL 2998 Certified) 	**Air Cleaning**	Portable ionizing devices use static electricity to get smaller particles (like a respiratory droplet) to stick to larger particles (like a piece of dust) so they respond quicker to gravity and fall to the floor.	* Portable ionizing devices may cause particles to fall more quickly to the ground but not at a rate that has any appreciable reduction in risk for airborne disease transmission. * Ionization devices without a UL 867 or UL 2998 certification have not been evaluated by a credible organization for ozone production at levels considered safe for public health. * ASHRAE states "Studies of ionizers have shown results ranging from no benefit to some benefit for acute health symptoms… Negative health effects arise from exposure to ozone and its reaction products. Consequently, devices that use the reactivity of ozone for cleaning the air should not be used in occupied spaces. Extreme caution is warranted when using devices in which ozone is not used for the purpose of air cleaning but is emitted unintentionally during the air-cleaning process as a by-product of their operation." * Devices with UL 2998 certification were evaluated according to industry standards and were determined to produce virtually zero ozone during their operation. *** Due to few perceived health benefits as well as ozone hazards associated with portable ionizers and ionizers without UL 2998 certification, NCDOT recommends against the use of these devices in facilities or vehicles.**	Attachment
UV-C Portable Room Decontamination 	**Surface Disinfection**	Portable UV-C (200 nm to 280 nm) lamps are placed in a space for a period of time to irradiate and disinfect surfaces within the effective range of the device.	* The FDA states that "Direct exposure of skin and eyes to UV-C radiation from some UV-C lamps may cause painful eye injury and burn-like skin reactions… Some UV-C lamps generate ozone… [and] UV-C can degrade certain materials, such as plastic, polymers, and dyed textile." Thus, these portable UVGI devices are designed for surface disinfection in unoccupied spaces, not disinfecting the air in occupied spaces. *** Because portable UVGI products are designed only for surface disinfection in unoccupied spaces, NCDOT does not recommend the use of these devices for air treatment.**	

Indoor Air Management Technology	Application	How it Works	Important Considerations	
TECHNOLOGIES TO AVOID				
Black Lights and "Near UV" Light 	**Surface Disinfection and Air Cleaning (Disinfection)**	Black Lights or Near UV lights (405 nm) use a different mechanism to kill microbes; they excite naturally-occurring molecules inside organisms, creating reactive oxygen species similar to bleach.	* According to ASHRAE, the "effectiveness [of Near UV] at killing viruses, including SARS-CoV-2, is not as well documented." Additionally, some studies suggest it is "approximately 1000 times less [effective] than UV-C and the effective doses are not practical in an occupied environment." *** Due to perceived effectiveness issues when compared to UV-C technology, NCDOT does not recommend the use of Black Lights and Near UV devices for air treatment.**	
"Far UV-C" Ultraviolet Germicidal Irradiation (UVGI) Devices 	**Surface Disinfection and Air Cleaning (Disinfection)**	Far UV-C (205 nm to 230 nm) UVGI devices are used to slowly disinfect air and surfaces using a spectrum of light that may be safe for human tissues.	* Far UV-C light is an emerging technology that has been proven to kill airborne SARS-CoV-2 in a laboratory, but it still requires significant field testing for safety and efficacy. * As stated in ASHRAE's Filtration/Disinfection Technical Resource, Far UV-C devices are "Unable to fully penetrate larger microorganisms. The UV dose required to inactivate microorganisms is significantly higher at these wavelengths than in the UV-C range [typically used for UVGI]. While safety concerns are reduced, [Far UV-C light] can still cause damage to eyes and skin." *** Further research is needed before NCDOT can consider endorsing this technology; until that research is performed and evaluated by NCDOT and its partners, NCODT does not recommend the adoption of such technology.**	

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MINUTES*

MAC MEETING OF AUGUST 18, 2021

The METRO Advisory Committee (MAC) met on Wednesday, August 18, 2021. The meeting was held via teleconference. ***Minutes are "summary" minutes, not verbatim minutes.

1. **CALL TO ORDER** at 6:02 PM.

2. **ROLL CALL** - The following MAC Members were present via teleconference, representing a quorum:

James Von Hendy, Chair
Joseph Martinez, Vice Chair
James Cruse
Jessica de Wit ***AR 6:05 PM***
Veronica Elsea
Michael Pisano
Becky Taylor

Additional METRO staff and presenters:

Alex Clifford, CEO/General Manager
Margo Ross, Chief Operations Officer
Isaac Holly, IT and ITS Director
John Urgo, Planning & Development Director
Curtis Moses, Safety, Security, & Risk Management Director
Brandon Freeman, Bus Operator
Donna Bauer, Administrative Specialist

3. **COMMUNICATIONS TO THE METRO ADVISORY COMMITTEE**

Vice Chair Martinez asked if the Accessible Services Coordinator position is being filled because he was approached by a Bus Operator to train someone on how to use a wheelchair on the METRO bus system. Alex Clifford, CEO, said the individual needing assistance should call Customer Service and we will make arrangements for the training. We are currently reviewing the job description and the needs of METRO. Mr. Cruse added that ParaCruz is very good at helping people in wheelchairs.

4. **RECEIVE AND FILE MINUTES FROM THE METRO ADVISORY COMMITTEE MEETING OF APRIL 21, 2021**

MOTION: ACCEPT AND FILE THE MINUTES FROM THE METRO ADVISORY COMMITTEE MEETING OF APRIL 21, 2021 AS PRESENTED

MOTION: ELSEA **SECOND: PISANO**

MOTION PASSED WITH 7 AYES: Von Hendy, Martinez, Cruse, de Wit, Elsea, Pisano, and Taylor

5. **COMMUNICATIONS FROM METRO ADVISORY COMMITTEE (MAC)**

Chair Von Hendy attended the June 25, 2021 Board of Directors meeting and reported on MAC's last two meetings of 2021. He spoke highly of MAC's contributions and dedication to METRO and felt MAC was well received and appreciated by the Board.

6. **COVID-19 UPDATE**

CEO Clifford reported on the following:

- METRO had a fully vaccinated employee test positive for COVID-19 two weeks ago. METRO continues to monitor information from the CDC, Cal/OSHA, county and state health agencies and make the necessary adjustments to protocols (e.g., CDC currently recommends face masks be worn inside an office environment, whether vaccinated or not).
- METRO is launching a mask mandate and weekly COVID testing in four METRO departments which have a substandard fully vaccination level.

- The management team continues to evaluate an all-employees vaccination mandate.
- Governor Newson has indicated that his executive order waiving the open meeting requirements may end September 30, 2021. Starting in October 2021, all meetings that fall under the Ralph M. Brown Act, which include MAC meetings, will have to be held in person.

Ms. Elsea asked if there was any news about Santa Clara County allowing METRO to increase the capacity on the Hwy. 17 buses. CEO Clifford responded that there is no update.

Ms. Elsea asked if the public can enter the Pacific Station lobby on hot days to get out of the heat. CEO Clifford said METRO is not allowing people to congregate in small areas. However, the restrooms are open to the public.

7. UPDATE ON INFORMATION TECHNOLOGY SYSTEMS (ITS)

Isaac Holly, IT and ITS Director, said METRO has been working hard to make the intelligent transportation system project succeed but the vendor has failed us. We just sent a letter of default to them. If certain requirements are not met (including the audio/visual enunciation system that Ms. Elsea mentioned earlier) within 30 days, METRO has legal grounds to release them from the contract and choose another vendor to complete the project. He added that METRO wants a stable, reliable system for its riders. MAC members thanked Director Holly for his efforts and dedication.

8. SERVICE PLANNING UPDATE

a. Quarterly Ridership Report

John Urgo, Planning & Development Director, gave an update on the ridership for the Fourth Quarter of FY21 and stated the full report would go to the Board of Directors on August 27, 2021. Ridership continues to rise every week and we are approaching about 50% pre-COVID ridership levels. More student services are expected to return this fall. Even though SJSU has started classes, most employers in the San Jose region have extended remote working. We are not expecting Hwy. 17 to rebound. Chair Von Hendy expressed concern about the low ridership on the Hwy. 17 buses but understands METRO is bound by whatever directive comes from Santa Clara County. Director Urgo said we are stuck with the current capacity limits, but our pass bys have gone down.

Ms. Elsea asked if METRO will be increasing Route 18 service in the fall. Director Urgo said that service will remain the same. UCSC service (Routes 15 and 22) will return to pre-COVID levels as students return to campus.

b. Bus Stops

b.i. Bus Stop Sign Improvement

Director Urgo said the bus stop improvement project is being implemented. Approximately half of the signs have been installed at our 800 bus stop locations.

Ms. Elsea asked if any research had been done on the Braille component. Director Urgo responded that METRO has done research and found some of the options were outside of our means to implement. One option may be to place a marker on the pole to identify the Bus Stop ID. Ms. Elsea said the Bus Stop ID would be helpful; with the ID, one can access route information.

Mr. Pisano and Chair Von Hendy both commented that they have seen the new signs and they look great.

b.ii. Add/Adjust Bus Stops at Santa Cruz County Government Building in Watsonville

Director Urgo said we will study this and work with Santa Cruz County. Currently, it would be challenging to add service anywhere given the work force shortages we are experiencing.

b.iii. Adjust Route 69W for Kaiser Facility on Soquel Avenue

Director Urgo said we do not have the resources to redirect Route 69W to the Kaiser facility. Pete Rasmussen, Transportation Planner II, is working with Kaiser and looking at a possible shuttle service model provided by Kaiser.

b.iv. Add Bus Stop for Capitola Library

Director Urgo said METRO doesn't have the resources to deviate service to the Capitola library at this time.

b.v. Maintenance of Simme-Seats at Bus Stops

Facilities is visiting every METRO bus stop and noting their condition, especially the Simme-Seats. We will come up with a plan to refurbish any that need maintenance.

c. Other Projects

c.i. ParaCruz and On-Demand Microtransit Trips

Director Urgo reported we are about six months into this one-year pilot project. We are seeing very low demand for this service—under 10 trips per day. We will continue to evaluate it. As ParaCruz rides increase, on-demand trips will be impacted.

Mr. Cruse asked if ParaCruz can pick up wheelchairs with the microtransit trips. Director Urgo replied yes, as long as there is wheelchair capacity on the ParaCruz van.

c.ii Increase Bicycle Capacity on Buses

In response to MAC's earlier request, METRO staff reviewed literature on this issue and even contacted their peers for information. The biggest advancement over the last 10-15 years is the three-position bike rack.

There are van-type services with trailers (i.e., UCSC and Caltrans) but METRO is not going to hitch a trailer to a bus nor install rear bike racks. We were potentially looking at procuring a zero-emmission, electric, commuter coach for the Hwy. 17 service that would have allowed bikes to be stored in the undercarriage. However, the range of the vehicle was not sufficient to travel the Hwy. 17 corridor. We recognize the limitations so will work with our City and County partners to encourage more bike racks, bike lockers and bike-share programs that would allow people to connect to transit with bikes.

9. SANTA CRUZ COUNTY FAIR – SEPTEMBER 15 - 19, 2021

COO Ross announced METRO will extend Route 79 service and provide ParaCruz service to the Santa Cruz County Fair. Discussion followed regarding the information that will be displayed on the flyers to be posted at the bus stops on Route 79. METRO will also man a booth at the fairgrounds with first responders and have on display a new electric bus and new ParaCruz van. Chair Von Hendy thanked METRO for making it possible to take the bus to and from the fairgrounds.

10. COMMUNICATIONS TO THE METRO CEO

Ms. Elsea asked if METRO is going to reinstate the disabled passenger training she participated in as part of the Bus Operator training. Margo Ross, COO, said METRO had to suspend that aspect due to COVID for safety reasons but that ADA training is part of the syllabus. Concern was

expressed over the loss of this practice. Brandon Freeman, Bus Operator, added that COO Ross and Director Moses have improved the training program and recognize the people component is important; however, for now, COVID precautions have to be followed. Chair Von Hendy acknowledged Ms. Elsea's concerns that something might be lost and thanked COO Ross, Director Moses and Mr. Freeman for their reassurances to continue training to fully serve our community. Ms. Taylor thanked Ms. Elsea for all of her years of dedication to so many in the community.

Discussion ensued on who should be contacted while METRO is reviewing the Accessible Services Coordinator position.

11. COMMUNICATIONS TO THE METRO BOARD OF DIRECTORS

None.

12. ITEMS FOR NEXT MEETING AGENDA

- COVID-19
- Information Technology Systems
- ParaCruz and On-Demand Microtransit Trips
- Bus Stop Sign Improvement
- Maintenance of Simme-Seats at Bus Stops

13. DISTRIBUTION OF VOUCHERS

Donna Bauer, Administrative Specialist, will mail out the vouchers on Thursday, August 19, 2021 to all members in attendance at this meeting.

14. ADJOURNMENT

The next MAC meeting is scheduled for Wednesday, October 20, 2021 at 6:00 PM.

Meeting adjourned at 6:55 PM.

Respectfully submitted,

Donna Bauer
Administrative Specialist