



Lighting and Marking Recommendations for Animal-Drawn Carriages, Buggies and Wagons

Authors: Robert “Bobby” Grisso, Extension Engineer, Biological Systems Engineering, Virginia Tech; Don Ohanehi, Research Scientist, Engineering Science & Mechanics, Virginia Tech; S. Dee Jepsen, Associate Professor, Agricultural Safety and Health, The Ohio State University; John Perumpral, Professor Emeritus, Department of Biological Systems Engineering, Virginia Tech; and Kirk Ballin, Program Coordinator, Virginia AgrAbility Project, Easter Seals UCP of NC and VA

Introduction

Horse-drawn buggies or wagons and other animal-drawn carriages have been used by the Plain Communities as the primary means of transportation for generations. Equestrian sports and tourism business enterprises have also increased the number of horse-drawn carriages on streets and highways.

In this document, buggies, carriages, wagons, and other animal drawn vehicles will be referred to as buggies. While the use of buggy transportation has remained steady, the population in rural communities has grown, and tourism in Plain Communities has increased. These changes have resulted in increased sharing of roadways by motor vehicles and buggies and more accidents. Universal buggy lighting and marking recommendations can be used effectively to reduce buggy/motor vehicle crashes and buggy users must be encouraged to use these recommendations to avoid or reduce the number of accidents.

Several state and county agencies and law enforcement agencies have been working together to develop recommendations for the marking and lighting of buggies. Currently, Virginia lacks recommendations or regulations with this regard except for the use of the Slow Moving Vehicle (SMV) emblem. Information on the safe use of

SMVs on motorways is available with the American Society of Agricultural and Biological Engineers (ASABE).

ASABE developed engineering standards for lighting and marking animal-drawn vehicles, and buggies. These standards provide a unique lighting and marking pattern for animal-drawn vehicles (Figures 1-3) and are the goal of this document.

The ASABE standard recommends the use of a battery or generator powered lighting system. Batteries recommended are typical storage, deep-cycle, or gel cell batteries meeting the SAE J537 standard.

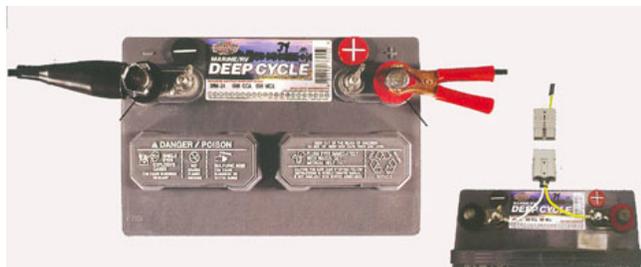
Battery systems, wiring and lighting kits, may be obtained from suppliers of specialty and recreational horse-driven vehicles. Less expensive sources of such kits may exist; but are not readily available from internet-based sources. An example of such a source in Virginia is:

Burkholder Buggy Shop
795 Mason Street, Dayton, VA 22821-9700
(540) 879-9260

During installation, all wiring, connections and switches should be securely fastened to the vehicles and protected from moving parts, water and corrosion. The recommended placement of

lights and reflective devices are shown in Figures 1-3.

Generally battery is the only power source available on the vehicle for the light system. Therefore a fully charged battery is critical for keeping the lights on and improving vehicle visibility. Batteries require maintenance and for this reason the manufacturer's recommendations must be followed.



Battery with special terminals with charger connections (left) and the connection for the light system (lower right).

Battery and charging systems should be properly matched and easy to connect. Most buggies will securely mounted batteries under the seat or trunk with quick access for the charger clamps (see example above). If electric power is not available, solar panel chargers are an alternative. Solar panels can be mounted on the storage shed. Make sure that the wiring associated with charging system has no opportunity to get cut.

It is a good practice to recharge the battery when the carriage is not in use. This will assure fully charged lighting system for highway travel.

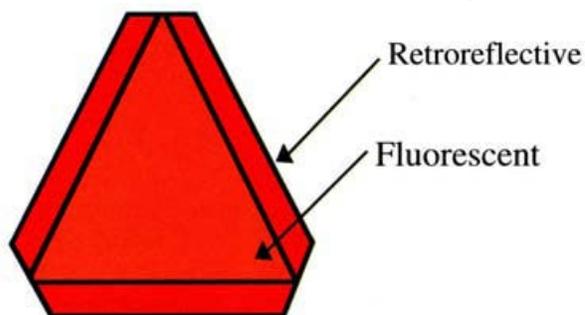
An important issue to consider is backup lighting in the event lights go out due to dead batteries, burned out bulbs, or malfunctioning of the total lighting system. Given the challenge of maintaining functional emergency backup systems, multiple backup measures are suggested. Passive markings generally used during day-time should be upgraded to make the visible in dark if

the lighting system fails. Low-voltage systems, such as LED based systems are preferred as backup system. LED (light-emitting diode) systems are readily available and one or two additional units as backups would be desirable.

Also shown in Figures 1-3 are leg wraps for horses. Fluorescent ankle wraps for horses pulling the buggies “glow” in low light and capture the attention of motorists to slow down. Marking the horse as well as the vehicle will allow motorists to judge the total length of horse and buggy more accurately during passing or when making left hand turns.

The Slow Moving Vehicle (SMV) Emblem

The SMV emblem are widely used on vehicles traveling slower than 25 mph. Studies have shown that two out of three highway crashes involving slow-moving vehicles are rear-end collisions. Of these rear-end collisions; nine out of ten occur during day time. During the day time, the bright, fluorescent orange triangle of the SMV emblem gets the attention of the motorists from more than 1,000 feet away. This provides the motorists ample time to slow down before it is too late. At night, the reflective border of the SMV emblem glows brightly with bright headlights. The distinctive, retro-reflective red triangle surrounding the fluorescent orange center immediately identifies a slow-moving vehicle.



Acknowledgements

This publication was developed with the support of the National AgrAbility Program (Grant No. USDA/NIFA 2014-41590-22326), the National Institute of Food and Agriculture, and the U.S. Department of Agriculture. The team that developed this publication is solely responsible for its content, and it does not necessarily reflect the views of the USDA or the U.S. Department of Labor.

References

Agricultural Equipment on Public Roads. 2009. North Central Education/Extension Research Activity Committee 197. Cooperative State Research, Education, and Extension Service. United State Department of Agriculture. Available from: http://www.csrees.usda.gov/about/white_papers/pdfs/ag_equipment.pdf

ANSI/ASAE EP576.2 October 2012. Lighting and Marking of Animal-Drawn Equipment, ASAE Standards, American Society of Agricultural and Biological Engineers (ASABE), St. Joseph, MI 49085.

Bean, T.L. 2008. Additional Marking of Horse Drawn Vehicles - Additional Safety. The Ohio State University, Extension Publication AEX-598.1-08. Available from: <http://ohioline.osu.edu/aex-fact/pdf/05981.pdf>

Jepsen, S.D. and T. Calip. 2009. Lighting and Marking Recommendations for Animal-Drawn Carriages. The Ohio State University, Extension Publication AEX-596.7-09. Available from: http://ohioline.osu.edu/aex-fact/pdf/0596_7.pdf

Jepsen, S.D. and T. Calip. 2009. Lighting and Marking Recommendations for Buggies and Wagons. The Ohio State University, Extension Publication AEX-596.4-09. Available from: http://ohioline.osu.edu/aex-fact/pdf/0596_4.pdf

Resources

Carriage Association of America (CAA) Directory on Lamps. Available from: http://www.caaonline.com/caa_content.asp?PageType=Dept&Key=6&MType=LA&MTypeDesc=Lamps

Murphy, D.J. 2013. Rx for SMV Highway Safety: Be Conspicuous, E-41, Agricultural and Biological Engineering, Cooperative Extension, Pennsylvania State University, University Park, PA. Available from: <http://pubs.cas.psu.edu/freepubs/pdfs/e41.pdf>

Pennsylvania DOT. 2008. Horse and Buggy Driver's Manual, PUB 632 (10-08). Available from: <http://www.justdrivepa.org/Resources/Amish%20Horse%20and%20Buggy%20Manual.pdf>

Pennsylvania DOT. 2008. Safe Driving in Amish Country, PUB 627 (6-08). Available from: <http://www.justdrivepa.org/Resources/Safe%20Driving%20in%20Amish%20County.pdf>

ASABE. 2013. Lighting and Marking of Agricultural Equipment on Highways, ANSI/ASAE S279.17 July 2013.

ASABE. 2010. Slow-Moving Vehicle Identification Emblem, ANSI/ASAE S276.7 W/Corr. 1, September 2010.

SAE/ASABE. 2008. Headlamps for Agricultural Equipment, ANSI/ASABE S608 August 2008.

SAE. 2000. Tail Lamps (Rear Position Lamps) for Use on Motor Vehicles Less Than 2032 mm in Overall Width, SAE J585, March 2000.

SAE. 2000. Storage Batteries, SAE J537, September 2000.

SAE. 2011. Flashing Warning Lamp for Agricultural Equipment, SAE J974, April 2011.

SAE. 2011. Reflex Reflectors, SAE J594, April 2011.

Table 1. Summary of the ASABE Engineering Practice recommendations.

Animal-Drawn Buggy Lighting and Marking				
Item	ASABE & Virginia Recommendations			Options
	Number	Color	Mounting	
SMV Emblem (Rear)	1	RED retro-reflective border surrounding fluorescent ORANGE center	Rear center, 2 to 6 feet from the surface of the road.	No alternative options exist for an SMV emblem.
Headlights¹ (Front)	At least 2	WHITE	Symmetrically around centerline, mounted between 2.5 and 5 feet high, visible to the front and the rear.	As an alternative to headlamps and tail lamps, at least two double-faced lamps protruding from the sides at the widest point can be used. The lamps will have a CLEAR lens to the front and a RED lens to the rear.
Tail Lights¹ (Rear)	At least 2	RED	Symmetrically as widely spaced as possible, between 2.5 and 4 feet high.	A turn signal system may be incorporated into the rear RED tail lamps or the flashing AMBER lamps. In that case, the lamp that is positioned on the side of the turn should flash and the lamp on the side away from the turn should go to steady burn.
Hazard Flashers¹ (Front and Rear)	At least 2	AMBER	Symmetrically, visible to front and rear, between 2.5 and 7 feet high.	No other options exist for AMBER flashing lights. An LED light may be mounted on the top center.
Retro-reflective Material (Rear)	2 inch x 9 inch strips	Alternating RED retro-reflective and ORANGE RED fluorescent material	Outlining the sides and top of the rear of the vehicle.	Where local culture uses WHITE retro-reflective material, it should be at least 1 inch wide. If this option is chosen, two red reflex reflectors or red retro-reflective material should be mounted symmetrically around centerline, as widely spaced as possible.
Retro-reflective Material (Side)	At least two 2 inch x 9 inch strips	YELLOW retro-reflective material	Symmetrically along each side of vehicle frame. If vehicle has a tongue or shaft visible on the outside of the animal, at least one additional yellow strip should be placed on outside of the tongue or shaft.	Where local culture uses WHITE retro-reflective material, it should be at least 1 inch wide. YELLOW or WHITE retro-reflective material may be attached to the harness, to the animal's legs, or both.
¹ Animal-drawn vehicles with a lighting system should be equipped with a battery operated or generator powered system. Batteries may be typical storage, deep cycle or gel cell conforming to SAE J537. From: Ohio State University Extension, Jepsen and Calip (2009)				

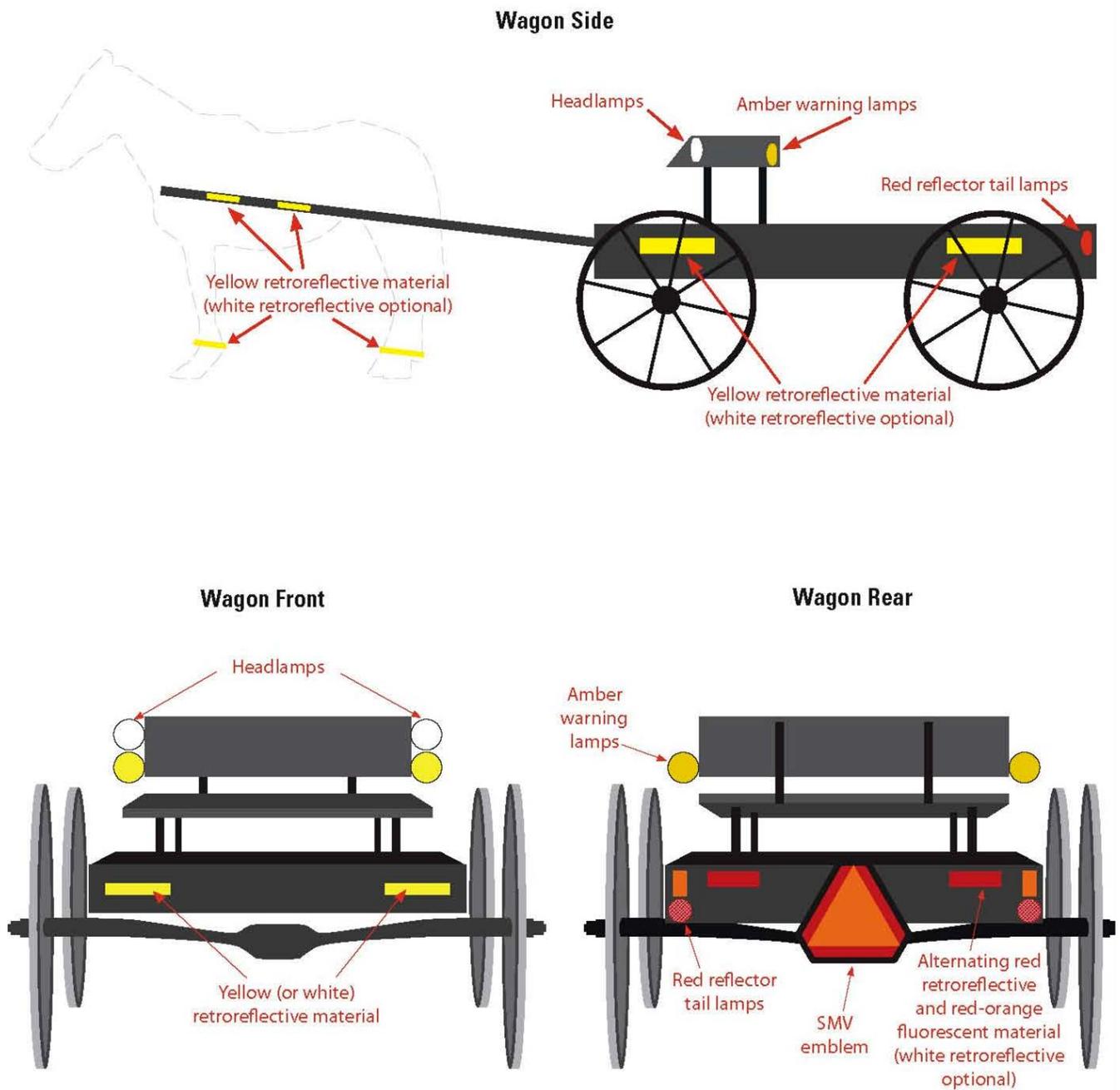


Figure 1. Recommended light and reflective materials for horse drawn wagons (From: Ohio State University Extension, Jepsen and Calip, 2009).

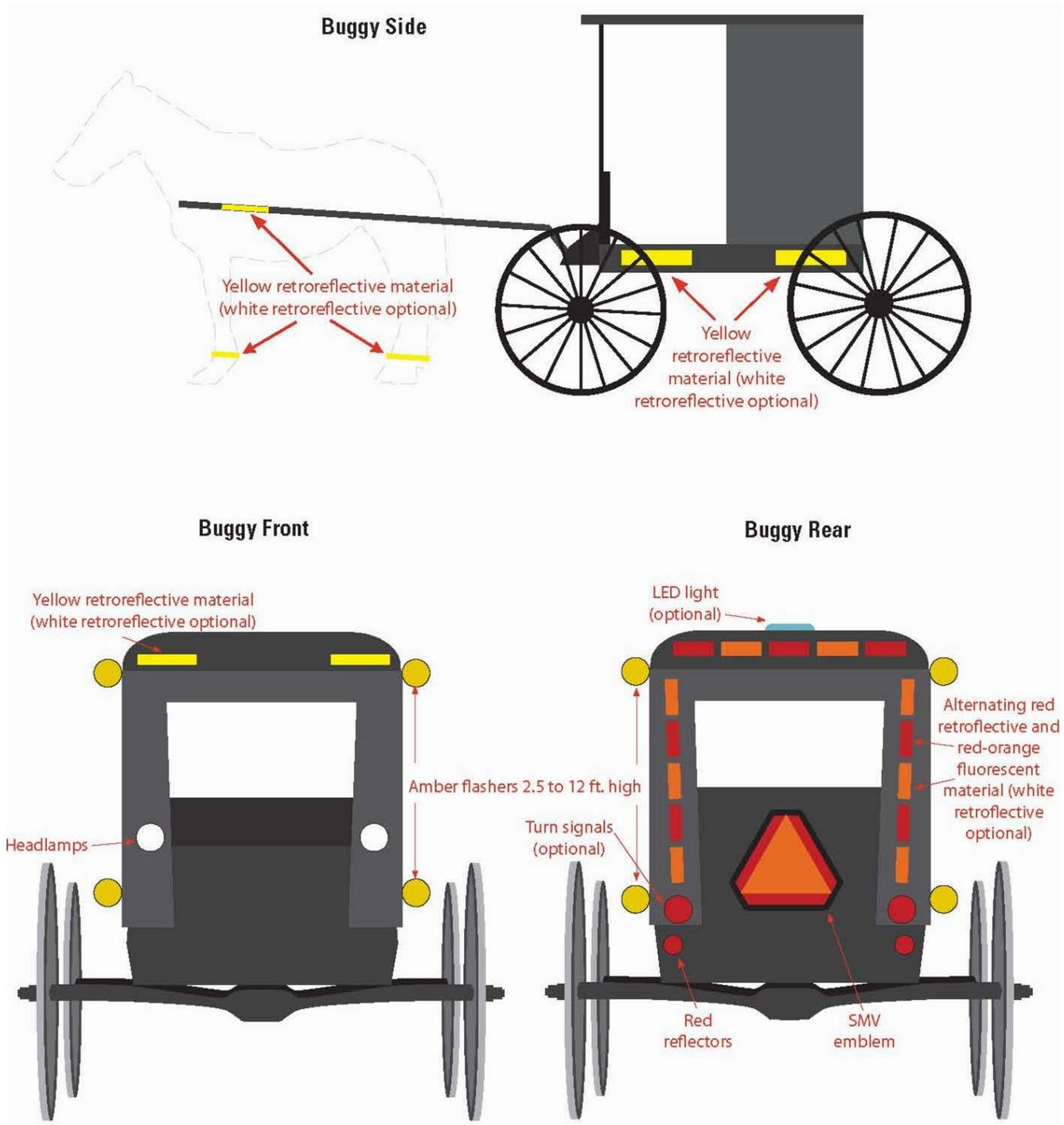


Figure 2. Recommended light and reflective materials for a horse-drawn buggy (From: Ohio State University Extension, Jepsen and Calip, 2009).

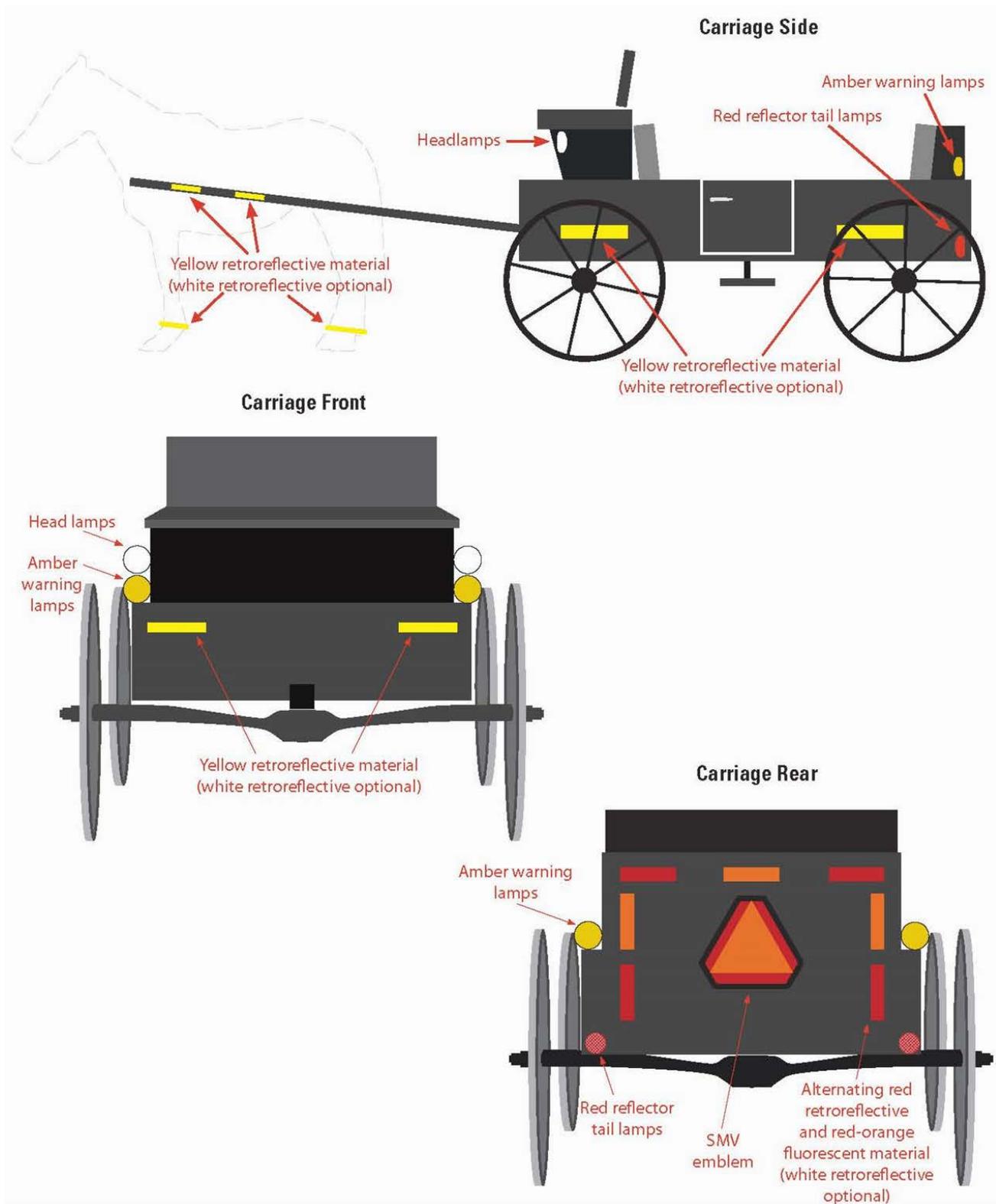


Figure 3. Recommended light and reflective materials for horse-drawn carriage (From: Ohio State University Extension, Jepsen and Calip, 2009).