



Farm Equipment/Motor Vehicle
Crash Prevention Conference
Des Moines, IA

White Paper

**Agricultural Equipment
on Public Roads**

by the

**Committee on Agricultural Safety and Health
Research and Extension**

Dennis Murphy
Penn State University
March 17, 2009



Agricultural Equipment on Public Roads

Committee on Agricultural Safety and Health Research and Extension: Who we are and how we function:

- USDA promotes high priority multistate research and education/extension through its land grant university system.
- Committees are appointed and managed by State Agricultural Experiment Station (SAES) directors in partnership with the Cooperative State Research, Education, and Extension Service (CSREES) of the USDA, other research institutions and agencies, and with the Cooperative Extension Service (CES).



Agricultural Equipment on Public Roads

- Committees purpose: provide opportunity for scientists, specialists, and others to work cooperatively to solve problems that concern more than one state, share research data, and coordinate and integrate research, education (academic/extension) and other types of activities.
- SAES are divided into four regional associations, one of which is: North Central Regional Association (NCR)
- NCR appointed the Committee on Agricultural Safety and Health Research and Extension in 2000-05.
- The first CASHRE designated as NCR 197 Agricultural Safety and Health Research and Extension (NCR 197).



Agricultural Equipment on Public Roads

- NCR 197 CASHRE produced in 2003: *National Land Grant Research and Extension Agenda for Agricultural Safety and Health: National Agenda for Action*
- Twelve priorities for action were identified: Sensors and guarding systems; ***Agricultural equipment on public roads***; Agriculture confined spaces; Emerging technologies; Human factors engineering and design; Management of agricultural emergencies; Livestock handling and housing systems; Public policy issues; Capital and management intensive vs. family labor intensive operations; Fire detection and suppression; Agricultural safety education and training; Special populations and enterprises



Agricultural Equipment on Public Roads

- Second CASHRE appointed 2005-09; designated as North Central Education/Extension Research Activity (NCERA 197) Committee:
 - National representation
 - More than safety specialists
 - More than land grant representatives
 - Currently: 22 members + USDA-CSREES Representative + SAES Administrative Advisor

Agricultural Equipment on Public Roads



Prepared by:
The Committee on Agricultural Safety and Health Research and Extension

North Central Education/Extension Research Activity Committee 197
Cooperative State Research, Education, and Extension Service
United States Department of Agriculture

January 2009

Recommended citation:
Committee on Agricultural Safety and Health Research and Extension. 2009. *Agricultural
Equipment on Public Roads*. USDA-CSREES, Washington, DC.

Distribution: web sites only

Penn State
www.agsafety.psu.edu

National Ag Safety Database
www.cdc.gov/nasd

USDA-CSREES
[www.csrees.usda.gov/about/
white_papers/pdfs/
ag_equipment.pdf](http://www.csrees.usda.gov/about/white_papers/pdfs/ag_equipment.pdf)



Agricultural Equipment on Public Roads

White paper development process:

- April 2007; Initial meeting to define section topics/issues, assigned chairs, recruit committee members
- 1st draft June 2008; presented at NIFS Professional Development Workshop; breakout sessions for gaps, suggestions for research, policy, standards, education
- 2nd draft September 2008, CASHRE
- 3rd draft October 2008, CASHRE + NIFS workshop participants
- 4th & 5th drafts, November & December 2008, CASHRE
- 6th draft = final document, February 2009



Agricultural Equipment on Public Roads

Two purposes for document:

1. To help identify research, policy and extension / outreach priorities for the U.S. Departments of Agriculture and Transportation, NIOSH, state departments of agriculture, transportation and law enforcement, county government, and production agriculture based organizations;
2. To identify possible design and practice standards, goals, or guidelines for farm equipment manufacturers, standard setting organizations, and government agencies.



Agricultural Equipment on Public Roads

Major sections:

- Introduction
- Rural/Urban Traffic Interface
- Federal and State Regulations
- Higher Speed Tractors
- Transportation of Workers on Public Roadways with Farm Equipment
- Suggestions for the Future



Rural/Urban Traffic Interface

PROBLEMS IDENTIFIED BY US:

- Little attention is paid to issues ... by federal, state or local governments.
- Public roadway crashes ... comparatively few but important part ... involving agricultural populations.
- Impacts of changing demographics not well researched or understood.
- Details of crashes ... unknown or lack sufficient detail to aid prevention efforts.
- No data ... accurate assessment of injuries, deaths, or property losses ... horse-drawn buggies...



Rural/Urban Traffic Interface

WHAT DO WE KNOW ABOUT THESE PROBLEMS?

- PUBLIC ROAD CRASHES – conflicting data due to definitions of terms & outcome measures; huge disparity in farm vehicle crash rates; disagreement on seriousness of issue.
- SPECIFIC TYPES OF CRASHES – Rear-End Collision, Left-Turn Collision, Passing Collision, Crossroads Collision, Oncoming Collision
- SPACES AND PERSPECTIVES – urban/suburban encroachment; width of roads/size of machinery; lack of understanding



Rural/Urban Traffic Interface

WHAT DO WE KNOW ABOUT THESE PROBLEMS?

- HORSE-DRAWN BUGGIES AND IMPLEMENTS – Anabaptists communities are spreading (27 states); significant differences among sects; little data to accurately describe crashes & injuries; increased use of SMV & marking; new ANSI/ASAE EP576.1 standard, "Lighting and Marking of Animal Drawn Equipment"



Rural/Urban Traffic Interface

WHAT DO WE KNOW ABOUT THESE PROBLEMS?

- LITTLE-EXAMINED ISSUES –
 - Little to no publicly available documentation: collisions with farm animals, Rural road bridge damage..., Ag equipment carrying hazardous materials
 - Good ideas: Use of escort vehicles, fixed and mobile rural road signs, greater use of trucks



Federal and State Regulations

PROBLEMS IDENTIFIED BY US:

- Uniform Vehicle Code is inadequate and not embraced in state regulations.
- Bewildering array of state vehicle code regulations ... lighting and marking
- State vehicle codes ... not kept pace with voluntary consensus standards ...
- Tractors ... historically less than 25 mph ... now up to 45 mph
- States inconsistent ... young operators



Federal and State Regulations

WHAT DO WE KNOW ABOUT THESE PROBLEMS?

- **UNIFORM VEHICLE CODE AND LIGHTING AND MARKING OF AGRICULTURAL EQUIPMENT** – states vary in adoption of UVC recommendations and in definition of slow moving vehicle; Yr 2000 recommendations
- **STATE VEHICLE CODES** – reviews last study of marking and lighting codes of all 50 states (Glascocock et al. (1995), Eicher et al. (1995); no studies since then.



Federal and State Regulations

WHAT DO WE KNOW ABOUT THESE PROBLEMS?

- SLOW MOVING VEHICLE EMBLEM – review history, including development & improvements, use, conditions; problems with recognition by public, drivers ed programs/test, relevance on modern equipment
- MISUSE OF THE SMV EMBLEM – enforcement of regulations, no longer unique
- SPEED INDICATOR SYMBOL (SIS) – higher speed tractors, Ohio SIS regulations, ASAE S584, flaws with Ohio regulations



Federal and State Regulations

WHAT DO WE KNOW ABOUT THESE PROBLEMS?

- VOLUNTARY CONSENSUS STANDARDS – reviews history and current status of lighting and marking standards (S213, S279, S318) by ASAE
- LICENSED DRIVERS – Doty and Marlenga (2006) review of all 50 states vehicle codes ... driver's licensing and other requirements ... ; differences between AgHO regulations and state vehicle codes



Higher Speed Tractors

PROBLEMS IDENTIFIED BY US:

- In U.S. farm tractors, self-propelled and towed equipment often fall outside road vehicle legislation requirements.
- Tractor speeds have increased ... tractors and towed equipment must be engineered ... retain control of under all conditions.
- Key safety-related systems that may be an issue: steering, brakes, suspension, tires, alignment, hitching components, ROPS, SMV emblem, and SIS.



Higher Speed Tractors

WHAT DO WE KNOW ABOUT THESE PROBLEMS?

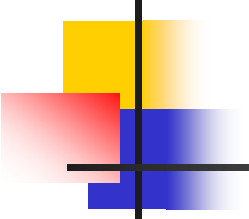
- **TRACTOR SPEEDS** – brief review of development, numbers in U.S, ASAE S390 recognizes speeds >65 km/h (40 mph)
- **TRACTOR STEERING** – reviews types of steering, steering control
- **TRACTOR BRAKING** – reviews braking methods & capacities, ANSI/ASAE Standard S365
- **TRACTOR AXLE SUSPENSION** – U.S. tractors lack suspension, reviews benefits of full suspension systems for low and higher speed tractors



Higher Speed Tractors

WHAT DO WE KNOW ABOUT THESE PROBLEMS?

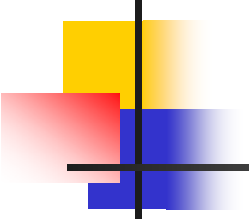
- TRACTOR/TOWED EQUIPMENT TIRES – hard pavement, high heat are agriculture tire enemies; agriculture tires not designed for highway use or >25 mph except for the F1 tires; how many implements have higher speed tires?
- ROPS ON HIGHER SPEED TRACTORS – current test: 3-5 mph rear overturn, 10 mph side overturn; trade-offs for higher speed standard
- DRAWBAR HITCH – North America ... uniquely designed hitch ... too much flexibility at higher speed ... ball hitch better ... decreases the turning radius



Transportation of Workers on Public Roadways with Farm Equipment

PROBLEMS IDENTIFIED BY US:

- The majority of the farm equipment is designed with only one seat, which is for the operator.
- Towed equipment ... does not have safe seating for either an operator or other persons on them
- Lighting and marking of animal-drawn vehicles ... may not be adequate to warn motorists of the slow speeds.
- There are no clear regulations preventing anyone from being extra riders on farm equipment or being transported on towed equipment on roadways.



Transportation of Workers on Public Roadways with Farm Equipment

WHAT DO WE KNOW ABOUT THESE PROBLEMS?

- Reasons & locations for extra riders
- ANSI/ASAE S574, Instructional Seat for Agricultural Equipment
- Limited statistics on number of deaths or injuries ... transportation of workers ... on public roadways
- Most studies focus on youth
- USDOL Migrant and Seasonal Farm Worker Protection Act: some requirements on transportation, several exceptions



Agricultural Equipment on Public Roads

SUGGESTIONS FOR THE FUTURE:

- Research is needed to:
 1. Develop criteria to better describe characteristics of crashes ... model definitions, methods, and data collection instruments ... standard data elements.
 2. Assess the understandability, effectiveness, and best use practices of lighting and marking of agricultural equipment on public roadways ... SMV, SIS, animal-drawn buggies & implements



Agricultural Equipment on Public Roads

SUGGESTIONS FOR THE FUTURE:

- Research is needed to (cont.):
 3. Improve engineered systems for higher speed tractors, self-propelled machines and towed equipment ... topics ...
 4. Examine the existence and consistency of farm equipment roadway safety information in driver's education programs across the United States.
 5. Expand behavioral studies on allowing extra riders ... include adults, and such factors as extra riders for work-related purpose



Agricultural Equipment on Public Roads

SUGGESTIONS FOR THE FUTURE:

- Research is needed to (cont.):
 6. Determine the effects of graduated licensing for youth ... including higher speed tractors ...
 7. Examine impacts and implications of county and state land use policies regarding operation of agricultural equipment on public roadways ... topics



Agricultural Equipment on Public Roads

SUGGESTIONS FOR THE FUTURE:

- Engineering design standards should:
 1. Better connected to research findings.
 2. Have better representation during their development by researchers and end-users.
 3. Be used to incorporate automatic and passive protection for drivers and riders of agricultural equipment during public road use.
 4. Be continually reviewed for the possibility of adoption of new technologies into design standards and practices.



Agricultural Equipment on Public Roads

SUGGESTIONS FOR THE FUTURE:

- Safety education programs are need to:
 1. Educate both the public and farmers on:
 - a. Best practices for operating agricultural equipment on public roads.
 - b. Approaching slow moving vehicles on public roads, including the purpose and use of the SMV and SIS emblems.
 - c. The effects of exclusions and exemptions from road traffic regulations and restrictions.



Agricultural Equipment on Public Roads

SUGGESTIONS FOR THE FUTURE:

- Safety education programs are need to (cont.):
 2. Work with local and state law enforcement agencies to increase awareness of county and state traffic laws related to farm equipment among law enforcement officers.
 3. Encourage Amish buggy manufacturers to utilize marking and lighting systems and components that meet current ASABE, SAE, and DOT standards.



Agricultural Equipment on Public Roads

SUGGESTIONS FOR THE FUTURE:

- Policy is needed to:
 1. Promote the purpose and use of the SMV and SIS emblems in every state's driver's license manual and driver's education program.
 2. Encourage a more comprehensive Uniform Vehicle Code ... better address modern types and uses of agricultural equipment on public roads ... topics ... registration of farm equipment, qualifications and training, extra riders, and animal-drawn buggies, wagons and equipment



Agricultural Equipment on Public Roads

SUGGESTIONS FOR THE FUTURE:

- Policy is needed to:
 3. Provide for a consistent source of funding for research into hazards, risks and best safety practices for operating agricultural equipment on public roads.
 4. Encourage land-use policies by state and local governments ... uses of public roadways in their jurisdiction
 5. Encourage stricter enforcement by local and state police of SMV emblem misuse.



Agricultural Equipment on Public Roads

Thank you!

Questions and Discussion