FILE NAME: Wagner (WAG)

DATE: 1980 Feb 25

DOC#: WAG001

DOCUMENT DESCRIPTION: Conference Presentation - Consideration on Regulating the Composition of Brake Lining

WAGNER

CONSIDERATION ON REGULATING THE COMPOSITION OF BRAKE LINING

John W. Kourik
Chief Engineer, Brake Products
Wagner Electric Corporation

1980 SAE Congress

Detroit, Michigan
February 25, 1980

Wagner Electric has an interest in the application aspects of any regulations affecting the composition of brake lining. We do not manufacture brake lining. We are a major producer of passenger car and truck brakes. We are a major manufacturer of replacement shoes and pad sets for passenger cars and trucks. We therefore are vitally interested in any change in composition of brake lining because of the ultimate effect these changes will have on performance, wear life, vehicle safety and compliance with existing Federal and state regulations.

It has been the experience of Wagner Electric that the rulemaking method employed by various Federal Agencies is an effective means to develop background for potential rulemaking activity. (1)* The Advance Notice of Proposed Rulemaking (ANPRM) provides a public announcement of a very general nature. It allows all interested parties to contribute facts and opinions of merit in helping that particular agency develop the course for its future rulemaking action. We have seen instances where the National Highway Traffic Safety Administration (NHTSA) initiated an Advance Notice of Proposed Rulemaking, and based on the public disclosures and their own research either terminated rulemaking action or progressed deeper into the sequence of rulemaking.

We have been reviewing the input (docket submissions) to the Environmental Protection Agency (EPA) and Consumer Product Safety Commission (CPSC)

* Encircled numbers refer to the illustrations in Appendix A.

files on the joint proposal which might result in an ultimate ban on asbestos [44FR60056]. Our survey of these submissions thru February 11, 1980 indicates that there have been 37 CPSC Docket entries and 83 EPA Docket entries for a total of 120 submissions. Some of these filings are duplicate entries. From the standpoint of activity which relates to brakes, vehicles and repair facilities we have found these following entries:

1 Brake Manufacturers
0 Lining Manufacturers
0 Lining Associations
3 Vehicle Manufacturers
0 Repair Facilities

The EPA file is fortunately not limited to docket submissions by the public. The Docket number OPTS 61005 "Record of Rulemaking" has a Table of Contents showing thirteen categories of activity. Their (EPA) resourcefulness in searching for facts is to be commended. Their success will be highly dependent on the public submissions.

We doubt that this is an adequate public response. The text of the ANPRM is somewhat lengthy but it is factual and direct to the objective. Many manufacturers or interested parties may have elected to not make a submission on the premise that the rulemaking action was directed only to those who convert asbestos into some useable end product.

Wagner Electric did not take a limited viewpoint. Our presentation will lift some of the highlights from our December 12, 1979 submissions to these dockets to explain the manner by which we provided the EPA and the CPSC with information we consider vital to their study. This is an opportunity to help both organizations understand the complex technical environment their study encroaches. This is the time to provide facts and share the commercial experience that we have gained in a highly specialized segment of a large industry.

The government groups need to decide whether to terminate rulemaking action on certain products or to continue more intensive and specific rulemaking action. The 3 portions of our docket entry that will be covered this morning are:

(1) the state-of-the-art for non-asbestos lining,

(2) Regulatory interface,

(3) alternatives to a full ban on asbestos.

We will not be talking about conversion of asbestos into brake lining. We will concentrate on the use of the brake lining and the necessity for the EPA & CPSC to evaluate many commercial aspects of the problems related to the docket activity.

STATE-OF-THE-ART OF NON-ASBESTOS LINING

The most recent press (industry) releases and magazine articles imply that there is an almost immediate capability to eliminate asbestos from brake lining. Such claims are not representative of the true state-of-the-art from non-asbestos linings. We base this belief on the small number of test materials that we have had from lining manufacturers. We'll help you look at the overall scope of the market and the need to evaluate the success or failure of the tests of these materials before concurring in the validity of the development claims. We also must determine their true availability based on committed tooling by the manufacturer and use these findings to see if we can procure the material needed to service a very extensive market.

Let's look at the number of applications that need to be covered by friction materials in the braking area only. (2) Friction requirements are different for a variety of vehicles because of the different types of applications, the speeds at which they operate, the frequency of brake applications, the type or service and the durability needed to have long intervals between

relining and servicing.

Wagner is extensively involved in supplying original equipment brake assemblies, aftermarket linings and replacement shoe and lining assemblies. Our aftermarket program is one example of the complexity of a changeover. We require 216 dimensionally unique segments for drum brakes and 134 unique disc pads for our passenger car replacement program even though this program already incorporates a high degree of standardization and simplification.

We have surveyed our current varieties of lining compounds and the sources for these materials. In these several categories we have a total of 50 materials that we purchase from 10 different sources.

ORIG. EQUIPMENT + AFTERMARKET APPLICATIONS	NUMBER OF LINING	
	COMPOUNDS	SOURCES
PASSENGER CAR	20	5
TRUCK SEGMENTS	18	5
TRUCK BLOCKS	16	6
CUMULATIVE	50	10

Let's look at the characteristics that are needed for OEM and replacement materials. Most of these are self-explanatory.

DESIRABLE CHARACTERISTICS
OF A SUITABLE LINING MATERIAL

STRUCTURALLY SOUND

LONG DRUM/ROTOR LIFE

LONG WEARING

CONSISTENT FRICTION - HOT & COLD

ACCEPTABLE NOISE LEVEL

NO MORNING SICKNESS *

ACCEPTABLE WATER RECOVERY

PHYSICAL FLEXIBILITY FOR ATTACHMENT TO SHOES USING STANDARDIZING SEGMENTS

LIGHT WEIGHT

* Erratic braking or "grabby" lock up on first stops.

Now consider the variety of brake designs used on old and new vehicles.

PASSENGER CAR & TRUCK HYDRAULIC BRAKE TYPES	TRUCK, TRACTOR & TRAILER AIR BRAKE TYPES	INDUSTRIAL BRAKES (EXTERNAL)
NON-SERVO	CAM	AIR
SERVO	DISC	HYDRAULIC
DISC	WEDGE	SPRING/SOLENOID

There is considerable technical literature available on the subject of brake goemetry and effect of friction materials on design, performance and speed sensitivity. We have submitted several of these and their bibliographics to the EPA/CPSC dockets for reference purposes.

Considering all of the above brake types it appears likely that only the passenger car and light truck disc brakes will have a suitable non-asbestos friction material available in the reasonably near future.

There will be a long transition as development efforts continue to be directed towards the availability of

(1) a substitute material that will allow vehicles to remain at or exceed today's safety level,

(2) a suitable substitute for current asbestos based materials at a reasonable cost,

(3) a long wearing lining material that also causes minimal drum wear or little rotor wear.

At this time we have an insufficient number of samples to predict a realistic target date for conversion to non-asbestos strip, segment or block material. We expect this to be at least several years away. We look with askance at the press releases extolling the imminent availability of non-asbestos lining materials without citing the limited number of applications covered.

REGULATORY INTERFACE

For a very cursory look at the Federal regulatory bodies and private associations that are affected by plans for asbestos substitutes we will only deal with 3. They are the

(1) American Association of Motor Vehicle Administrators (AAMVA),

(2) Bureau of Motor Carrier Safety (BMCS) of the Department of Transportation (DOT),

(3) National Highway Traffic Safety Administration (NHTSA) (DOT).

The registration of lining codes designated according to prescribed Society of Automotive Engineers' Recommended Practices (SAE J661) has been facilitated by the work of the AAMVA. A rough count of the edge codes on file with the AAMVA indicates that there are 120 companies who have registered over 1620 different edge codes. An extensive test program will evolve as linings compounded with substitutes for asbestos are developed for release and production.

Even in this day of standardization the number of edge codes for vehicle applications has proliferated. In the interim there will be even more. There are economic and safety factors which continue to influence the search for improved compounds. The competitiveness of the marketplace necessitates low cost/prices. The need to meet very stringent and specific requirements for new vehicle performance requires special materials as the Federal vehicle safety standards are revised and upgraded.

The Federal Motor Vehicle Safety Regulations issued by the Bureau of Motor Carrier Safety provide certain performance parameters for vehicles that are in service. While these requirements are not overly stringent, they do require the use of reasonably satisfactory lining materials. The regulations have been extremely beneficial over a period of many years. As simple as they are, they

have kept many inferior materials out of the market.

The Safety Standards issued by the NHTSA for new vehicles have had the most powerful impact on the development of both passenger car and truck lining materials. Two basic standards cover this multitude of highway vehicles:

1) FMVSS 105 for hydraulic-braked vehicles,

2) FMVSS 121 for vehicles with air brakes.

The individual performance requirements for passenger cars and those proposed for vehicles under 10,000-pounds GVWR have generated a whole host of lining materials with special characteristics to provide the vehicle manufacturers with some measure of reserve when testing to the strict compliance parameters of the NHTSA.

The following provides a very simple tabulation of these various requirements only by their title or description.

FMVSS 105 BRAKE TEST REQUIREMENTS

VEHICLES UNDER 10,000 LBS. GVW AND SCHOOL BUSES

FIRST (PREBURNISH) EFFECTIVENESS

SECOND EFFECTIVENESS

PARKING BRAKE

LIGHTLY LOADED EFFECTIVENESS

PARTIAL FAILURE

INOPERATIVE BRAKE POWER AND
POWER ASSIST UNITS

FIRST FADE & RECOVERY

SECOND FADE & RECOVERY

FOURTH EFFECTIVENESS

WATER RECOVERY

PROPOSED

FMVSS 105 BRAKE REQUIREMENTS

VEHICLES OVER 10,000 LB. GVW

(Docket No. 70-27, Notice 19)

PARTIAL FAILURE STOPPING DISTANCE

INOPERATIVE BRAKE POWER

* *

FMVSS 121 TRUCK-TRACTOR AND TRAILER TEST

REQUIREMENTS

STOPS AT GVWR

PARKING BRAKE TEST AT GVWR

STOPS AT UNLOADED WEIGHT

PARKING BRAKE TEST AT UNLOADED WEIGHT

* *

FMVSS 121

DYNAMOMETER TEST

REQUIREMENTS

BRAKE RETARDATION

BRAKE POWER

HOT STOP

RECOVERY

The Office of Standards Enforcement (OSE) of the NHTSA has initiated a compliance evaluation program that created a commercial revolution in the assessment of Quality Control activity by suppliers. This program enforces the work of the Office of Crash Avoidance (OCA) which must follow the Congressional mandate to issue minimum safety standards. Many persons not directly involved in new vehicle safety standards are unaware that the OCA/OSE interpretation of "minimum" would invalidate the use of many AQL (acceptable quality level) sampling plans, e.g., MIL-STD 105. Most sampling plans had been used throughout the automotive industry to establish nominal performance levels with permissible deviations. These sampling plan results were understood, accepted and agreed upon when negotiated by supplier and customer in commercial contracts. The NHTSA determined, in the case of safety-related products, to not accept sampling techniques as proof of compliance to a minimum standard unless there was sufficient overdesign incorporated in the acceptance values to assure 100% compliance.

The equipment manufacturers were not at first aware of the compliance consequences when the industry "nominal" design value became the NHTSA "minimum" value - essentially making 50% of the old product noncomplying. The Director of the Office of Standards Enforcement, Francis Armstrong, presented a paper entitled "The Issues of Complying with Federal Motor Vehicle Safety Standards and Other Requirements" in January 1969. See Appendix B for excerpt. This paper has a very clear illustration [its Fig. 7] of the significance of the change the suppliers had to make in their designs to assure compliance if nominal design sampling plans were employed for manufacturing control. The entire paper should be a part of the technical reference material in any design department for vehicle equipment suppliers or vehicle manufacturers of products

regulated by Federal Motor Vehicle Safety Standards. Mr. Armstrong cautioned "...It is up to the manufacturer to determine the degree of overdesign, relative to the minimum requirements of the standard, necessary to maintain an 'in compliance' status for his product."

The evolution of FMVSS 121 for the air-braked vehicles went through a 10-year cycle of standard development. The first version of the Standard had very stringent performance requirements for both vehicle and dynamometer tests. At one time there was only one lining material available which could meet these requirements. At the same time there were strong objections to the commercial acceptability of these new vehicles. The NHTSA had to reduce the severity of the stopping distance requirements and the dynamometer requirements. A broad variety of lining materials then evolved. A competitive environment was restored and consumer satisfaction is gradually returning to the heavy highway vehicle industry.

ALTERNATIVES TO A FULL BAN ON ASBESTOS

As the concern for asbestos fibers in the atmosphere has been given greater publicity, the large processors of asbestos-bearing lining material have taken positive steps to improve the work environment.

We know that our suppliers, the lining manufacturers, have implemented aggressive housekeeping programs and maintain their effectiveness. In the Wagner manufacturing areas we have always maintained good housekeeping practices. We use exhaust and filtering systems in our production areas where we drill, grind and rivet linings to brake shoes.

The Occupational Safety and Health Administration (OSHA) has provided a technique and published a requirement by which we measure the effectiveness of our controlled environment. It permits us to collect, record and report

this information in a universally accepted method. Such regulatory practices are bound to have made an improvement in working conditions whether there is any real hazard to health or not. Major manufacturers and processors are able to control their environments. The cost of these controls has already been made part of the economic considerations in manufacturing. However, more stringent controls would certainly need cost-to-benefits analysis for justification.

The publicity associated with controls aimed at manufacturing processes has also provided the opportunity for preventative action in other areas exposed to asbestos fibers. We maintain an even cleaner dynamometer test area and garage area in our development facilities because we use vacuum cleaners to collect the residue of worn linings from both dynamometer and vehicle brake tests. This practice could be extended to all commercial repair facilities.

Wagner is one of several companies who have already incorporated a major benefit to a repair shop environment by the preparation technique used for our Aftermarket lined shoe sets. Our passenger car sets are preground with an arc or contour of the lining controlled from the anchor pin location. ③ This eliminates the need for a garage or repair facility (where there is typically less control of dust) to grind shoe and lining assemblies before they are installed on the vehicle.

Pre-arced lining assures better customer satisfaction, from a brake performance standpoint, because it fits into both new drums and oversize drums without alteration. We introduce the lined shoes into the distribution network ready to install. This action has caused a significant reduction in concentration of asbestos fibers in more public work areas. More users need to be made more aware of this side benefit of this superior product feature. We mark

our cartons to highlight (1) that no grinding is required and (2) they have a product with asbestos content.

Many of the reline shops still purchase material from other sources which has to be ground on their premises. If they persist in this practice there are means available to them which will reduce the asbestos fiber content in their shops. Exhaust collection and filtering equipment is available for small grinders used by such shops.

We have not tried to specifically measure the magnitude of the change in shop practices to use precontoured lined shoes, but we have contacted manufacturers of shop equipment for an indication of shop trends. We learned that the number of shoe grinding attachments sold at this time is significantly less than the number of lathes purchased to face rotors or turn drums. Until recent times they sold 10 lathes to 6 grinders. Now its about 10 lathes for each grinder.

We conclude, therefore, that the programs of major manufacturers of Aftermarket shoe sets which provide pre-arced or preground lining has already significantly reduced the risk of contamination in these shops. If they use dust collection systems for what little lining dressing is necessary, and vacuum systems to clean up the worn lining debris they are well on the way to having atmospheres which are essentially fiber-free.

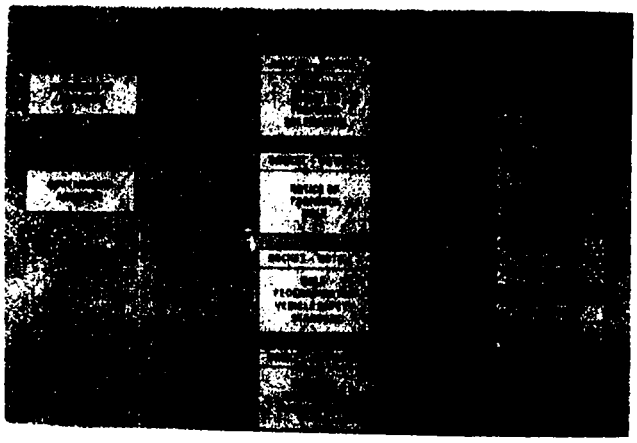
CONCLUSION

The actions taken by the EPA, CPSC and OSHA have already brought attention to the fact that care should be exercised with materials that are suspected of having some hazard to health. It has only been a relatively short time that health risks have been publicized for asbestos. Asbestos has been a constituent of brake lining for over 1/2 a century. A lot of experimentation is taking place with substitutes for asbestos. These substitutes could, in

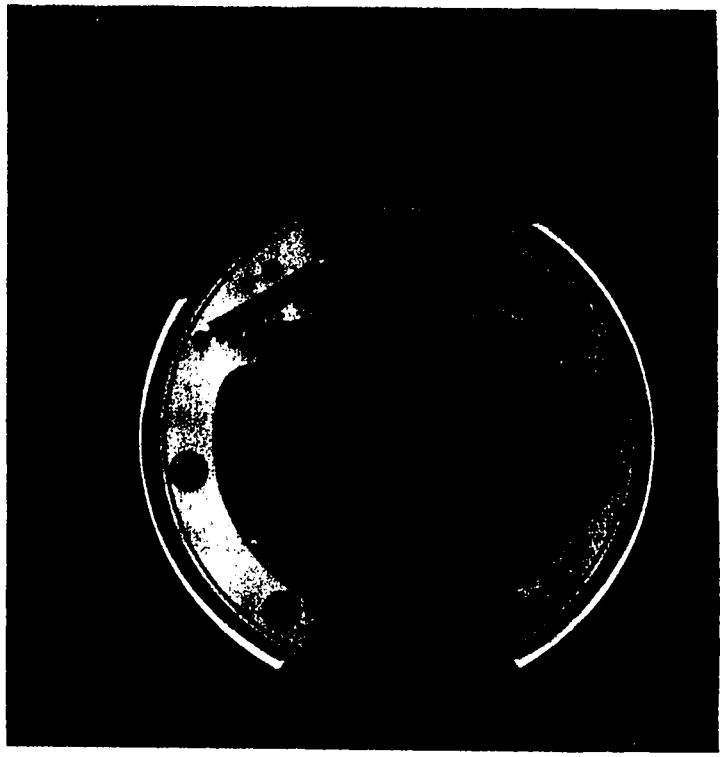
fact, have health risks which haven't been identified. In general, industry can deal with well identified situations and we believe that the action taken by the EPA, CPSC and OSHA will further identify potential problems and will enable them to assess the cost associated with minimizing health risk. As a brake manufacturer we do not want to conduct repetitive test programs if subsequent candidates for replacement of asbestos are found to have health risks. The lining industry, as a whole, has developed well in excess of the 50 compounds we purchase and has many more sources than the 10 we currently use in satisfying the commercial needs of the original equipment and After-market lining business.

We emphasize that the publicity associated with new car development and the prominence given to specific and select applications of non-asbestos materials is not representative of the mass or bulk of friction materials used in current new vehicle production or the replacement market.

APPENDIX A



① Rulemaking Sequence



③ Clearances with Pre-arced Linings

② Typical Brake Applications for Friction Materials

690147

APPENDIX B

he Issues of Complying with Federal Motor Vehicle Safety Standards and Other Requirements

Francis Armstrong
ational Highway Safety Bureau, Federal Highway Administration,
U. S. Department of Transportation

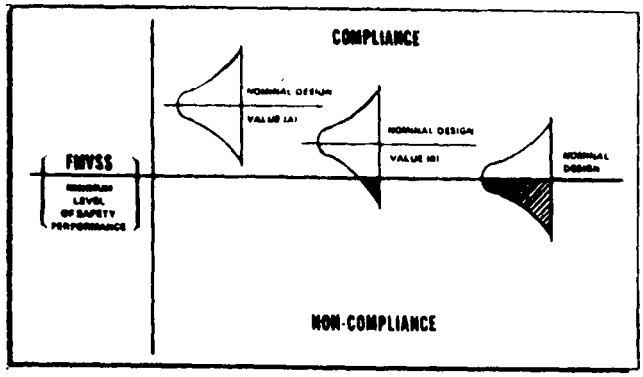


Fig. 7 - Relationship between FMVSS and nominal designs

Excerpt

It is abundantly clear that no form of statistical sampling by the bureau, no matter how cleverly conceived, could be reasonably implemented to handle a situation where the bureau assumed the responsibility for validating the manufacturers' certification. Further, the legislation is clearly written to exclude any inference, no matter how remote, that the government is party, in any way, to the manufacturers' certification.

Within this framework, functions the compliance activities of the bureau. Our job, so to speak, is to find the "bad guys." It is a well-known axiom in quality control circles that "you cannot inspect quality into a product." This is particularly true in our case, and accordingly, the bureau's compliance testing program is better defined as an audit-type operation to provide a measure of assurance that manufacturers are, themselves, diligently pursuing the type of programs that will provide the consumer with products that meet, as a minimum, the requirements of the Federal Motor Vehicle Safety Standards.

Having recognized that the requirements exemplified by the Federal Motor Vehicle Safety Standards are minimum requirements, it is a logical conclusion that we do not talk in terms of an AQL (acceptable quality level) relative to those standards in terms other than 100% compliance.

We do, however, recognize that industry itself must, as part of the production process, think in terms of a workable AQL. The utopian wonderland of "perfection in production" just cannot be expected to exist in the manufacture of such a high volume and complex item as the automobile. But, it is also just as reasonable to expect that as the Federal Motor Vehicle Safety Standards are minimum requirements, they should not be interpreted and used as nominal design values.

Fig. 7 is a simplified portrayal of three possible approaches illustrating the relationship between FMVSS (Federal Motor Vehicle Safety Standards) and the establishment of nominal design values.

Design value (A) has been established recognizing the effect that normal production variance would have on the compliance status of the finished product. The nominal design value, in this example, exceeds the requirements of the standard to the degree that all products manufactured within the normal quality spread attainable in actual production would be in compliance with the standard.

Design value (B), while exceeding the minimum safety performance requirements of the standard, fails to recognize, sufficiently, the effect of normal production variance on the compliance status of the finished product. Accordingly, as part of the inevitable facts of production life, some measure of noncompliance must certainly exist.

Design value (C), on the other hand, has been established using the federal standard as the mean or central tendency of the normal statistical distribution of quality output under production conditions. Under these circumstances, the incidence of noncompliance would, of course, be quite high.

From my earlier remarks establishing 100% compliance as the only AQL acceptable to the bureau, it is obvious that only the example depicting "nominal design value (A)" typifies conditions that could realistically be expected to achieve acceptable compliance performance by industry. The bureau is not concerned with design for design's sake. The manufacturer must, of course, retain complete freedom of design in meeting the performance requirements of the individual standards. It is up to the manufacturer to determine the degree of overdesign, relative to the minimum requirements of the standard, necessary to establish and maintain an "in compliance" status for his product. The degree of overdesign necessary for any one product, be it vehicle or equipment, can, and probably will, vary from manufacturer to manufacturer. Certainly, it will be directly related, among other things, to the manufacturers' ability to monitor and control his production process.