274 HJ SB 630 - SB 666

PLASTERER

NATURE OF WORK

Applies plaster to interior walls and ceilings. Also applies stucco to exterior walls. May cast, or run in place, ornamental designs in plaster. Interior plaster is applied over gypsum, metal lath, or directly to masonry in two or three coats. When plaster is finished in two coats, it is applied to gypsum lath or directly to masonry. The base coat is made straight with a long straight-edge, then smoothed with a long flat tool called a darby. Three-coat plaster is applied over metal or wire lath. The first coat (scratch) is applied either by hand or machine and is roughed up to prepare for second coat. To assure an even wall the craftsman applies a border of plaster (screed) at the top and bottom of the wall to the desired thickness and straightness. When the screeds have sufficiently hardened, the area between is filled and brought to a true surface by a long straight-edge, then smoothed with a darby. The final coat in either two or three-coat work is a thin carefully applied coat which is applied and smoothed for paper or paint or is textured to meet the architectural specification. A recently developed one-coat or veneer plaster has been produced which is applied to a large size gypsum plaster base and is finished with one coat. May be required to work with plaster machine which sprays plaster to walls and ceilings.

Exterior plaster is applied in two or three coats according to architectural specifications.

TOOLS USED

Pointing trowels, angle tools, trowels, hawk, darby, straight-edge, feather-edge, floats, brushes.

WHERE EMPLOYED

On residential, industrial and commercial buildings, schools and hospitals.

WORKING CONDITIONS

Plastering is considered a relatively hazardous occupation. Falls from scaffolds or ladders, injuries from falling objects, skin burns from lime, are some of the more common accidents, in addition to the usual mishaps possible on construction work.

HELPFUL HIGH SCHOOL COURSES

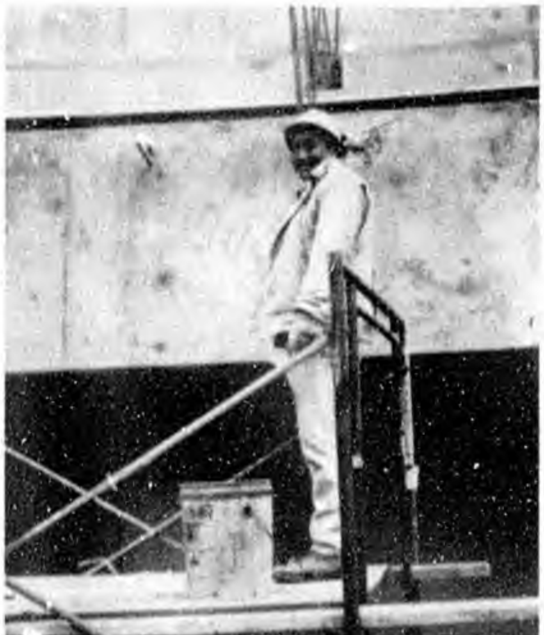
Mathematics
Wood and Metal Shops
Mechanical Drawing
Art

EMPLOYER

Contractors affiliated with Association of General Contractors, Masonry Contractors.

UNION

Local No. 867, Operative Plasters and Cement Masons.



PLUMBER/PIPEFITTER, ANCHORAGE

NATURE OF WORK

Fabrication and installation of all kinds of pipe and piping systems. Industrial and Commercial instrumentation, Gas, Water, Air, Steam Process, Waste Disposal, and some fire systems piping. Work includes Rigging, Lay Out, Fabrication, Blueprint Reading, Installation, Startup, and Maintenance. Pipe joining techniques used are: Welded (gas, arc, and heli arc), Soldered, Flanged, Mechanical, Poured, Glued and Screwed type joints. Materials used are: Cast Iron, Galvanized, Block Iron, Copper, Wrought Iron, Plastic, Transite, Brass, Stainless, other alloy and non metalic piping materials.

TOOLS USED

Pipe wrenches, drills, power and hand threading machines, power saws, hand saws, hammers, come alongs, chisels, welding machines, pipe bevelers, pipe cutters, ox and ace torches, hydraulic pipe benders, wrenches, vises, many other power tools and hand tools.

WHERE EMPLOYED

By pipefitting contractors in new building construction, mainly at the construction site; as maintenance personnel in the petroleum, chemical and food processing industries. By plumbing contractors and firms dealing in plumbing and heating equipment. By firms which fabricate piping and by specialty contractors in industrial and fire control equipment systems.

WORKING CONDITIONS

Work is strenuous and may involve heavy lifting, pulling and pushing. It may require standing for long periods or cramped and uncomfortable positions. Risks include falls from ladders, cuts from sharp tools, burns from hot pipes or steam. Working in all kinds of weather (outside).

HELPFUL HIGH SCHOOL COURSES

Mathematics, including Algebra and Geometry, Metal and Wood Shop, Mechanical Drawing or Blueprint Reading, General Science, Chemistry, Physics.

EMPLOYERS

Plumbing Heating, Cooling Contractors of America, Anchorage area.

UNIONS

Local Union No. 367, United Association of Journeymen and Apprentices of the Plumbing and Pipefitting Industry of United States and Canada.

PLUMBER/PIPEFITTER, FAIRBANKS

NATURE OF WORK

Fabrication and installation of all kinds of pipe and piping systems. Industrial and Commercial instrumentation. Gas. Water. Air. Steam Process. Waste Disposal. and some fire systems piping. Work includes Rigging. Lay Out. Fabrication. Blueprint Reading. Installation. Startup. and Maintenance. Pipe joining techniques used are: Welded (gas. arc. and heli arc). Soldered. Flanged. Mechanical. Poured. Glued and Screwed type joints. Materials used are: Cast Iron. Galvanized. Block Iron. Coppe.. Wrought Iron. Plastic. Transite. Brass. Stainless. other alloy and non metalic piping materials.

TOOLS USED

Pipe wrenches. drills. power and hand threading machines. power saws hand saws. hammers. come alongs. chisels. welding machines. pipe bevelers. pipe cutters. ox and ace torches. hydraulic pipe benders. wrenches. vises. many other power tools and hand tools.

WHERE EMPLOYED

By pipefitting contractors in new building construction. mainly at the construction site; as maintenance personnel in the petroleum. chemical and food processing industries. By plumbing contractors and firms dealing in plumbing and heating equipment. By firms which fabricate piping and by specialty contractors in industrial and fire control equipment systems.

WORKING CONDITIONS

Work is strenuous and may involve heavy lifting. pulling and pushing. It may require standing for long periods or cramped and uncomfortable positions. Risks include falls from ladders. cuts from sharp tools. burns from hot pipes or steam. Working in all kinds of weather (outside).

HELPFUL HIGH SCHOOL COURSES

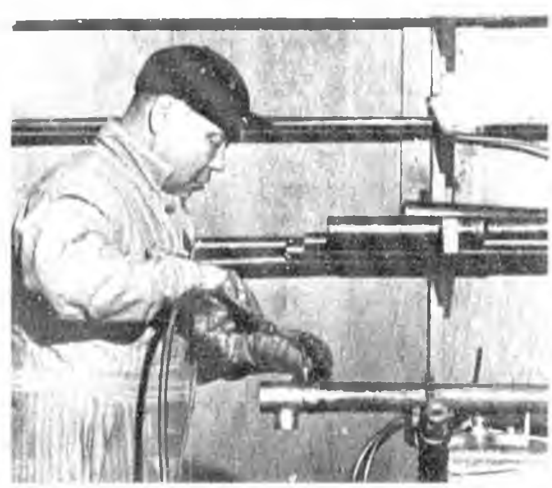
Mathematics. including Algebra and Geometry. Metal and Wood Shop. Mechanical Drawing or Blueprint Reading. General Science. Chemistry. Physics.

EMPLOYERS

Plumbing Heating. Cooling Contractors of America. Anchorage area.

UNIONS

Local Union No. 375. United Association of Journeymen and Apprentices of the Plumbing and Pipefitting Industry of United States and Canada.



ROOFER

NATURE OF WORK

Local No. 190 membership is composed of skilled journeymen, apprentices and helpers employed in the following work: All slate, tile, asbestos rigid shingles, asbestos or brick siding, asphalt shingles and asphalt siding, and any or all kinds of built-up roofing whether applied cold or hot, dry rolled and nailed, sprayed, trowelled, or mopped. All rigid insulation when mopped, sprinkled, spotted or nailed to roof deck. All damp proofing, or water proofing, or enameling, or enameling pipe lines storage tanks and containers of all descriptions, all types of cork, rigid or rolled insulation, foam glass applied either hot or with cold adhesives, and/or all other work involving the use of bituminous asphalt products, including Koppers' enamel, all kinds of primers, and pitch products and by-products, and all plastics applied as either damp, water proofing or roofing; all roof coatings applied with spray, pole brushes and squeegees.

TOOLS USED

Roofing kettles, felt machines, power roofing cutters, power brooms and power hoists.

WHERE EMPLOYED

For the most part, for contractors roofing and waterproofing new construction. There is always some repair and re-roofing of older buildings.

WORKING CONDITIONS

The smallest crew in build-up (hot) roofing consists of three persons. Generally much larger crews work on all the big construction jobs. The principle hazards in the trade are hot materials used and danger of falling.

QUALIFICATIONS

1. Age — 18 to 27. (Exceptions may be made by the Apprentice Committee.)
2. Have a 10th grade education, or a certified equivalency.
3. U. S. Citizenship.
4. Physically fit for the trade.

SHEETMETAL WORKERS

NATURE OF WORK

Lays out, cuts, forms, fabricates, assembles, and installs sheet metal items, such as ducts, blowers, gutters, downspouts, flashings and skylights, in building construction and alteration for heating, ventilating, and air conditioning. Fabricates and installs stainless steel kitchen, restaurant, and soda fountain equipment, partitions and shelves. Constructs electric signs and does sheet metal work for other industrial and architectural purposes. Working from blueprints lays out the work, cuts the metal, forms the metal, then welds, bolts, rivets, solders, or cements the seams and joints as required.

TOOLS USED

Hand and power operated shears, brakes, hammers, stakes, forming machines, welders, turning machines, soldering equipment.

WHERE EMPLOYED

Mainly in the construction industry, by contract or job shops, making and installing all types of sheet metal equipment.

WORKING CONDITIONS

Works alone and with others inside and outside on the job and in the shop. Stands, walks, climbs, works on benches, machines, and buildings where work is done. Sometimes works from high ladders and scaffolding. Subject to noise and hazards of cutting, burning, and falling.

HELPFUL HIGH SCHOOL COURSES

Mathematics through Trigonometry
Mechanical Drawing
Drafting
Blueprint Reading
Wood and Metal Shop

EMPLOYERS

Mechanical Contractors of Alaska, Inc. AGC (Alaska Chapter) Independent Sheet Metal Contractors.

UNION

Local No. 23, Sheet Metal Workers International Association.

TEAMSTER SURVEYORS

NATURE OF WORK

Surveying as performed by the Technical Engineers of Alaska, affiliate of Teamsters Union Local 959 embraces all manner of construction surveys. Such surveys are involved in highways, bridges, buildings, water and sewer lines, pipelines, airports and a host of related construction projects. The work involves the detailed layout of all facets of construction such as foundations and structural members, the monitoring of line and grade and finally a survey of the project "as - built."

TOOLS USED

Construction surveyors utilize transits, levels, theodolites, electronic distance measuring devices, laser alignment systems and various small tools.

WHERE EMPLOYED

Technical Engineers are fortunate in the diversity of locations where work is available ranging from the isolated and wild bush areas to downtown urban projects.

WORKING CONDITIONS

Conditions of work are regulated carefully to provide safety and reasonable comfort.

HELPFUL HIGH SCHOOL COURSES

Anyone aspiring to work as a surveyor should avail himself of every opportunity to take courses in mathematics and science. Algebra, Geometry, and Trigonometry are absolute necessities for the successful surveyor. Several high schools in Alaska also offer surveying courses.

UNION

Construction surveying in Alaska is performed by the Technical Engineers of Alaska, an affiliate of Teamsters Union Local 959.

TYPES OF EMPLOYERS

Firms employing surveyors include principally private engineering and surveying consultants and construction companies. Member companies of the Alaska Chapter of the Associated General Contractors are the largest group of employers.

TEAMSTER HEAVY DUTY DRIVERS

NATURE OF WORK

Operation of Heavy Duty Trucks, Equipment used are: Belly Dumps, 12 Yard End Dumps, Truck and Trailers, Tractors pulling Doubles and Fork Lifts.

Through their open entry, open exit training program, which may last up to four weeks, the trainee learns basic theory of driving these trucks.

WHERE EMPLOYED

Employed at all phases of heavy construction, including pipeline.

SELECTIONS AND FUNDING

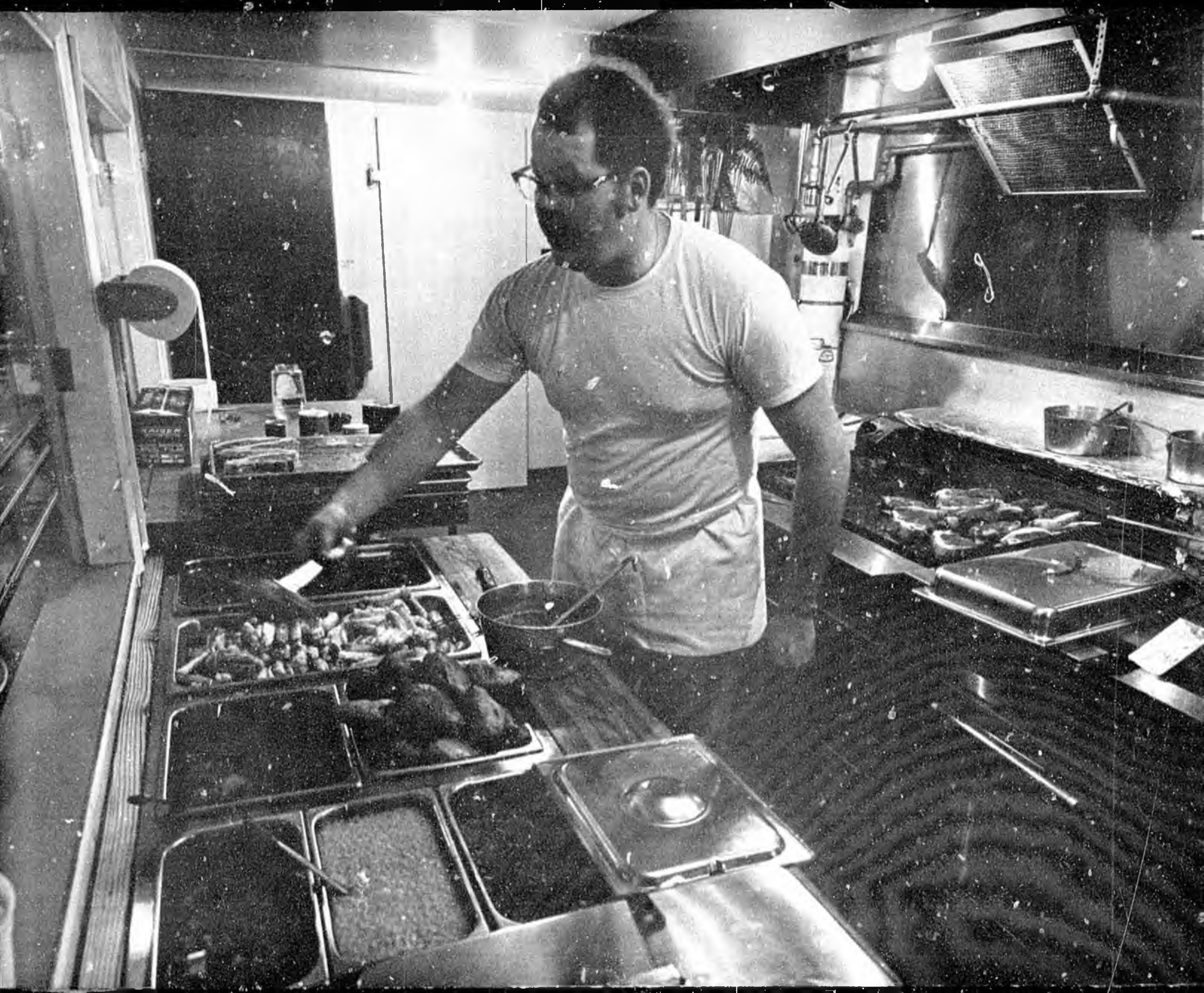
Trainees are selected from applicants (Statewide) through the State Employment Services and the Bureau of Indian Affairs. Funded by Alyeska Pipeline Service company.

EMPLOYERS

Alyeska Pipeline Service Company and Sub Contractors: Arctic Contractors, Associated Green, H. C. Prince, Perini Arctic Associates, Morrison - Knudsen, and River.

UNION

Alaska Teamsters Employer Training Trust, Local No. 959.




compliments of
Pipeline Service Co.
McCutcheon

ALASKA BUILDING & CONSTRUCTION TRADES COUNCIL AFL-CIO
APPRENTICESHIP OUTREACH PROGRAM

238 East Fifth Avenue
Anchorage, Alaska 99501

315 Fifth Avenue
Fairbanks, Alaska 99701

DATE ....

NAME .... SOCIAL SECURITY NO ....

MAILING ADDRESS ....

CITY .... ZIP .... TELEPHONE ....

HOW LONG AT THIS ADDRESS .... HOW LONG IN ALASKA ....

WHERE BORN .... DATE OF BIRTH .... RACE ....

MARRIED OR SINGLE .... DEPENDENTS .... PHYSICAL DEFECTS ....

ARE YOU A VETERAN? .... DATE OF DISCHARGE .... LENGTH OF SERVICE ....

GIVE BRANCH OF SERVICE AND MILITARY OCCUPATIONS ....

DID YOU SERVE IN VIETNAM? ....

EDUCATION — HIGHEST GRADE COMPLETED .... WHERE ....

GIVE DETAILS OF OTHER SCHOOLING OR TRAINING ....

SCHOOL SUBJECTS LIKED BEST .... AVERAGE GRADES ....

SCHOOL SUBJECTS LIKED LEAST .... AVERAGE GRADES ....

WHAT HOBBIES DO YOU HAVE, IF ANY? ....

EMPLOYMENT HISTORY — LIST LATEST EMPLOYMENT FIRST. INCLUDE MILITARY WORK EXPERIENCE

Type of Work Performed	From	To	Employer Name and Address

WHICH TRADE ARE YOU INTERESTED IN? ....

WHERE DID YOU LEARN OF THIS PROGRAM ....

WILL YOU TRAVEL WHEREVER THIS TRADE REQUIRES FOR EMPLOYMENT? ____

REFERENCES:

....
NAME ADDRESS

....
NAME ADDRESS

....
Signature of Applicant

CHOOSING A CAREER

Most young people are looking forward to productive lives in their chosen field. The occupation they choose determines to a large extent the kind of house they will live in, the car they drive, whether or not they will be able to own their home, the opportunities they will be able to offer their children, and their families' standard of living.

The future is indeed very gloomy for the untrained and unskilled man on today's labor market. He and his family are destined to a much lower standard of living than his friends and neighbors, who have prepared themselves.

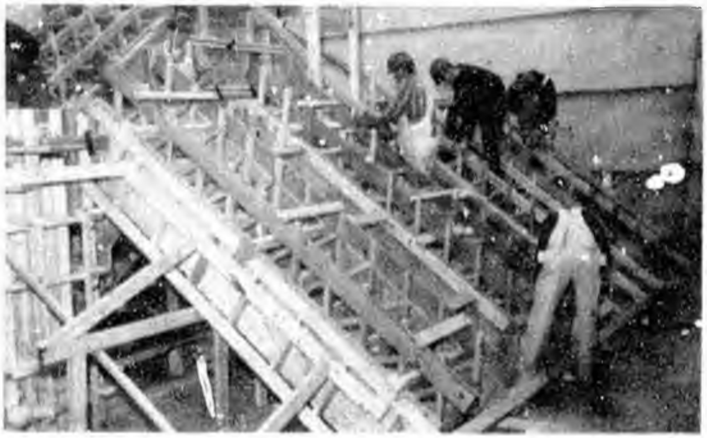
Opportunities in America's Mighty Construction Industry are greater today than ever before, and the training required to become skilled in the various construction trades is more available now than ever before.

The Construction Industry requires a higher proportion of skilled workers than any other industry — 2 out of 3. This compares with 1 in 5 in manufacturing and transportation, and fewer than 1 in 10 in other industries.

CHOOSE A CAREER THAT IS GROWING WITH AMERICA . . . CARPENTRY

The carpenter has a proud tradition of accomplishment in developing our nation. He has been, and remains today, America's Master Builder. From the early pioneer days of the rough-hewn log cabins to the era of modern engineering, the Construction Carpenter has been busy building our homes, schools, churches, stores, hospitals, offices, factories, mills, hotels, bridges, docks and piers. The carpenter is a diversified builder. He plays a major role in the construction of all types of buildings: whether they be of wood frame, concrete, masonry, or steel.

Concrete wall forms erected by apprentices as part of their related training.



Concrete forms for columns, beams, suspended slabs, walls, and stairways erected by apprentices as part of their related training.

A carpenter apprentice, working with a journeyman carpenter on a reinforced concrete form job.

High above the street level, this apprentice is receiving valuable on the job training on a high rise building.

Securing this large circular form in preparation for a concrete pour is part of a day's work for this apprentice.

This stair project is an example of work performed by Apprentices in this Program.

There are more than 800,000 Carpenters in America today. They make up the largest single group of skilled workers in our country. Over 160,000 of these Carpenters are sixty years of age or older, and will be leaving the trade through retirements and deaths in the years immediately ahead. There are presently only about 27,000 registered Carpenter Apprentices to meet the needs of America's expanding Construction Industry and to replace the men who will soon be leaving the Industry through retirements and deaths.

Carpenters rank among those for whom employment opportunities are expected to expand in the future at a faster rate than for the skilled labor force as a whole. These facts all add up to this: Employment opportunities for thoroughly trained Construction Carpenters is great today and will be greater tomorrow.

ALASKA'S CARPENTER APPRENTICESHIP PROGRAM

Our Carpenter Apprentice Program in Alaska is a four year training period designed to provide skilled Journeymen Carpenters for the Alaska Construction Industry. It consists of 8,000 hours of on the job training, (working for a Contractor) and 1040 hours of extensive pre-job training presented at our Training Center in Anchorage. This Pre Job Training is financed and administered jointly by Management and Labor, and no tuition fee is required by the apprentice. Dormitory facilities and round trip transportation is provided for Apprentices residing outside the Anchorage area. It consists of approximately 30% classroom and 70% manipulative work, and covers every phase of the construction carpenter's trade.

We are seeking applications from young people of different racial and ethnic groups, aged 18 to 28, (veterans 18-32), with more than ordinary ability to work with their hands as well as with their heads, a good knowledge of basic mathematics, a tough physique, with agility and a good sense of balance, with perseverence and a desire to succeed.

WHAT TO DO IF YOU ARE INTERESTED

If you are interested in additional information about the Construction Carpenter Profession or if you think you would like to apply for this Program, call the Training Coordinator's office for an appointment to attend an orientation session. He will explain the many advantages offered as well as the disadvantages one could expect to encounter in this profession. You will then be able to make a realistic decision as to whether or not you wish to apply for this program.

Call 277-0490 — 277-1014.

Sponsors and Administrators of Alaska's Carpenter's Apprenticeship Program A Joint Venture between the Alaska Chapter of the Associated General Contractors of America and the Alaska State Council of Carpenters

EARNING WHILE LEARNING

HOW THE APPRENTICESHIP PROGRAM OPERATES

FUNDING

The program for training and developing a skilled craftsman (a journeyman) is provided for in the Collective Bargaining Agreement (Contract) between the contractors and unions in the several divisions of the construction industry. That contract may also provide for the establishment of a trust fund for the use of the Joint Apprenticeship Committee to cover expenses relating to the operation of the program. The contribution to the fund, ranging from ten to fifteen cents per hour, is made by the employers on the basis of the hours worked by the union journeymen.

JOINT APPRENTICESHIP COMMITTEE (JAC)

The Joint Apprenticeship Committee, composed equally of contractors and union representatives, develops the standards of apprenticeship which define the processes of the trade, the number of hours to be spent in related classroom instruction and the number of years of on-the-job training. These Standards are registered with the United States Department of Labor.

TERM OF APPRENTICESHIP

The term of apprenticeship for the construction trades will range from two to five years, depending on the trade. Wages paid the apprentices are usually on the basis of a percentage of the journeyman rate, customarily starting at 50 percent or higher, and increasing progressively every 1,000 hours through completion of their apprenticeship the journeyman rate will be received.

RELATED CLASSROOM INSTRUCTION

Apprentices attend classes of related technical instruction, supplementing their training on the job, to give them a comprehensive understanding of the theoretical aspects of their work. This related technical instruction is a fundamental feature of apprenticeship. Usually the classes are held during the winter and slack seasons for construction work. Some trades provide several weeks or months of technical related training prior to beginning employment and on-the-job training.

In class, apprentices learn the basic theories of their trade; on the job, under the direction and supervision of a skilled journeyman, they learn its practice.

FEES OR CHARGES

No charge is made for the classroom instruction. However some trades will require manuals, codes, or texts which are used constantly by journeymen. A nominal charge is made for such essentials.

INDENTURE

Each apprentice signs an Apprenticeship Agreement with the Joint Apprenticeship Committee. If the apprentice is a minor, the parent or guardian must also sign the Agreement. This Agreement is also registered with the Bureau of Apprenticeship, U. S. Department of Labor, which also awards certificates of Completion to apprentices upon successful completion of their training.

TRAINING COORDINATORS

Frequently, the Joint Apprenticeship Committee will employ a person to act as a coordinator to oversee the operations of the program and to supervise the training of apprentices. The Coordinator keeps records of work progress and acts for the committee between meetings. Such coordinators have proven to be of great value to the effectiveness of the apprenticeship program and to the industry.

THE ANCHORAGE TRAINING INFORMATION CENTER

Sponsored by

The Labor Unions and Employers Associations of the Construction Industry

R. L. McFarland and Joe Armstrong, Co-Chairmen

238 East 5th Avenue — Anchorage, Alaska 99501

QUALIFICATIONS, REQUIREMENTS AND INFORMATION FOR THE ALASKA BUILDING AND CONSTRUCTION APPRENTICESHIP AND TRAINEE PROGRAMS

APPRENTICESHIP TRADES	AGE		EDUCATION	DOCUMENTS		TESTS		TERM OF APPRENTICE		TRADE RELATED INSTRUCTION (CLASS ROOM)		WAGE INFORMATION			
	Without Military, Related Work Exp.	W/Military or Related Work Experience	Minimum Grade or Equiv.	Proof of Birth	High School Transcripts	Pass GATB Test	Pass Entry Exam	Years	Hours	Number Weeks 1st Class	Additional Each Year	Starting Wage Per Hour	% Journey Man Pay	Raise in Pay as Indicated	Journeyman Wage Per Hour
(Heat and Frost Insulators) ASBESTOS WORKERS – SWP*	18 - 27	18 - 30	12th	X	X			4	6,400	3	3	$8.47	60	Each 1,600 Hrs.	$14.11
BOILERMAKERS – SWP*	18 - 31	Approval Apprentice Committee	12th	X	X			4	6,000	4 Sets Correspondence	12 Lessons	$9.11	70	750 Hrs. and Lessons Completed	$13.01
BRICKLAYERS TILESETTERS – SWP*	17 - 24	18 +	12th			X	X	3	6,000	8	8	$7.72	55	6 Months	$14.03
(Anchorage) CARPENTER, CABINETMAKER, MILLWRIGHT	18 +	18 +					X	4	8,000	8	7	$8.29	64	1,000 Hrs.	$12.96
(Fairbanks) CARPENTER, CABINETMAKER, MILLWRIGHT	17 +	17 +				X	X	4	8,000	8	6	$8.98	64	1,000 Hrs.	$14.03
CEMENT MASON[1] and PLASTERER[2] (Anchorage)	18 - 30	18 - 30	8th		X			3		6	6	1. $ 9.29 2. $10.13	75	12 Months	1. $12.38 2. $13.50
CEMENT MASON and PLASTERER (Fairbanks)	18 - 30		8th		X			3		6	6	$9.38	75	2,000 Hrs. or 1 Year	$12.38
COOKS[1] and BAKERS[2] – SWP*	18 - 35	18 +	9th	X	X			3	6,000	12	3 to 4	1. $7.70 c 2. $7.97 b	75	1,000 Hrs.	1. $10.27 2. $10.63
ELECTRICAL – 1. Wireman 2. Lineman 3. Telephone Workers (SWP)*	18 - 24	18 - 27	12th		X	X	X	4	8,000	12	Additional 12	$9.56	65	1,000 Hrs.	$14.70
IRONWORKER – SWP*	18 - 30	18 - 30	12th		X			3	4,800	6	4-6 Wks	$8.28	60	Min. 6 Mos. 800 Hrs.	$13.80
OPERATING ENGINEER – SWP* 1. Universal Equipment 2. Grade and Paving Equipment 3. Plant Equipment 4. Heavy Duty Repairman	18 - 25	[illegible]	12th	X	X	X			6,000	8	6	$9.04	70	1,000 Hrs.	$12.91
PAINTER, GLAZIER, CARPET and RESILIENT FLOOR COVERERS	18 - 25	18 - 25	8th					3	6,000	10	3	$8.64	60	1,000 Hrs.	$14.40
(Anchorage) PLUMBERS and PIPE FITTERS	18 - 25	Vets Only 18 - 29	12th	X	X			5	10,000	6	Additional 20	$7.40	50	1,000 Hrs.	$14.80
(Fairbanks) PLUMBERS and PIPE FITTERS	16 +		12th		X			5	10,000	16	6	$7.66	50	1,000 Hrs.	$15.32
ROOFERS – SWP*	18 - 27	18 - 33	10th	X	X			3	3,600	3	3	$8.97	65	600 Hrs.	$13.80
SHEET METAL WORKERS	18 - 25	18 - 27	12th		X	X		4	8,000	5	5	$9.37	60	1,000 Hrs.	$15.62
TRAINEE PROGRAMS				OTHER REQUIREMENTS				TERM OF TRAINEE							
BULL COOK, WAITER, WAITRESS, HELPER AND ATTENDANTS	18 +	18 +	Reading and Language Comprehension	Current Health Card					30 days	8	0	Approx. $8.04	85	30 Days	Approx. $9.46
LABORERS	18 +	18 +						0		4	Optional 2 wks Upgrading	$11.35	100		$11.35
PILEDRIVERMEN	18 - 24	18 - 32	Reading and Language Comprehension				X	2		[illegible]	4	$7.90	60	6 Months	$13.17
TEAMSTER – Truck Drivers	18 +	18 +		Min 5'7" 140 lbs						4		$11.45	100		
Surveyors	18 +	18 +	12th	X	X		X		600	15		$10.83	100		

SWP* Indicates State-wide Programs. Applicants who apply from within Alaska (statewide) and meet Qualifications/Requirements will be notified for Screening (Interview) by Appropriate Joint Apprenticeship Committee. Training facilities located in Anchorage or as directed by Joint Apprenticeship Committee. Teamster and Operating Engineer Applicants must have a Valid Alaska Drivers License.

RECRUITMENT IS RESTRICTED TO ALASKA RESIDENTS — MINIMUM ONE YEAR RESIDENCY

TO EARN - WHILE YOU LEARN

ADVANTAGES OF APPRENTICESHIP

Admittedly, a WHITE COLLAR bias exists in the minds of immature or impractical people. Too often college education is emphasized to the point of belief that anything less is second-rate. This is wrong.

Apprenticeship is the skilled trades of the Construction Industry should be considered as advanced education. As such, it offers young people marked advantages.

1. The apprentice is an employed worker. The contractor is the only one who creates the job for an apprentice. The union does not employ apprentices.

2. They are paid good wages while learning the skills of the trade and are not cheap labor.

3. Their rate of pay increases with knowledge and ability.

4. Offers opportunity for continued wages and job security upon completion of training.

5. The apprentice becomes self-reliant at a comparatively early age.

6. Imposes no financial burden to their parents or community.

7. Provides classes to learn the theory of their trade and those techniques which cannot be taught economically at the job site.

8. Their instructors are capable, practical journeymen selected for the industry by the Joint Apprenticeship Committee.

9. They learn to produce with modern tools and machines and will gain experience under the most modern methods.

10. They learn properly to use tools or install modern industrial materials worth thousands of dollars during their apprenticeship. This is one of the many reasons why a competent journeyman cannot be developed in a classroom.

11. They work under the direction of a competent journeyman at all times and receive close personal attention.

12. Their progress, as reflected in work reports and class grades, are constantly reviewed by the Joint Apprenticeship Committee.

13. They are protected during their indenture by the Joint Apprenticeship Committee to insure that they have an opportunity to develop all the skills of the craft and become a fully qualified journeymen.

14. Because of high entrance requirements and high standards of conduct and competence, they associate with good and honorable young people.

15. It serves to meet the great need for young people as replacements for journeymen who advance or retire under the industry's generous pension plans.

16. With experience and study, the apprentice can become a foreman, estimator, or superintendent. Many of the owners and employers in the construction industry started their careers as apprentices.

17. The apprentices may advance to positions of responsibility in their union. Union leadership is earned through hard work, service and respect for others. Nearly all union leaders have come from the ranks.

18. As they grow in experience, they may follow related fields as a salesman, broker, or supplier.

19. They may engage in labor-management relations or qualify for specialized work for government agencies.

20. As a journeyman in the construction industry they will be engaged in an honorable and respected occupation with opportunities for advancement limited only by their own ability and ambition.

PLEASE POST

Glazier

Bricklayer

Pile Drivermen

Electrician

Lineman

Plumber

WANTED

Apprentice Applicants

FOR

Skilled Construction Trades

1. Resident - must be in Alaska one year or more.
2. Education - High School Diploma or GED preferred.
3. Age - 18 to 24, some to 30.
4. Jobs - Hospitals, schools, offices, refineries, pipelines, docks, etc., throughout the State of Alaska.

FOR MORE INFORMATION

CONTACT

Apprentice Outreach Program
238 E 5th Avenue
Anchorage, Alaska 99501

Apprentice Outreach Program
315 Fifth Street
Fairbanks, Alaska 99701

Iron Worker

Cement Mason

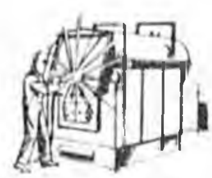
Sheetmetal Worker

Operating Engineer

Plasterer

Asbestos Worker

Culinary



Boilermaker

Teamster

Floor Layer

Painter

Carpenter

Laborer

Roofer

TELEGRAM

RCA ALASKA COMMUNICATIONS, INC.
PHONE: 586-6440
JUNEAU, ALASKA 99801

#

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PMS REP TERRY GARDINER

JUN 3191

1976 APR 21 PM 6 26

WILL BE UNABLE TO ATTEND THE HEARING SCHEDULED ON SENATE BILL 630 THIS ASSOCIATION RECOMMENDS ITS PASSAGE. WE HAVE BEEN INVOLVED IN APPRENTICESHIP PROGRAMS QUITE EXTENSIVELY AND AT THE PRESENT TIME HAVE SOME 500 ALASKANS WORKING IN THE STATE OF ALASKA ENROLLED IN OUR PROGRAM. THE FEDERAL REGULATIONS REGARDING AGE HAVE WORKED VERY WELL FOR THE ELECTRICAL INDUSTRY

JOE S ARMSTRONG

MANAGER NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION

"An Act relating to motorcycle safety; and providing for an effective date."

COMMITTEE REPORT

3/31/76 HOUSE

Mr. Speaker: Date May 24, 1976

The Committee on JUDICIARY has had CSSB 666 under consideration. A Majority of the members of the Committee

( ) recommends it DO PASS

( ) recommends it DO NOT PASS

( ) recommends it DO PASS WITH ATTACHED AMENDMENT(S)

( ) recommends it BE REPLACED WITH CS FOR ________ AND THAT CS FOR ________ DO PASS

( ) "and" recommends it BE REFERRED TO THE ________ COMMITTEE

( ) reports it back WITHOUT RECOMMENDATION

(✓) "other"

Members signing the Majority report:

[signature] No Rec		
[signature]	[signature]	

Members NOT concurring in the Majority report:

________ recommends:

________ recommends:

________ recommends:

________ recommends:

________ recommends:

[signature] Chairman

1939

Original sponsor: Huber

Offered: 3/26/76
Referred: Rules

IN THE SENATE BY THE STATE AFFAIRS COMMITTEE

CS FOR SENATE BILL NO. 666

IN THE LEGISLATURE OF THE STATE OF ALASKA

NINTH LEGISLATURE - SECOND SESSION

A BILL

For an Act entitled: "An Act relating to motorcycle safety; and providing for an effective date."

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF ALASKA:

* Section 1. AS 28.35 is amended by adding a new section to read:

19 Sec. 28.35.270. MOTORCYCLE HELMET. A person who has reached the age of majority as defined by AS 25.20.010 may not be required to wear a helmet while operating a motorcycle if he is the holder of a license which, under regulations adopted under AS 28.15.070(b), is classified singly as a license to operate a motorcycle.

* Sec. 2. This Act takes effect immediately in accordance with AS 01.10.070(c).

Have sanctioned 3 states

500,000 - highway safety
12 1/2 Million highway construction

Called states in for hearings

Cal.; Illinois; Utah

rider; renters; under 19 - must use helmets

THE BROTHERS

MC

ALASKA

March 21, 1976

Honorable John Huber
Alaska State Senate
Pouch V, State Capitol Building
Juneau, Alaska 99811

Dear Senator Huber,

I Just recently learned of your sponsership of the bill to repel the mandatory helmet law. I am very much in favor of this bill's passage. I would like to extend my cooperation to you on this bill.

I have been active in petitioning signatures to repel the helmet law, and have sent them to Mr. Daved M. Baldwin, National Chairman, National Committee on Uniform Traffic Laws and Ordinances. So far I have sent in aproximately five hundred (500) signatures.

Please advice me of the action that has been taken on this bill and that will be taken in the future.

Sincerely yours,

Charles R. Lemmons

Charles R. Lemmons
P.O. Box 4-2041
Anchorage, Alaska
99509

Reference to NHTSA Technical Note
DOT HS-801 137

A Motorcycle Safety Helmet Study

Safety Helmet Effectiveness [10]

A comparison between head injury sustained by safety helmet users and nonusers in traffic accidents in rural areas of Illinois, on the basis of a standard accident speed for both groups of riders, revealed the following:

1. In general, when helmets were not used, fatal or serious head injury was 3 times greater and head injury of all types was twice as great.

2. Helmets dislodged from the rider's head during the course of an accident did not reduce head injury and helmets damaged by cracking or splitting during impact were only slightly effective in that fatal or serious head injury was reduced by only 20% over non-helmeted riders. As expected, helmets that had not been damaged or ejected proved the most effective.

3. Helmets significantly reduced head injury in all three of the accident speed ranges considered: 60% for speeds up to 30 mph, 52% for speeds between 31-50 mph, and 51% for speeds over 50 mph. However, these differences in helmet effectiveness were not significant and helmets were equally effective in all three speed ranges.

4. Helmets significantly reduced head injury at both seat positions on the motorcycle, 68% for passengers and 52% for operators, but the difference in helmet effectiveness between the two positions was not significant.

5. Helmets significantly reduced head injury in accidents involving either noncollision (by 57%) or collision (by 50%), but the difference in helmet effectiveness between the two types of accidents was not significant.

Reference to NHTSA Technical Note
DOT HS-801 836

Motorcycle Safety- The Case for Helmet Use

Motorcycle helmets do not increase incidence of neck injury in accidents.

It has been suggested that helmet use increases the incidence of fatal neck injury in motorcycle crashes (using data from a 1969 statistical analysis of motorcycle accidents in New York).[13] Actually, the incidence of neck injury in motorcycle accidents during 1966 and 1967 involved any type of neck injury, and most of these involved only comp'aints of pain with no visible signs of injury. Studies done recently in Nebraska,[14] California and Canada[15] show that the incidence of neck injury of any type occurs in less than two percent of all motorcycle crashes.

Motorcyclists have been wearing safety helmets for more than 30 years, and during this period a number of studies of injury patterns in motorcycle accident have been made. None support the claim that helmets increase fatal neck injuries. The neck injury issue has been used in opposition to helmet laws as an attempt to exploit a peripheral issue on which there is not a great deal of valid data. Consequently, the problem has been magnified far out of proportion.

In order to provide conclusive evidence which will resolve the issue once and for all, the University of California and the Los Angeles County Medical Examiner's Office, under contract with the NHTSA, are now undertaking in-depth analysis of all fatal motorcycle crashes in Los Angeles County. Post mortem examination of each helmeted and unhelmeted rider will be made to document the incidence of neck injury in each group. The results of these analyses will provide authoritative resolution of the neck injury issue.

Mandatory helmet use laws reduce the number of serious head injuries and fatalities resulting from motorcycle accidents.

It is a logical conclusion that if a mandatory helmet use law is passed, more people will wear helmets, and consequently fewer fatalities and fatal injuries will occur in motorcycle accidents. Researchers have tried to verify this by comparing motorcycle fatalities and head injuries before and after implementation of a mandatory helmet use law. Of particular interest is a Brisbane, Australia report[16] which utilized three groups -- one sample done before implementation of a helmet use law, and two samples done in the two years immediately following. This study found (see Table IV) (a) that a significant increase in helmet use by motorcyclists involved in accidents (as expected) and (b) a significant decrease in head injuries in the post-legislation group.

Field of View With and Without Motorcycle Helmets

IV. Summary and Conclusion

In general, motorcycle helmet visual restrictions were smaller along the horizontal plane as compared to the vertical planes. The full coverage helmets produced relatively small reduction in the entire field of view. As expected, the full facial coverage helmets resulted in somewhat larger reductions. The two styles of full facial coverage helmets yielded significantly different fields of view. Goggles produced approximately the same lateral visual field as the most restricted helmet.

With regard to restriction of the total field of view in the horizontal plane, it can be concluded that full coverage helmets (the most common type in use) provide only minor restrictions, less than 3 percent from that of an unhelmeted person. The full facial coverage helmets designed to comply with the lateral vision requirements of the ANSI Z90.1 standard and FMVSS No. 218 provided a restriction in lateral vision only marginally more than the full coverage helmets (7.3 percent). The "worst case" helmet provided a restriction of 21.9 percent from the unhelmeted lateral field.

All helmets tested exceeded the maximum State licensing requirements of 140° total "peripheral" view in the horizontal plane. Also, all helmets were in general compliance (especially visual regulations) with DOT standards. Therefore, helmet selection in terms of acceptable visual field, appears to be a matter of personal preferance among the many available styles.

Reference to NHTSA Technical Note
DOT HS-801 759

Effect of Safety Helmets on Auditory Capability

SUMMARY

Wearing a protective helmet has little to do with whether or not a motorcycle driver will hear a particular sound of interest to him or her. While it is true that safety helmets do attenuate external sounds, the amount of such attenuation is inconsequential, even when coupled with the amount of age-related hearing loss that normally occurs with age. The major determiner of whether a given sound will be heard is the ratio between the intensity of that sound and the intensity of the masking noise generated by the motorcycle (i.e., the signal-to-noise ratio). Safety helmets have an inconsequential effect because they reduce the loudness of both the sound of interest and the motorcycle noise by an equal amount and hence do not alter the signal-to-noise ratio between the two. A helmeted motorcycle rider can hear a sound of interest approximately as well as a person in an automobile with the windows closed.

IDAHO STUDY

SUMMARY OF STUDY FINDINGS

This summary is for the benefit of those who are more interested in survey results than in detailed analysis. All findings are substantiated in the body of the study.

1. There were 7.67 motorcyclists strongly in support of the mandatory helmet law for every 1 strongly opposed to the law.

2. Of motorcyclists who commented on the mandatory helmet law, 77.3% were in favor of the law.

3. Of motorcyclists who wore helmets, 84.7% indicated that the helmet reduced injury and 8.7% voluntarily added that it saved their lives.

4. Neck injuries were very rare in the severity A (incapacitating) injuries.

5. Over half of the respondents were at least twenty years old.

6. Motorcyclists over 35 years old comprised 20.7% of the respondents.

7. A few motorcyclists (2.6%) had less than one month motorcycling experience, but 75.6% had more than one year motorcycling experience.

8. Analysis of medical costs and days lost by severity code indicates that the injury severity codes marked by investigating officers are accurate indications of injury severity.

9. The opinion survey was favorable to motorcycle licensing with written and traffic exams, but not favorable toward off-road driving exams.

10. The opinion survey was favorable toward motorcycle training courses, with reservations on funding and administration.

11. The opinion survey supported the importance of eye protection but was not favorable toward a law requiring full-time eye protection.

12. Annual motorcycle mileage estimates varied greatly with an average somewhere between 3500 and 4500 miles per year.

13. Single motorcycle accidents predominately occurred in rural areas during daylight hours, while motorcycle accidents involving a car or truck occurred mostly in urban areas during daylight hours.

14. There was a marked difference in urban and rural accidents by injury severity type. Over half of the A injury severity accidents occurred in rural areas, while B and C injury severity accidents occurred mostly in urban areas.

15. Automobile driver awareness of and courtesy toward motorcyclists was determined to be the primary single factor in motorcycle collisions.

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file with members 4/5/76

BARRY'S CUSTOM CYCLE

HOUSE OF HARLEY

1204 CHUGACH WAY • ANCHORAGE, ALASKA • 99503 • (907) 272-0423

Mr Terry Gardiner
Box 1092
Ketchikan Alaska 99901
District 1

Dear Terry,

This letter is in reference to Senate bill #666
"The Resolution"

Crash helmets should not be required for people over 19 years of age. This should be an option.

(Please consider this letter as written testimony when the resolution comes for vote before) the committee.

Sincerely,

Beverly [illegible]
Arvin O. [illegible]

NHTSA Technical Note
DOT HS-801 836

MOTORCYCLE SAFETY-
THE CASE FOR HELMET USE

Prepared by:

U.S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Traffic Safety Programs
Office of Driver and Pedestrian Programs

February 1976

crash helmets have been the subject of considerable court litigation across the country. With the exception of Michigan and Illinois, the appellate courts in at least 30 states have upheld the constitutionality of such requirements.[19] Further confirmation of their constitutionality is the action of the U.S. Supreme Court in affirming the decision in *Simon v. Sargent*.[20]

Thus the courts have held that requiring a crash helmet and eye-protective devices is a reasonable regulation and within the police power of the state to protect the public health, welfare, and safety. Such requirements do not deny equal protection under the constitution since the equal protection clause does not require that everyone be treated equally but rather permits a reasonable classification and classifying motorcyclists separate from operators in other vehicles is reasonable. The equal protection clause does require equal treatment within each reasonable classification.

A common legal theme in these court decisions is that crash helmets and eye-protective devices *protect other users* of the highway from danger since such protections help prevent the motorcyclist from losing control of his vehicle due to flying rocks or debris, limbs of trees, etc. Also, in rejecting the claims of motorcyclists that such requirements are only for the protection of himself and thus are beyond the power of the government to regulate, the opinion of the court in *Simon v. Sargent* is representative:

> ". . . (W)e cannot agree that the consequences of such injuries are limited to the individual who sustains the injury. . . . From the moment of the injury, society picks up the person off the highway; delivers him to a municipal hospital and municipal doctors; provides him with unemployment compensation if, after recovery, he cannot replace his lost job, and if the injury causes permanent disability, may assume the responsibility for his and his family's continued subsistence. We do not understand a state of mind that permits plaintiff to think that only he himself is concerned."[21]

NHTSA Technical Note

MOTORCYCLE SAFETY -

THE CASE FOR HELMET USE

Penelope Johnson
Lewis Buchanan
Paul Levy

Prepared by:

National Highway Traffic Safety Administration
Traffic Safety Programs
Office of Driver and Pedestrian Programs
February 1976

MOTORCYCLE SAFETY - THE CASE FOR HELMET USE

INTRODUCTION

In line with the National Highway Traffic Safety Administration's mission to save lives on our nation's highways, significant effort has been directed towards better motorcycle equipment, education and licensing. Of these, the most immediate safety benefits are available from increased motorcycle helmet use by all motorcycle riders and passengers.

Currently, forty-seven States, the District of Columbia and Puerto Rico have enacted comprehensive motorcycle helmet usage laws. Utah requires helmet usage on all roads posted above thirty-five miles per hour (35 mph); California and Illinois have no laws. Because of the demonstrated effectiveness of helmet use described in this paper, the Secretary of Transportation initiated sanction action as provided for under the Highway Safety Act against those three States for their failure to conform to Standard No.3. However, recent actions by the Congress of the United States indicate that the Highway Safety Act of 1975 will contain a provision which prohibits the Secretary of Transportation from sanctioning any State because it fails to require helmet use by persons over 18 years of age. This action by the Congress may lead to efforts on the part of many States to repeal existing motorcycle helmet laws.

While those opposing helmet usage laws do so primarily on the basis of concern with the governmental interference with personal liberties, they have also raised issues relating to the validity of the technical data supporting the effectiveness of helmets. The legal, governmental and social issues of safety helmet use are beyond the scope of this report.

HISTORICAL BACKGROUND

In order to show the importance of the motorcycle helmet as an effective safety device, it is necessary to survey the research which has been conducted during the past thirty years. While the motorcycle has been popular in the United States since the eraly 1960's, it has been an intergral part of European and Australian transporation for far longer. Thus, one should look to the British and the Australians, who are responsible for the initial research on helmet effectiveness.

Between 1940 and 1943, Dr. Hugh Cairns conducted in-depth studies of 106 motorcycle accidents to determine if the crash helmets in use in Great Britian were effective in reducing injury[1,2]. After study of the helmets themselves, the type of injury and the severity of injury for each case, Dr. Cairns reported reduced severity of injury through helmet use; one-fourth the frequency of fractured skulls through helmet use; and a reduction of one-half in hospital treated injuries for helmet users. The report based on these studies formed the precedent for future helmet research, and presented the first discussion of safety helmets as important safety equipment.

The work of Cairns was continued by Lewin and Kennedy, who published a study in 1956 of 555 civilian and 135 army motorcyclists admitted to hospitals.[3] Similar results supporting helmet effectiveness were reported, and criteria of an effective helmet were also presented. In 1957 Chandler and Thompson developed a statistical demonstration of the usefulness of helmets, based on 7,010 motorcyclists injured in 1954 or 1955.[4] In addition to comparing helmet effectiveness in urban and rural areas, the study documents a 30-40 percent reduced chance of head injury if a helmet is worn in a motorcycle accident. These British doctors had taken the first significant steps toward identifying the life saving potential of motorcycle helmets.

On January 1, 1961, a law became effective in the State of Victoria (Australia) making it mandatory for all motorcycle riders to wear safety helmets. A relatively thorough study of the data both two years before and after implementation of the law indicated:[5]

1. The legislation was successful, i.e., compliance was near 100 percent;

2. Fatalities for 1961 and 1962 were reduced by half, and after study of many other factors, the reduction appears attributable to helmet use; and

3. The risk of fatality to an accident involved helmet user is one-third that of an accident involved non-user.

Thus, the Australian experience showed that a mandatory helmet use law was enforceable and the resultant helmet use reduced fatalities in motorcycle accidents.

In the United States, safety officials and state legislators watched with concern as fatality totals from motorcycle accidents continued to increase. A Washington State accident summary published in 1967, showed that two-thirds of all Washington motorcycle fatalities in 1965 and 1966 resulted from head injury.[6] In 1966, New York and Michigan adopted helmet use laws. Late that year the United States Department of Health, Education and Welfare published preliminary data suggesting that projected motorcycle fatalities would be reduced by 40 percent if all motorcyclists used helmets.[7] This and other evidence was evaluated, and led the NHTSA to include a motorcycle safety standard as one of the initial thirteen Highway Safety Programs Standards

<u>The number of serious, including fatal, head injuries is reduced when motorcycle riders are wearing helmets.</u>

Two recent American studies have explored helmet use in relation to injury severity in motorcycle accidents. The first was conducted by staff from the School of Medicine of the University of California at Davis, and reviewed the injury and accident reports of 1,273 persons injured in Sacremento, California in 1970.[9] Table II, taken from the study, concerns 626 male drivers and shows helmet use, injury severity and injury severity rates. (Serious injuries include those resulting in death, hospitalization, most nontrivial medically diagnosed fractures in any anatomic location except digits, or continuous medical care beyond two visits to a physician.) Comparison of non-helmeted driver data to that of helmeted drivers shows that:

1. Non-helmeted drivers were injured twice as often as helmeted drivers;
2. Serious injury occurred nearly three times as often to non-helmeted drivers; and
3. Statistically significant decreases in all head injury rates were detected when helmets were worn by the driver.

TABLE II
SERIOUS AND NON-SERIOUS HEAD INJURY RATES FOR INJURED MALE DRIVERS ACCORDING TO HELMET USE SACRAMENTO COUNTY, CALIFORNIA, 1970

Helmet Use	Total Injured Drivers	Drivers with Serious Head Injury	Serious Head Injury Rate (%)	Drivers with Non-Serious Head Injury	Non-Serious Head Injury Rate (%)
Yes	218	33	15.14*	20	9.17*
No	408	93	22.80*	53	12.99**

* Difference in proportions significant, $p = .016$
** Difference in proportions non-significant, $p = .136$

Note that a difference in serious head injury rates as large as those shown in the table could have occurred by chance less than two times in one hundred.

Safety Helmet Effectiveness [10]

A comparison between head injury sustained by safety helmet users and nonusers in traffic accidents in rural areas of Illinois, on the basis of a standard accident speed for both groups of riders, revealed the following:

1. In general, when helmets were not used, fatal or serious head injury was 3 times greater and head injury of all types was twice as great.

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The second American study was carried out by the NHTSA, and was published in 1974.[10] Information was gathered from police records of 5,608 traffic and non-traffic motorcycle accidents which occurred in Michigan (May, June, July, 1971, June, July, August, 1972) and Illinois (November 1971 - October, 1973). After the Illinois data was corrected for overrepresentation of rural accidents, analysis and comparisons were made. Table III (taken from Appendix C of the report) shows the standardized head injury rates for users and nonusers for Illinois and Michigan. The ratio of nonusers to users (bottom line of Table III) makes a very important point -- that accident involved riders without helmets have three times as many fatal and serious injuries as helmet users in both States (3.0 for Michigan and 2.9 for Illinois). The ratios for moderate injury are also similar, (2.2 for Michigan, 2.0 for Illinois) indicating twice as many helmet nonusers suffering moderate injuries as helmet users. Again we have convincing evidence that if an accident occurs, a rider's chance of fatal. serious or moderate injury will be greatly reduced if he is wearing a helmet.

TABLE III

Standardized Percentage of Head Injury Rates for Motorcycle Riders in Michigan and Illinois

	Fatal or Serious		Moderate		Minor/ Indet		Total % Injured		Total Riders	
	Mich	Ill	Mich	Ill	Mich	Ill	Mich	Ill	Mich	Ill
Users	5.3	7.0	4.4	6.4	3.1	3.2	12.8	16.6	3820	438
Non Users	15.8	20.0	9.5	12.5	5.9	3.8	31.2	36.3	286	927
Ratios	3.0	2.9	2.2	2.0	1.9	1.2	2.4	2.2	-	-

Motorcycle helmets do not dangerously restrict or interfere with safe operation of a motorcycle.

Those who oppose laws requiring the use of safety helmets have claimed that helmets are dangerous because they restrict a motorcyclist's ability to see and hear potential hazards. However, these claims are not supported by any type of research or statistical documentation.

The NHTSA has completed initial studies of each of these problems.[11,12] In the first study on vision, four popular helmets were tested to determine the degree to which each limited motorcyclists vision. The field of view of 19 experienced motorcyclists was measured using each of the four helmets (two full facial coverage, and two full coverage). Each person's field of view was also treated without a helmet.

The results of the study show that full coverage helmets, representing almost 95 percent of current helmet sales, restrict a motorcyclist's field of view in the horizontal plane (peripheral vision) by less than 3 percent. The study also found that the helmet which provided the smallest field of view (a full facial coverage helmet intended for motorsport competition) restricted the riders' horizontal field of view less that 22 percent. All of the helmets provided a horizontal field of view of more than 180°, well above the 140° used by State driver licensing agencies for screening out drivers with possible vision problems that would warrant some type of restricted driving privilege.

With regard to hearing, helmets do reduce a person's ability to hear, but in actual practice the reduction in auditory capacity for the motorcyclist is inconsequential. The primary reason for this is that the noise generated by the motorcycle and the noise produced at high speed by the wind are so great that any sound loud enough to penetrate this noise is loud enough to be heard inside the helmet.

To understand why this is true, it is necessary to examine the phenomenon of hearing. Whether or not a given sound will be heard by a driver is dependent upon three factors: (1) the auditory capability of the driver, (2) the intensity and frequency of the sound of interest, and (3) the intensity and frequency of the environmental noise that might "mask" or hide the desired sound. A given sound will be heard by a driver if it is loud enough when it reaches his ear to be above his hearing threshold, and if it is not "masked" or hidden by other sounds or noise present at the same time. Motorcycles create average levels of ambient noise ranging from 85 to 98 db(A) for on-street or dual purpose machines. For a rider to hear any other sound in the presence of this high noise level, the sound must be as loud or louder than the motorcycle itself, i.e., it must have a signal-to-noise ratio of approximately 1 to 1. The greater the signal-to-noise ratio, (e.g., the more intense the sound of interest relative to the ambient noise) the greater the attention getting properties of the signal and the higher the probability that it will be heard. Helmets reduce the loudness of both the sound of interest and the motorcycle noise by an equal amount, and therefore do not alter the signal-to-noise ratio between the two sounds, Consequently, as long as the rider can hear the motorcycle itself while wearing a helmet, he or she can also hear any other sound with a favorable signal-to-noise ratio at least as well as a driver who does not wear a helmet.

<u>Motorcycle helmets do not increase incidence of neck injury in accidents.</u>

It has been suggested that helmet use increases the incidence of fatal neck injury in motorcycle crashes (using data from a 1969 statistical analysis of motorcycle accidents in New York).[13] Actually, the incidence of neck injury in motorcycle accidents during 1966 and 1967 involved any type of neck injury, and most of these involved only complaints of pain with no visible signs of injury. Studies done recently in Nebraska,[14] California and Canada[15] show that the incidence of neck injury of any type occurs in less than two percent of all motorcycle crashes.

Motorcyclists have been wearing safety helmets for more than 30 years, and during this period a number of studies of injury patterns in motorcycle accident have been made. None support the claim that helmets increase fatal neck injuries. The neck injury issue has been used in opposition to helmet laws as an attempt to exploit a peripheral issue on which there is not a great deal of valid data. Consequently, the problem has been magnified far out of proportion.

In order to provide conclusive evidence which will resolve the issue once and for all, the University of California and the Los Angeles County Medical Examiner's Office, under contract with the NHTSA, are now undertaking in-depth analysis of all fatal motorcycle crashes in Los Angeles County. Post mortem examination of each helmeted and unhelmeted rider will be made to document the incidence of neck injury in each group. The results of these analyses will provide authoritative resolution of the neck injury issue.

Mandatory helmet use laws reduce the number of serious head injuries and fatalities resulting from motorcycle accidents.

It is a logical conclusion that if a mandatory helmet use law is passed, more people will wear helmets, and consequently fewer fatalities and fatal injuries will occur in motorcycle accidents. Researchers have tried to verify this by comparing motorcycle fatalities and head injuries before and after implementation of a mandatory helmet use law. Of particular interest is a Brisbane, Australia report[16] which utilized three groups -- one sample done before implementation of a helmet use law, and two samples done in the two years immediately following. This study found (see Table IV) (a) that a significant increase in helmet use by motorcyclists involved in accidents (as expected) and (b) a significant decrease in head injuries in the post-legislation group.

TABLE IV: HELMET USE AND HEAD INJURY BEFORE AND AFTER MANDATORY HELMET USE LEGISLATION

	Pre-Legislation	Post-Legislation	
	Group 1	Group 2	Group 3
No. of Persons	151	38	65
No. of Helmets Used	25	34	63
Rate of Wear	16.6%	81.1%	96.9%
Major Head Injury	44	6	13
% of Group Total	29.1%	15.7%	20.0%
Minor Head Injury	58	11	23
% of Group Total	38.4%	28.9%	35.4%

Other studies of fatalities and head injuries before and after helmet law implementation (Victoria, Australia (1964), New York State (1969) and Washington State (1969)) drew similar conclusions; further, the national motorcycle fatality rate decline since 1967 is also an impressive indicator.

CONCLUSION

There is no question that there is still some lack of carefully designed studies of motorcycle accidents, and that there remain questions to be answered in the field of motorcycle safety. States have only recently started to maintain accurate records of the unique characteristics associated with the motorcycle accidents and injuries. Because of this shortage of specialized data, it remains a difficult task to conduct studies of a rigorous nature that will precisely define the benefits of helmet use.

We can, however, look back over the past 30 years of motorcycle accident research, and using the data and insights thus acquired, develop meaningful programs to reduce fatalities and injuries resulting from motorcycle accidents. From such studies and experience, NHTSA has promoted efforts in education and licensing to enable motorcycle riders to better handle the problems characteristic to motorcycle use. However, to reduce fatalities and serious injuries, it is absolutely essential to address the leading cause, which of course, is head injury. From the data presented here, we can conclude with high confidence that motorcycle helmet use greatly decreases the likelihood of fatal and serious injury if an accident does occur; also, it is clear that the helmet is a truly effective, necessary piece of safety equipment. It is therefore important that helmet usage be included along with improved motorcycle education and licensing procedures as a major part of all highway safety programs. Through uniformly high rates of helmet use, whatever the means of achieving such rates, we should be able to greatly reduce the number of motorcycle deaths recorded in the U.S. in years to come.

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NHTSA Technical Report

DOT HS-801 758

FIELD OF VIEW WITH AND WITHOUT MOTORCYCLE HELMETS

Prepared by:

U.S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Research and Development
Safety Research Laboratory

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16. Abstract

The total field of view for 19 experienced motorcyclists at 10 angular positions was obtained by moving a target along a circular perimeter and recording the angle at which it was first perceived. All subjects were tested with no helmet, two full coverage helmet models, two full facial coverage helmet models, and goggles.

Along the horizontal plane, visual restriction was less than 3 percent with full coverage helmets as compared to no helmet. The full facial coverage helmets produced 7.3 percent and 21.9 percent lateral field reduction. The helmet with the large restriction was a "worst case" helmet representing a small percentage of helmet sales and typically used in off-street situations. Lateral vision with goggles was approximately equivalent to that achieved by the most restrictive helmet.

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TABLE OF CONTENTS

I. Introduction

The effectiveness of motorcycle safety helmets in preventing or reducing the severity of head injury in motorcycle crashes has been well documented. Under authority of the Highway Safety Act of 1966, the Department of Transportation published a Motorcycle Safety Standard for State highway safety programs which required that each motorcycle operator and passenger wear an approved safety helmet. Currently 47 States, the District of Columbia, and Puerto Rico meet the requirement. However, the laws implementing this requirement have been opposed by a vocal minority of motorcyclists. One of the allegations made is that motorcycle safety helmets are hazardous because they restrict the lateral vision of cyclists.

Since no previously published studies have measured the fields of view of helmeted and unhelmeted motorcyclists, the work described in this report was initiated to develop such data. The limited time period allowed to complete this study suggested a simple manually controlled test device. Therefore, the total field of view at ten angular positions was obtained by moving a target along a circular perimeter and recording the angle at which it was first perceived. A total of 19 motorcyclists participated with each using four different styles of helmets. A less detailed test was performed along the horizontal plane using safety glasses and goggles.

II. Test Methods

This section includes discussions of the procedures, apparatus, and subjects utilized during this test program. Most pieces of apparatus mentioned in Procedures are described in detail under Apparatus.

A. Procedures

The primary objective was to evaluate the field of view for helmeted and unhelmeted riders. Total field of view was measured with the head in a fixed forward position and the eyes free to move towards the target. The maximum visual angle was observed along five reference planes. One reference plane was the typical horizontal or lateral plane. (Occasionally, this total lateral field of view is referred to as peripheral field, but the word peripheral is only applicable for a fixed eye position test.)

A target point slowly moving from out of the visual field to the point of perception determined each data point. Three such readings produced an average value along each of the ten test angles (see Figure 1). It should be noted that measuring the location of a target leaving the field of view would produce a different absolute number. However, in the present study, relative comparisons with and without helmets are more important than absolute values.

Positioning the subject at the center of the perimeter test device significantly influenced the exact target position when it entered the visual field. A string stretched across the diameter of the bow and placed a few inches above the subject's head served as a center marker. Vertical alignment with respect to the horizontal plane was accomplished by adjusting the height of the chair on which the subject sat. The large eight (8) foot diameter bow (see Figure 2) allowed for slight subject misalignment without seriously affecting the recorded angle.

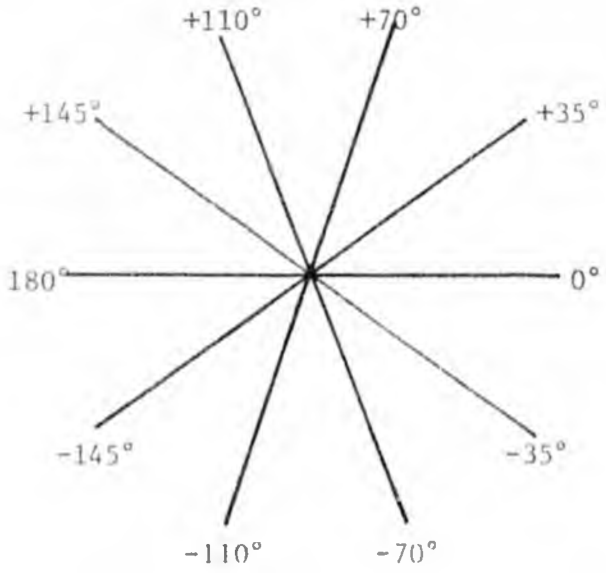


FIGURE 1 Angles Along Which Field of View was Measured

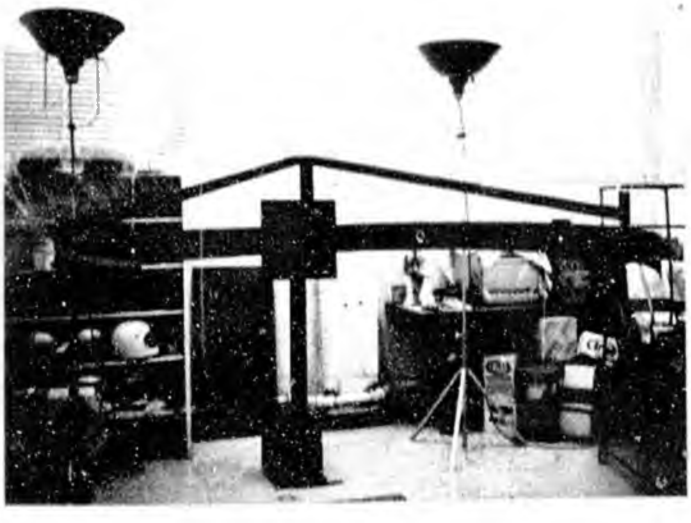


FIGURE 2 Perimeter Device for Measuring Visual Angles

A chin support kept the subjects from making large movements from the fixed forward position, but many individuals tilted their heads slightly towards the target. Helmet position on the head varied between individuals, and some helmet readjustment occurred during the testing. Therefore, any particular reading might be expected to be largely different from the average value. But this situation is realistic compared to the variance one would find between different riders during in-use conditions.

Three other tests were performed on each subject. The first test determined the maximum head turning (rotation in the horizontal plane) with and without helmets. With the subject facing forward, a light 3/16 inch aluminum tube was taped to each helmet. When the subject turned his head, while both hands were on handle bars provided, the "pointer" indicated angular displacement on the perimeter bow. The no helmet condition was approximated by repeating the above test using a light weight hockey helmet.

The second additional experiment measured visual field with safety glasses and goggles. This test was limited to the results obtained along the horizontal plane. The final evaluation was a simple helmet positioning check. The vertical distance between the subjects' eyes (centerline) and the helmet brim above was measured.

The helmets used in the study are depicted in Figure 3. They were selected to represent both the "worst case" of field of view restriction with a helmet and the typical cases. The helmets were of two designs, commonly referred to as full coverage and full facial coverage. The major distinction is that the full coverage helmets do not provide crash protection from direct impacts in the facial area. From qualitative observation it

Arthur Fulmer
Model AF-40

Buco
Enduro Model

Shoei
Model S-20

Bell
Star Model

FIGURE 3 - Four Helmet Models as Worn During Visual Field Testing

can be discerned that the full facial coverage helmet creates a substantially reduced field of view as compared to an unhelmeted rider. However, it should be noted that this configuration of helmet was originally designed to provide maximum protection under motor-sport racing conditions and is not typically used by motorcyclists riding on public roads. The Safety Helmet Council of America estimates that less than 6 percent of the helmet sales are of this configuration. All helmets were purchased from commercial cycle shops and are manufactured by large helmet companies.

The safety glasses were made by Foster Grant and Studio Craft. These are displayed in Figure 4. The Foster Grant glasses were constructed with thin wire frames, and the Studio Craft had heavy plastic frames. Scott and Salice represented two of the many styles of goggles. Scott had a flat shield, while Salice had a bubble shield. Both types of goggles are shown in Figure 5.

B. Apparatus

The four (4) foot radius perimeter device is shown in Figure 2. This structure was fabricated from welded rolled aluminum sections. It extends 127° from the center of rotation. Because of the large moment on the rotating support piece, there was a slight (1 inch) sag at the extreme edge of the bow. This was compensated by slightly tilting the entire structure backwards. One (1) degree increments were marked on the outside surface of the bow (away from the subject). Both chordal and circumferential measurements were used to double check the angular locations.

Salice

Scott

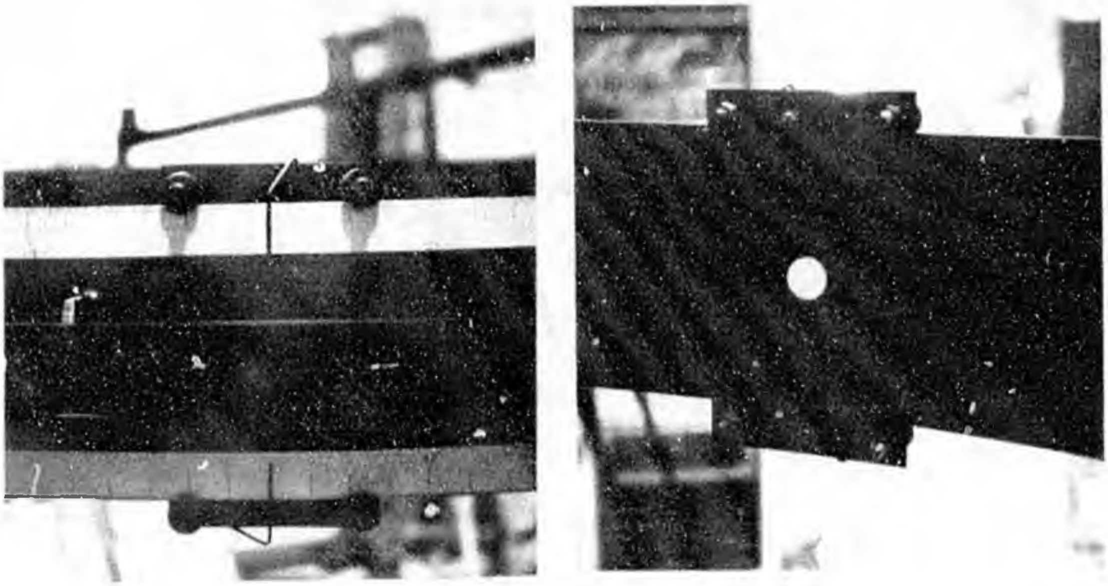
FIGURE 4 -Goggles as Worn During Visual Field Testing

FIGURE 5 - Safety Glasses Tested: Studio-Craft (on left) and Foster Grant

Two trolleys supported by four nylon rollers each moved around the track with markers pointing to the angle indicators. A black 18-inch flexible rod was attached to one wheel of each trolley. This permitted moving the trolley into the subjects view without having any hands near the target area. This device is displayed in Figure 6.

The seat structure provided for adjustable subject height and chin support. After original positioning, the subject could move slightly in the seat and still return to the same location within the perimeter device. Figure 7 shows the chin support during a test condition with no helmet. The chin rest caused some interference with the full facial coverage helmets. The lower portion of these full facial coverage helmets had to be lifted up to place the subjects' chin in the chin support. The helmet was then returned to its normal position. Several checks validated that the final helmet placement on the head was approximately equivalent to the original position. No interference existed with the full coverage helmets. Typical helmet and chin support positioning may be observed in Figure 3. It should be noted that there is minimal interference in the full facial coverage helmets.

The target that the subjects observed entering their field of view was a white dot on the black trolley. The 0.81 inch diameter dot subtended a one (1) degree visual angle to the subjects' eyes. Indirect lighting (provided by four photo flood lamps) produced a bright non-glare room illumination. Light incident on the white dot was measured as approximately 100-foot candles.



(a) side away from subject (b) side toward subject

FIGURE 6 Trolley With Visual Target and Angle Indicator

FIGURE 7 Chin Support and Guide Device

C. Subjects

A total of 19 subjects (18 male and one female) completed the test series. All participants were experienced motorcyclists. It was felt that this group of people could better position (to normal comfort levels) the helmets and not suffer fatigue during the one and one-half hour test. Subjects ages ranged from 20 to 55 with median age of 31. Fifty percent of the participants normally wore eye glasses. Many did not use their glasses during the test because the temple (side) portion of the frames blocked a particular perimeter target position. It was felt that vision rather than eye glasses style was to be tested, so when interference occurred the subjects removed their glasses. Many near-sighted individuals commented that they could easily perceive (though not see with great acuity) the target when it was out of the range of normally corrected vision.

III. Results and Discussions

A. Helmets

At each test angle, with respect to the horizontal plane, three trial readings were recorded. Typically, the subject and helmet positions remained fixed so that the readings were within a few degrees of each other. The data were gathered for all subjects at each angle. Table 1 shows the mean and standard deviation obtained from all individual data.

The standard deviations were rather large for both helmeted and unhelmeted conditions at each test angle. Several simple explanations were obviour rom the nature of the test. First, there are physiological and anatomical differences between subjects that affect both normal field of view and position within the helmet. Second, exact placement of the helmet on the head and precise positioning of the head in the perimeter were difficult to obtain repeatably. Third, slight and unconscious head and shoulder movements from side-to-side were impossible to control.

However, there was a concept that was overlooked in the experimental design that now appears to be a major factor. While the chin rest provided positive downward and side-to-side head guidance, the jaws were not clamped down. Table 1 clearly indicates a larger scatter in the data for above the horizontal plane readings as compared to below. Thus, if a subject subconsciously opened his jaw when looking up towards a target, then an artifically larger visual field would be recorded. This phenominon could occur with both helmeted and unhelmeted subjects.

Angular Plane	Arthur Fulmer		Bell		Buco		Shoei		No Helmet	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
0°	113.6*	6.4	92.1	5.7	116.1	5.20	107.1	4.8	116.2	7.8
+35	80.3	12.7	70.1	12.3	83.9	11.0	77.1	9.5	85.7	9.9
+70°	46.8	11.6	37.6	8.2	56.3	12.5	47.2	10.9	64.3	11.5
+110°	49.3	14.1	38.9	8.2	54.8	11.5	46.4	9.1	66.5	11.0
+145°	85.1	11.3	69.6	11.3	83.9	12.7	77.0	9.3	88.5	11.9
-35°	107.0	8.1	70.4	10.0	107.7	6.1	89.5	8.4	111.1	7.8
-70°	81.7	6.1	39.4	8.1	81.5	6.2	51.4	9.9	84.0	6.0
-110°	81.8	7.8	41.5	6.8	79.9	7.0	53.4	6.9	83.7	6.5
-145°	104.8	10.0	67.9	9.4	107.4	9.0	90.6	6.7	110.5	7.4
180°	112.5	7.2	89.5	6.8	115.6	7.3	108.2	7.0	116.5	7.8

TABLE 1 Mean and Standard Deviation Data for All Angular Planes

*All measurements are in degrees

Considering the large number of variables that are very difficult to fully control, the statistical aspects of the data seem adequate for the intended purpose of an initial determination and identification of field of view values with and without helmets.

Figures 8 through 12 graphically illustrate the average field of view for each helmet and the no helmet condition. Note that the field is displayed as the subject observes it (i.e. 0° is to the right). Figure 13 is a composite of the three helmeted and the unhelmeted test results. One of the full coverage helmets is omitted because it is essentially the same as the other.

As noted in the introduction, a primary purpose of this work was to develop data on the degree to which the lateral vision (i.e., the field of view in the horizontal plane) is reduced by the use of safety helmets. Helmets representing the "worst case" and the typical case of lateral field reduction were used.

Table 2 displays the total visual field along the horizontal plane for each of the helmets tested as well as the unhelmeted condition. From this table it can be determined that the two full coverage helmets (Arthur Fulmer and Buco) had relatively little effect on lateral vision; both reduced the field less than 3 percent. The Shoei helmet, a full facial coverage helmet designed to meet FMVSS No. 218, reduced the total visual field along the horizontal plane by only 7.3 percent. The Bell Star* full facial helmet was selected as the "worst case" helmet in terms of reduction in the field of view along the horizontal plane. The Bell Star helmet reduced lateral vision by 21.9 percent. However, as noted previously, this configuration of helmet accounts for less than 6 percent

*Bell also markets another full facial coverage helmet, the Star 120, which provides a field of view similar to the Shoei helmet.

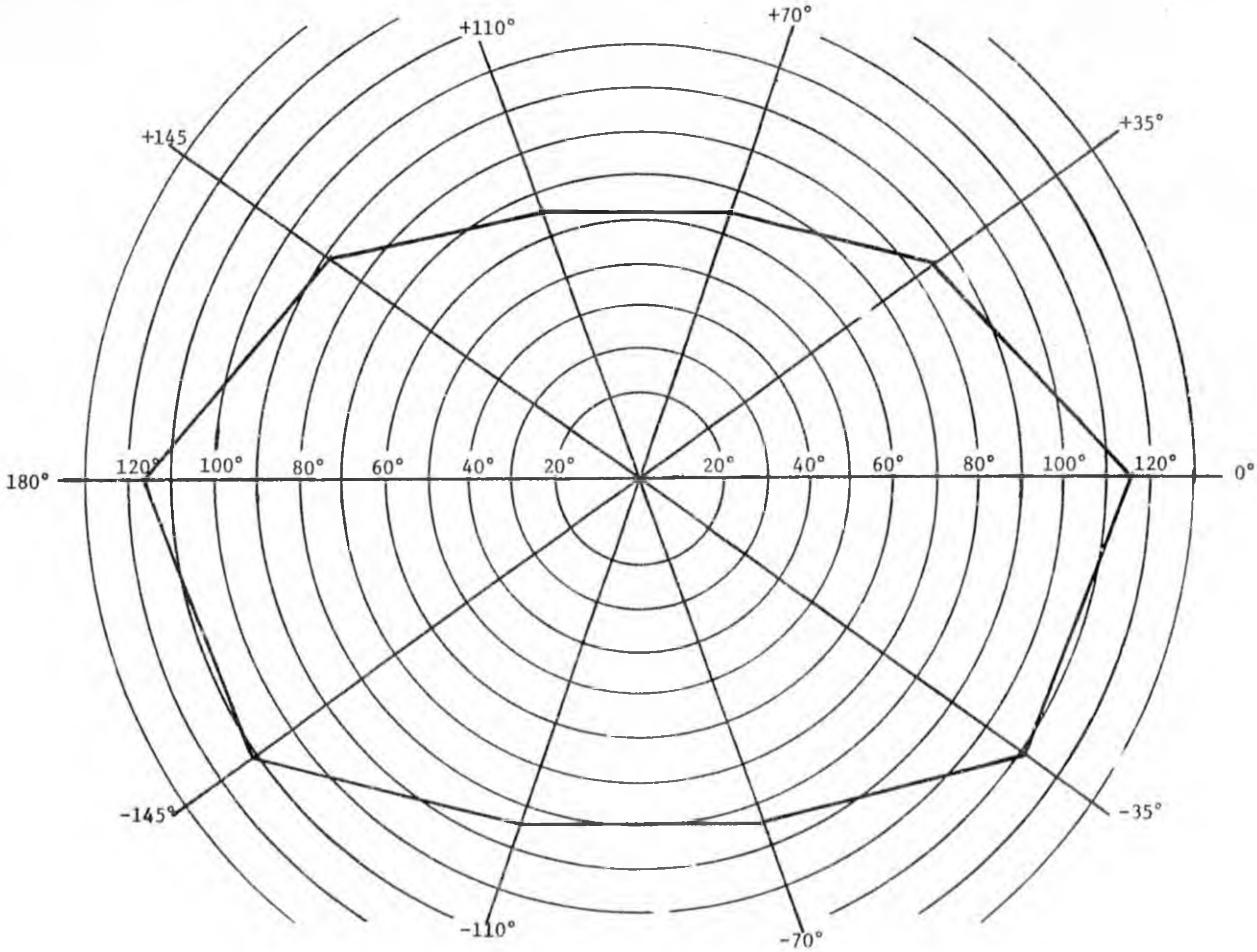


FIGURE 8 -Average Visual ield With No Helmet

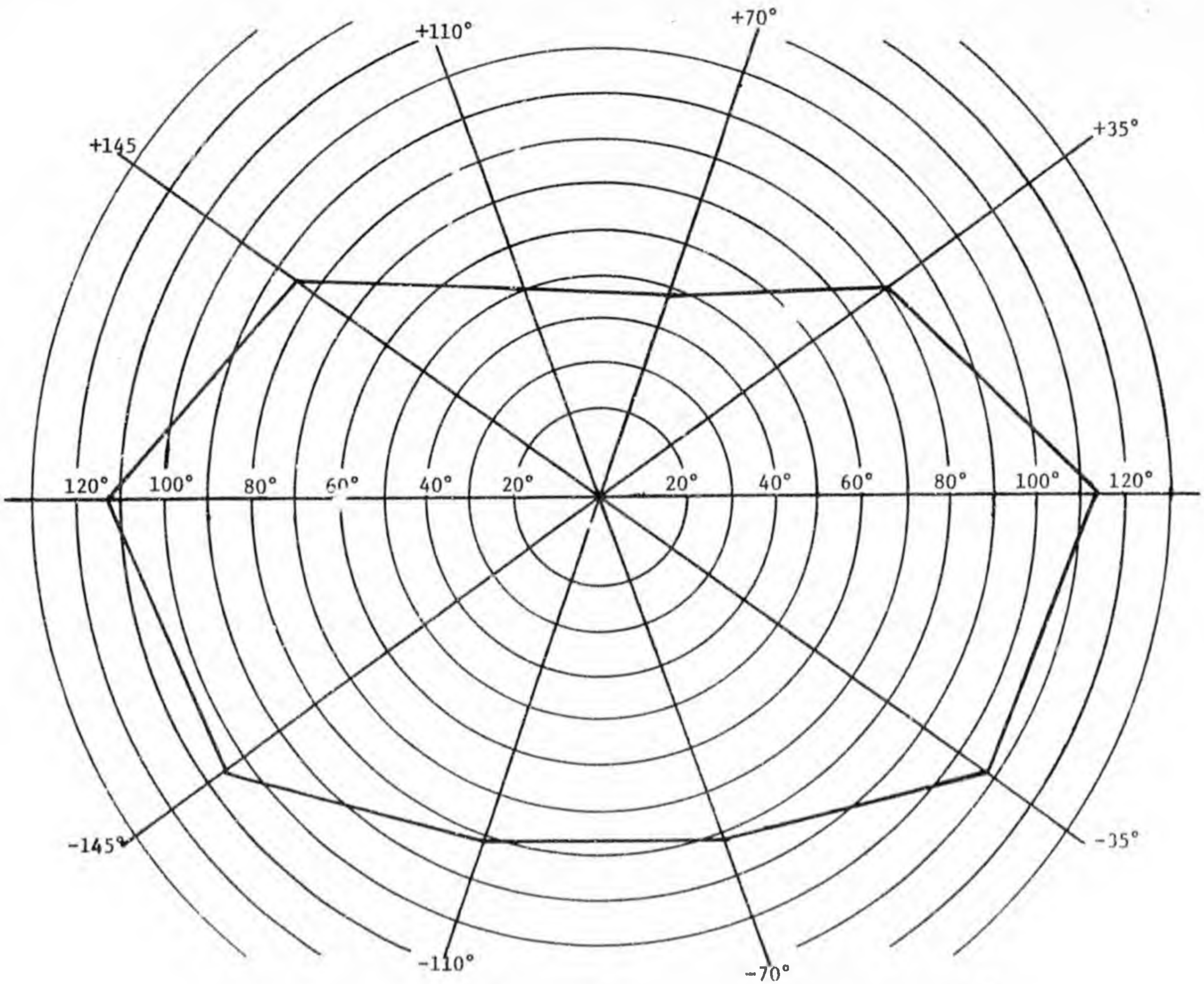


FIGURE 9 - Average Visual Field with Arthur Fulmer Model AF-40 Helmet

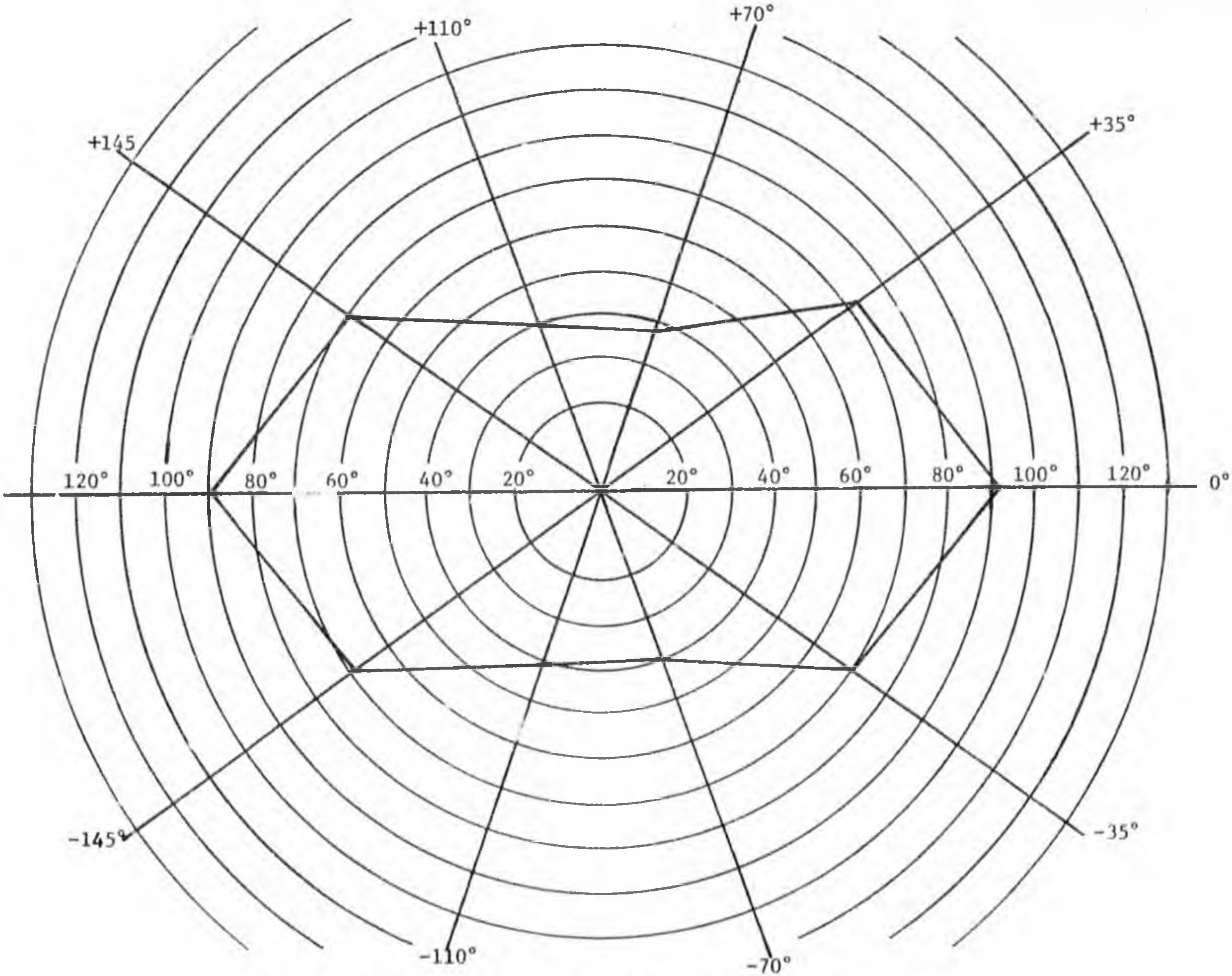


FIGURE 10 - Average Visual Field With Bell Star Model Helmet

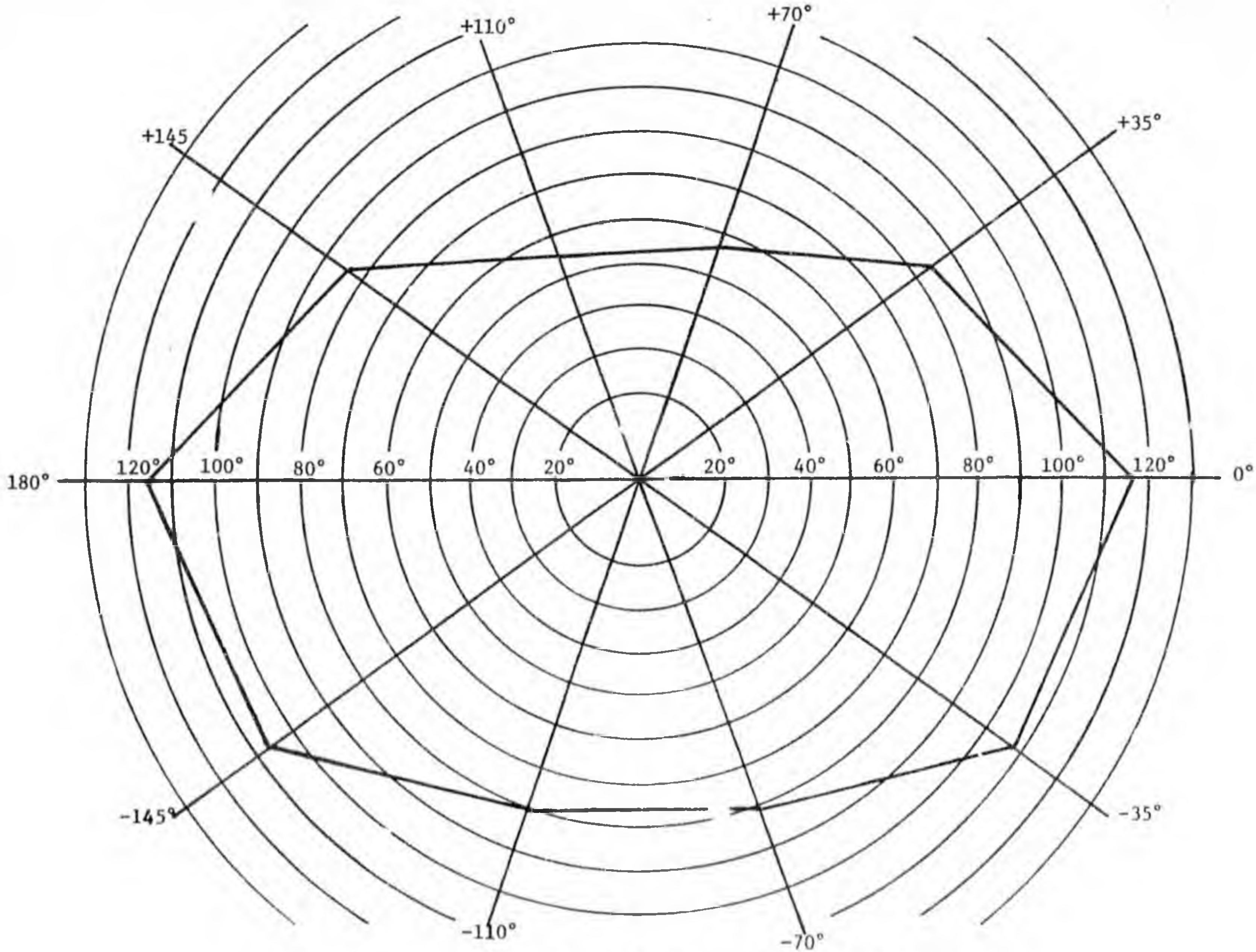


FIGURE 11 - Average Visual Field With Buco Enduro Model Helmet

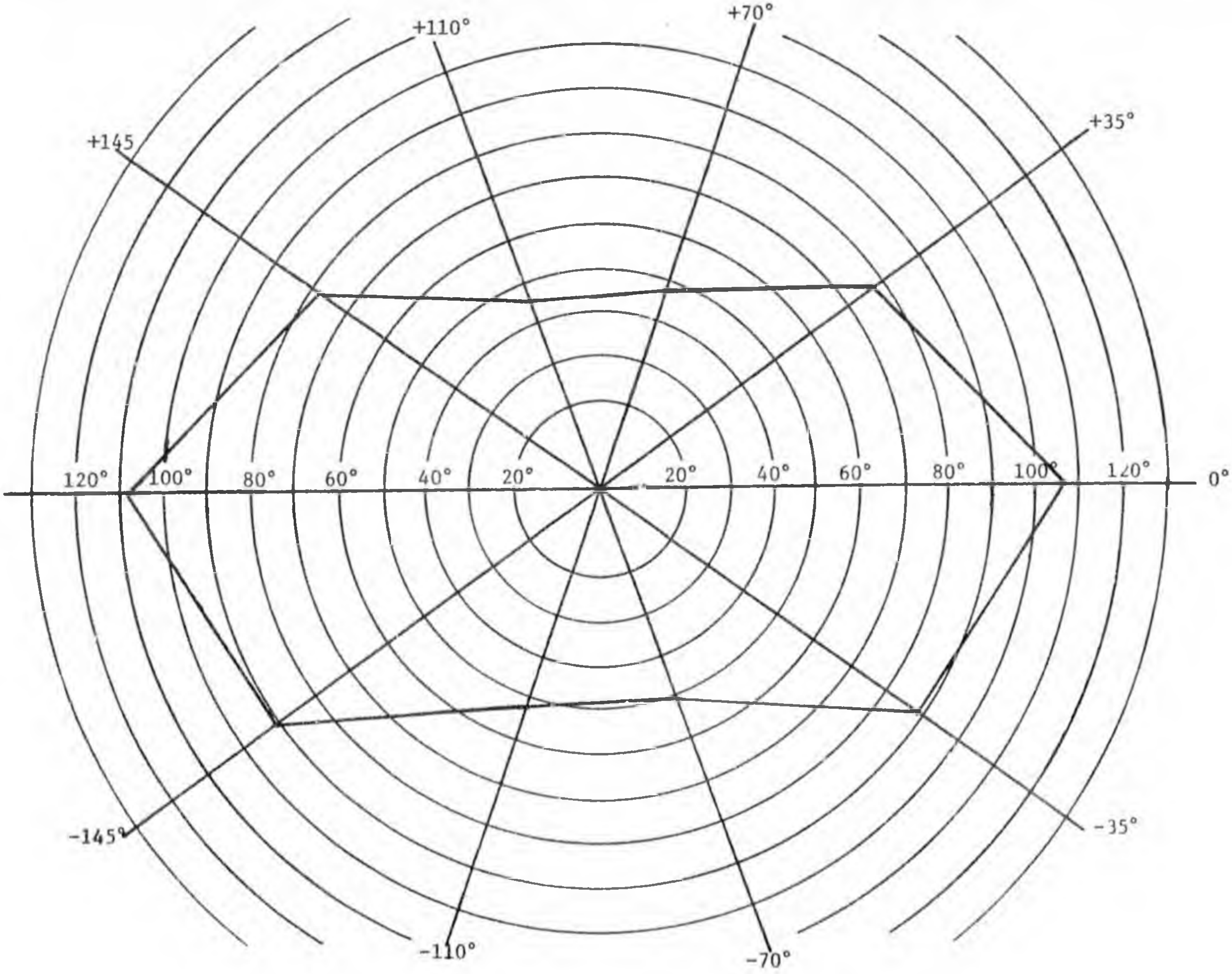


FIGURE 12- Average Visual Field With Shoei Model S-20 Helmet

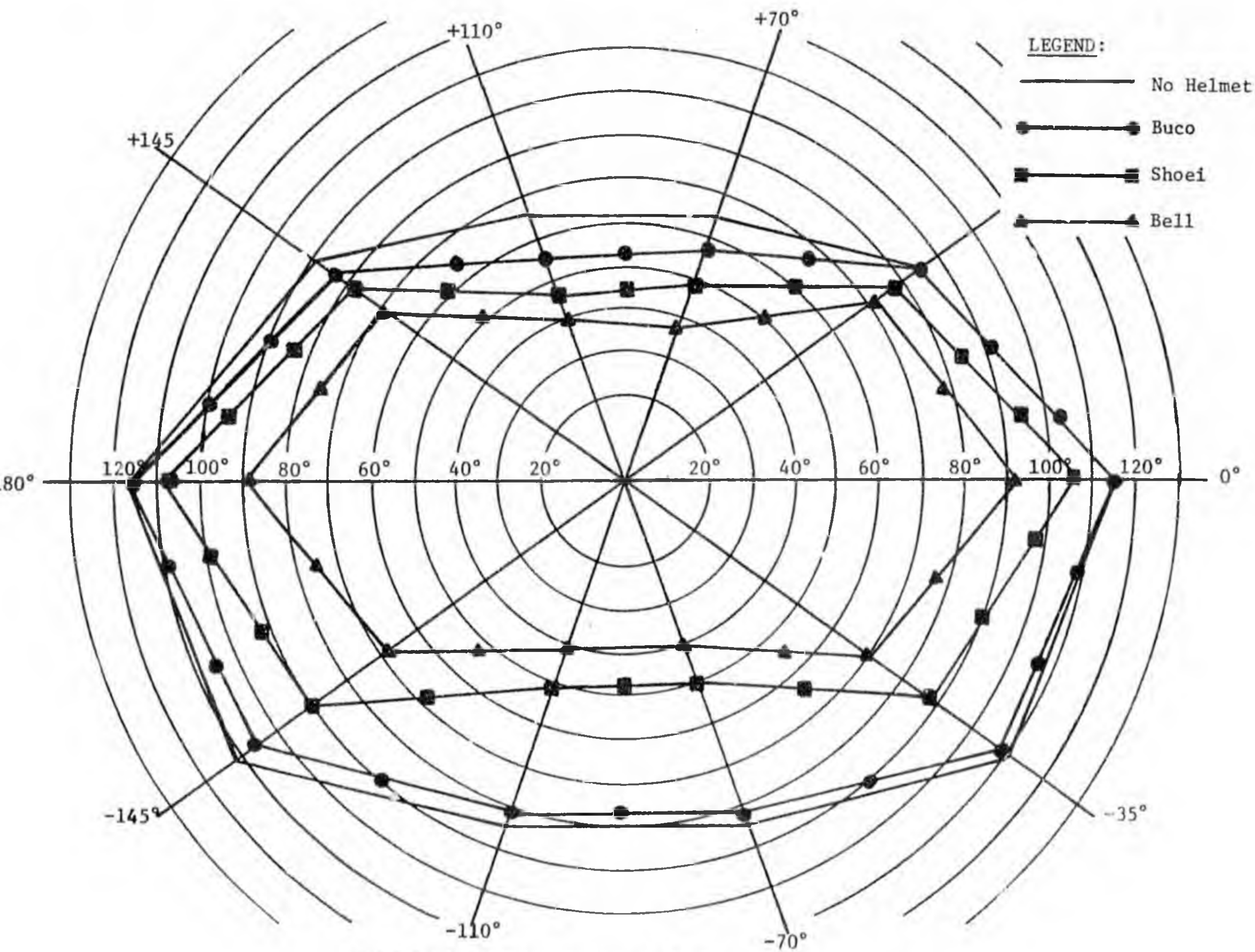


FIGURE 13 Composite Visual Field

of current helmet sales and many of these are used exclusively for off-road motorsport activities rather than for on-street motorcycle riding.

	Arthur Fulmer	Bell	Buco	Shoei	No Helmet
Mean	226.2°	181.7°	231.7°	215.8°	232.7°
Standard Dev.	12.9°	10.6°	11.3°	9.0°	14.0°
Percent Reduction from no helmet value	2.8%	21.9%	0.4%	7.3%	-

TABLE 2 Total Visual Field Along the Horizontal Plane

As can be observed from Figures 8 - 13, the full facial coverage helmets (Bell and Shoei) reduced the total visual field along the vertical planes significantly from the unhelmet or full coverage helmet conditions. Full facial coverage helmets also accounted for a significant reduction in the total field of view area (i.e., the envelop depicted by the bold lines in Figures 8 - 13). In the extreme comparison between the "worst case" helmet, the Bell Star, and the no helmet condition, the total visual area was lessened by 55 percent.

Two facts must be made clear at this point. First, along the horizontal plane all helmets provide more than a 180° field of view. This exceeds the maximum 140° total "peripheral" vision required for any State licensing test. Second, choice in helmet purchasing is the decision of the individual mototcyclist. The full coverage helmets met DOT regulations (FMVSS No. 218) and had relatively small effects on the visual field. If additional protection is desired, then a full facial coverage helmet may be the rider's choice.

B. Goggles and Safety Glasses

Goggles and safety glasses were evaluated only along the horizontal plane. The total field was 184.2° for the Salice goggles and 186.1° for the Scott g les. These values were very similar to those of the Bell Star helmet. everal participants complained about the distortion in the Salice goggles due to the double curvature of the bubble shaped plastic shield.

The safety glasses evaluation proved to be meaningless. Two conditions existed --either the temple piece interfered or it did not. If the side piece did not obstruct viewing the target, then normal bareheaded vision was being tested. Therefore, the only safety glasses data which is meaningful is that about 50% of the wide framed Studio Craft glasses interfered with lateral vision. The thin framed Foster Grant glasses did not obstruct vision.

One interesting extraneous result appeared when testing with Foster Grant glasses. Because this test was essentially the same as the initial bareheaded test, the two were compared. The glasses test was the final procedure of an hour and a half test program. Despite the generally tired eye conditions of most subjects, the average total horizontal field increased from 232.6° to 237.5°. This small, but consistent (13 to 19 subjects) improvement appears to be a psychological, as well as physiological function of a learning process.

C. Additional Tests

Two tests related to vision (but not measured with the perimeter device) were also performed on all subjects. The first study dealt with reduced head turning with motorcycle helmets. Table 3 displays the findings of this study. The results with a light-weight hockey helmet were clearly larger than with the motorcycle helmets. Each subject provided data for four comparisons between no helmet (as simulated with a hockey helmet) and motorcycle helmet conditions. Therefore a total of 76 (4 x 19) comparisons could be made. Surprisingly, 86% of the individual analyses showed higher angular rotation for the hockey helmet condition. The restriction of head turning is small, but highly consistent. There appears to be no anatomical obstruction, so the effect is probably psychological in nature.

	Hockey Helmet	Arthur Fulmer	Bell	Buco	Shoei
Total Angle	195.8°	188.4°	188.6°	187.4°	184.4°

TABLE 3 Head Turning (Side-to-Side)

Data was collected on the typical positioning (presumably the most comfortable) that each subject chose. Measurements were made of the approximate distance between the center of the participant's eye and the helmet brim above. In order of increasing distance, the helmets were as follows: Bell (1.22), Arthur Fulmer (1.38), Shoei (1.51), and Buco (1.84). The standard deviations were large, so it is difficult to specify a typical comfortable helmet placement index.

IV. Summary and Conclusion

In general, motorcycle helmet visual restrictions were smaller along the horizontal plane as compared to the vertical planes. The full coverage helmets produced relatively small reduction in the entire field of view. As expected, the full facial coverage helmets resulted in somewhat larger reductions. The two styles of full facial coverage helmets yielded significantly different fields of view. Goggles produced approximately the same lateral visual field as the most restricted helmet.

With regard to restriction of the total field of view in the horizontal plane, it can be concluded that full coverage helmets (the most common type in use) provide only minor restrictions, less than 3 percent from that of an unhelmeted person. The full facial coverage helmets designed to comply with the lateral vision requirements of the ANSI Z90.1 standard and FMVSS No. 218 provided a restriction in lateral vision only marginally more than the full coverage helmets (7.3 percent). The "worst case" helmet provided a restriction of 21.9 percent from the unhelmeted lateral field.

All helmets tested exceeded the maximum State licensing requirements of 140° total "peripheral" view in the horizontal plane. Also, all helmets were in general compliance (especially visual regulations) with DOT standards. Therefore, helmet selection in terms of acceptable visual field, appears to be a matter of personal preferance among the many available styles.

NHTSA Technical Note

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EFFECT OF SAFETY HELMETS ON AUDITORY CAPABILITY

Prepared by:

U.S. DEPARTMENT OF TRANSPORTATION
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ROBERT L. HENDERSON

INTRODUCTION

One of the arguments advanced by opponents of safety helmets and laws mandating their use is that such helmets reduce auditory capability to a level unsafe for driving. There is no scientific data supporting this view. There is, however, scientific data showing clearly that the reduction in auditory capability resulting from wearing a protective helmet is inconsequential in the driving situation. The primary reason for this is that the noise generated by the motorcycle itself (and at higher speeds, by wind) is so great that any sound loud enough to penetrate this noise is loud enough to be heard inside a helmet.

To understand why this is true, it is necessary to examine the phenomenon of "hearing." Whether or not a given sound will be heard by a driver is dependent upon three factors:

1. The auditory capability of the driver; i.e., his sensitivity to sound stimuli at each frequency within the auditory range (20-10,000 Hz for the average adult).
2. The intensity and frequency composition of the sound at the ear of the driver.
3. The intensity and frequency composition of any ambient noise that might "mask" or hide the desired sound, also measured at the ear of the driver.

A given sound will be heard by a driver if it is loud enough, when it reaches his ear to be above his threshold (minimum sensitivity), and if it is not "masked" or hidden by other sounds (noise) present at the same time. Motorcycles create average levels of ambient noise ranging from 85 to 98 db(A) for on-street or dual purpose vehicles to as much as 110 db(A) for racing machines (Harrison, 1974). For a rider to hear any other sound in the presence of this high noise level, the sound must be as loud as or louder than the motorcycle itself; i.e., have a signal-to-noise ratio of approximately 1:1. If these conditions hold, the sound can theoretically be "heard" by an attending driver. The greater the signal-to-noise ratio; e.g., the more intense the sound of interest relative to the ambient noise, the greater the "attention-getting" properties of the signal and the higher the probability that it will be heard. In the paragraphs that follow, it will be shown that wearing a protective helmet reduces the loudness of both sounds of interest and motorcycle noise an equal amount and hence does not alter the signal-to-noise ratio between the two. Consequently, as long as the rider can hear the motorcycle itself while wearing a protective helmet, he or she can also hear any other sound with a favorable signal-to-noise ratio at least as well as a driver who does not wear a protective helmet.

BASIC HUMAN AUDITORY CAPABILITY

The theoretical sensitivity of the human auditory mechanism to sound stimuli of various frequencies is shown in Figure 1 (after Kryter, 1970). Maximum sensitivity occurs between 1000 and 3000 Hz, decreasing at both higher and lower frequencies. This sensitivity distribution would rarely be found in an individual driver, since the progressive loss in hearing sensitivity due to the aging process will have begun by the time an individual is old enough to be licensed. Since the aging process does significantly affect auditory capability, it must be considered in our analysis. In the absence of quantitative data concerning the age distribution of motorcycle drivers, an arbitrary assumption was made that relatively few motorcycle drivers would be found older than 55, with the vast majority of drivers considerably younger. By selecting an age range between 46-55, for which good auditory sensitivity data was available, it was felt that the analysis would involve the "worst case" situation with regard to driver age. In other words this group would represent the motorcyclists who could hear least well; those with the greatest loss of auditory sensitivity. The top curve in Figure 1 illustrates the effects of aging on the auditory threshold of a group of 367 males between 46 and 55 years of age (from Kryter, page 118). It can be seen from this figure that the age-related hearing loss is restricted to the higher frequencies, commencing around 600 Hz for this group, and increasing rapidly with increasing frequency.

DIRECT EFFECT OF HELMETS ON AUDITORY THRESHOLD

Wearing a protective helmet has exactly the same effect on auditory threshold as hearing loss due to aging; e.g., the auditory threshold is raised, in this case by an amount equal to the sound attenuation provided by the helmet. An indication of the magnitude of this attenuation or "helmet loss" is presented in Figure 2. This figure shows the average difference between the intensity of sounds measured inside a number of different helmets at the ear of the wearer, and the intensity of the same sounds measured outside

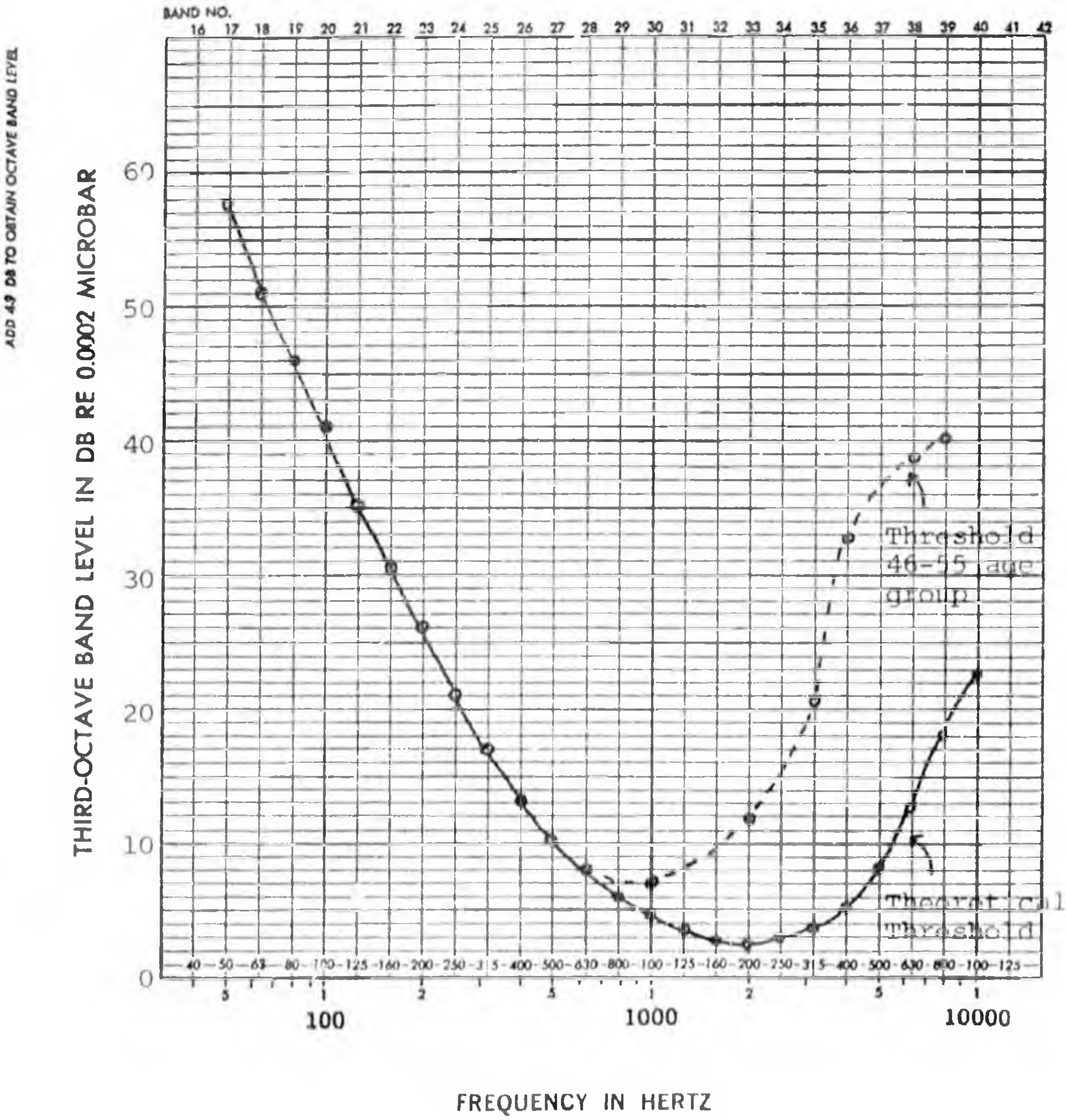

Figure 1. Human Auditory Sensitivity to Sounds of Different Frequencies