AD-765 326

TREE AND AUTOMOBILE DEBRIS

Robert E. Warren

Bell Telephone Laboratories, Incorporated

Prepared for:

Defense Nuclear Agency

31 August 1973

DISTRIBUTED BY:

NTIS

National Technical Information Service
U. S. DEPARTMENT OF COMMERCE
5285 Port Royal Road, Springfield Va. 22151

Best

Available

Copy

POR-6787
(WT-6787)

MIDDLE NORTH SERIES

DIAL PACK EVENT

AD 765326

PROJECT OFFICERS REPORT

PROJECT LN108

TREE AND AUTOMOBILE DEBRIS

HEADQUARTERS
DEFENSE NUCLEAR AGENCY
WASHINGTON, D.C. 20305

Issuance date: 31 August 1973

POR-6787
(WT-6787)

MIDDLE NORTH SERIES

DIAL PACK EVENT

PROJECT OFFICERS REPORT—PROJECT LN108

TREE AND AUTOMOBILE DEBRIS

HEADQUARTERS
DEFENSE NUCLEAR AGENCY
WASHINGTON, D.C. 20305

R. E. Warren, Project Officer

Bell Telephone Laboratories
Whippany, New Jersey 07981

ABSTRACT

Information was needed on the fragmentation of trees and automobiles in the 10- to 50-psi peak overpressure range of a high-explosive test, as part of a program to evaluate the hazards of these debris sources near certain blast-hardened facilities. Toward this objective, full-size trees and automobiles were exposed at Event Dial Pack, a test operation where a 500-ton TNT surface charge was detonated. Three spruce and three aspen trees were subjected to this blast at both the 15- and 50-psi overpressure locations, and four automobiles were placed at each of the 15-, 30-, and 50-psi positions, with another stationed at 10 psi.

The fragmentations of these trees and automobiles are described by determining the weight distributions and size descriptions of the tree debris and the weight distributions of the automobile debris as a function of overpressure. It is found that about 60 percent of the branchwood weight was fractured from the trunk fragment sections of the tree species at 15 psi, and nearly 100 percent at 50 psi. Also, on the average, 15, 80, 160, and 400 pounds of debris originated from each automobile at 10, 15, 30, and 50 psi, respectively. The tree-fragmentation results from this project compare quite well with those obtained from similar tests conducted in a shock tunnel.

As secondary objectives, the dispersion and lofting of the tree and automobile debris at their respective source overpressure positions are approximated. The dispersion estimates are based on the recorded ground distributions of these debris, and lofting estimates are gained from the high-speed movie films taken.

PREFACE

Project LN108 at Event Dial Pack was performed to obtain information on blast-generated tree and automobile debris with regard to the SAFFGUARD ABM System (for which Bell Telephone Laboratories is doing the research and development) and with regard to the blast-hardened communication network system.

The author would like to acknowledge E. F. Witt of Bell Telephone Laboratories for his aid in planning and conducting this investigation; A. P. R. Lambert, Resident Project Officer, for his able assistance in coordinating the project field operations; and L. Giglio-Tos of U. S. Army Ballistics Research Laboratories for providing pressure-transducer support instrumentation to obtain the project overpressure recordings, as part of Project LN101, which was under his direction.

UNCLASSIFIED

Security Classification

DOCUMENT CONTROL DATA - R & D

Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author)
Bell Telephone Laboratories, Inc.
Whippany Road
Whippany, New Jersey 07981

2a. REPORT SECURITY CLASSIFICATION
UNCLASSIFIED

2b. GROUP

3. REPORT TITLE

Tree and Automobile Debris

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)
Project Officer's Report of Project LN108, Event Dial Pack

5. AUTHOR(S) (First name, middle initial, last name)

Robert E. Warren

6. REPORT DATE
31 August 1973

7a. TOTAL NO. OF PAGES
156

7b. NO. OF REFS
13

8a. CONTRACT OR GRANT NO.

b. PROJECT NO. LN108

c.

d.

9a. ORIGINATOR'S REPORT NUMBER(S)
POR-6787
(WT-6787)

9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)

10. DISTRIBUTION STATEMENT

Approved for Public Release; Distribution Unlimited.

11. SUPPLEMENTARY NOTES

12. SPONSORING MILITARY ACTIVITY
Director
Defense Nuclear Agency
Washington, D.C. 20305

13. ABSTRACT

Information was needed on the fragmentation of trees and automobiles in the 10- to 50-psi peak overpressure range of a high-explosive test, as part of a program to evaluate the hazards of these debris sources near certain blast-hardened facilities. Toward this objective, full-size trees and automobiles were exposed at Event Dial Pack, a test operation where a 500-ton TNT surface charge was detonated. Three spruce and three aspen trees were subjected to this blast at both the 15- and 50-psi overpressure locations, and four automobiles were placed at each of the 15-, 30-, and 50-psi positions, with another stationed at 10 psi.

The fragmentations of these trees and automobiles are described by determining the weight distributions and size descriptions of the tree debris and the weight distributions of the automobile debris as a function of overpressure. It is found that about 60 percent of the branch wood weight was fractured from the trunk fragment sections of the tree species at 15 psi, and nearly 100 percent at 50 psi. Also, on the average, 15, 80, 160, and 400 pounds of debris originated from each automobile at 10, 15, 30, and 50 psi, respectively. The tree-fragmentation results from this project compare quite well with those obtained from similar tests conducted in a shock tunnel.

As secondary objectives, the dispersion and lofting of the tree and automobile debris at their respective source overpressure positions are approximated.

DD FORM 1 NOV 65 1473 REPLACES DD FORM 1473, 1 JAN 64, WHICH IS OBSOLETE FOR ARMY USE.

UNCLASSIFIED

Security Classification

UNCLASSIFIED

Security Classification

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Event Dial Pack						
Debris						
Tree Debris						
Automobile Debris						
Vehicle Debris						
Blast Transport						
Blast Fragmentation						
Blast Damage						
Dispersion						
Tumbling						
Blowdown						

UNCLASSIFIED

Security Classification

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

Page

FIGURES (continued)

TABLE OF CONTENTS (Continued)

Page

FIGURES (continued)

CHAPTER 1

INTRODUCTION

Debris sources in the vicinity of SAFEGUARD ABM sites and blast-hardened communication stations could be a major hazard to the functioning of these systems in the event of a nuclear attack. A blast wave produced by a large-yield nuclear detonation near such facilities would fragment these sources and transport the resulting debris significant distances. The high-energy impacts of this debris and its accumulation are capable of causing damage to, and malfunctions of, vital system components.

Essentially, the SAFEGUARD sites and the hardened communication stations are each designed to withstand a certain prescribed nuclear blast environment and the corresponding nuclear weapons effects. This fact implies, among other things, that the sites and stations must be able to tolerate the expected debris hazard conditions posed by nearby debris sources and associated with their prescribed design environment (and any less severe environment).

1.1 BACKGROUND AND THEORY

A debris studies program has been underway at Bell Telephone Laboratories to determine and describe the debris hazards of various typical debris sources associated with the above-mentioned prescribed design nuclear blast environments. Since buildings, trees, automobiles and other vehicles are usually the most predominant and most hazardous types of debris sources found close to the above-stated hardened facilities, efforts have been primarily directed toward describing the hazards of these source types for the blast environments of interest. The ultimate purpose of this program is to recommend appropriate protective measures or changes to be taken in those instances where the hazard is determined to be too severe.

1.1.1 Present Model. Because of the nuclear test ban, debris hazard information regarding a specific source cannot be directly obtained by conducting tests at the prescribed high-weapon-yield environments of interest. An alternative approach had to be devised instead. Consequently, a model has been developed with the capability of predicting the debris hazard conditions of any given source for any given blast environment in the region of Mach reflection. However, the model has to be supplemented with data on the fragmentation of the source primarily, and on the lofting and dispersion of the source debris secondarily, in the specified environment before an accurate debris hazard prediction can be made. The dispersion of debris refers to the tangential or sideward (normal to the radial plane) movement of debris during transport relative to its radial transport, in a statistical manner, while lofting alludes to the statistical vertical movement of debris relative to its radial transport. Fortunately, the fragmentation, lofting, and dispersion data are approximately independent of weapon yield, but mainly depend on peak overpressure or actually peak dynamic pressure. Therefore this data can be obtained in low-yield high-explosive tests. The transport of debris is the main feature simulated by the model due to strong weapon-yield dependence.

Basically, the model predicts the blast-wave transport of all the debris generated from a source; the debris hazard conditions are no more than a description of the debris transport phase and the final debris accumulation conditions. Before the model can be used, the breakup or fragmentation of the source, or an integral part of the source, must be known. The source fragmentation data needed are the weight and size distributions, and their interrelationship, of all the debris originating from the source (or an integral part). This information is required since the weight-size (shape) relation of a debris fragment specifies its aerodynamic characteristics which are necessary inputs or prerequisites for the model transport calculations, and in addition, numbers, weights, and sizes are fundamental parameters in describing the hazard conditions. Once this data is experimentally determined for the given environment, the debris is lumped into groups of similar aerodynamic characteristics and its transport is estimated by numerically integrating the debris transport equations of motion. A one-dimensional blast wind is assumed in these calculations as the environments of interest are in the Mach region. The transport equations do not account for the secondary forces causing lofting and dispersion and therefore, approximation of these subordinate effects must also be acquired experimentally. Only the hazard conditions of an integral part of the source (i.e., a single tree or a single automobile) need be found in this manner when superposition of these integral results can be used by the model for estimating the overall hazard of the entire source (i.e., a forest or parking lot). Superposition applies for multiple tree sources because a blast wind passing through a forest stand has shown evidence of remaining one-dimensional with no appreciable attenuation or increase in rise time attributable to the presence of trees: Operations Upshot-Knothole (Reference 1) and Castle (Reference 2). Similar shielding effects for automobiles can be assumed small and superposition used. However, the shielding effects of closely spaced buildings cannot be neglected.

In summary, model predictions of the debris hazard conditions of tree sources, automobile sources, and non-close building sources, are contingent upon determining the fragmentation, lofting, and dispersion data for the single-tree, the single-automobile, and the single-building sources, respectively, at the environmental overpressures of interest.

1.1.2 Previous Experiments. The fragmentation, dispersion, and lofting data for various types of single-building sources were obtained in projects that participated in two previous high-explosive experimental programs conducted at Defence Research Establishment Suffield (DRES), Canada: Operation Distant Plain in 1966 (Reference 3) and Event Prairie Flat in 1968 (Reference 4). The hazard of any nonclose building source can be predicted at the environments of interest using these results. Analogous tree and automobile information was needed to approximate their corresponding hazards. At the present time, no theories exist to aid in the estimation of tree and automobile fragmentation, or dispersion and lofting of tree and automobile debris, in any blast environment. Furthermore, though several prior experimental tests were indirectly related to the tree and automobile fragmentation topics, the data acquired was usually inappropriate and inapplicable. A short summary of these tests follows.

Trees have been exposed in several previous nuclear and high-explosive tests. However, the tests were not concerned with fragmentation, but with tree response to blast loadings, the effect of tree stands on the free-field blast flow, or the blowdown of trees due to blast as a hazard and impediment to troop and equipment movement. Some tree-debris transport and fragmentation data were indirectly obtained in a few of these tests. A literature survey on this subject appears in Reference 5. Unfortunately, the fragmentation data is of little value since a complete survey of all the debris from a single tree or group of trees is required for an adequate tree-fragmentation description. Also, all of these latter tests and most of the other tree tests were conducted at environmental overpressures quite different from the design overpressures of the hardened facilities of concern. To troubleshoot and help plan this project, and obtain preliminary tree-fragmentation data, tree sections of various tree species were subjected to blasts in the shock tunnel facility at the URS Research Company in December 1969 (Reference 5). Though not thorough, the shock tunnel results were the only relevant tree-fragmentation data before the results of this project became known. A comparison of corresponding results appears later in the Results and Discussion chapter of this report (Chapter 3).

Automobiles have been subjected to several nuclear bursts in Nevada, yet at environments of little interest, and furthermore, the prime regard was the damage sustained and not fragmentation. Jeeps, on the other hand, have been exposed to several nuclear and high-explosive detonations at environments of interests, but also for purposes of determining their damage and vulnerability under various blast loadings (References 6 and 7). Nevertheless, the postshot photographs of these jeeps give an idea of their overall fragmentation under such conditions. The best estimate of automobile fragmentation before this project followed from the reasoning that automobile fragmentation would be slightly greater than jeep fragmentation at the same blast environment. This is because automobiles are less rigidly constructed, they have a larger number of loosely attached extraneous parts, and their tumbling transport would be larger since they have a higher drag per unit weight in a given environment.

1.2 OBJECTIVES

The intentions of this project were to obtain data needed on the fragmentation of trees and automobiles, and on the dispersion and lofting of their respective debris, in the 10- and 50-psi peak overpressure range of a high-explosive test. The project was conducted at Event Dial Pack, which involved a 500-ton TNT surface explosion with the equivalent air blast environment as that from a 1-kiloton nuclear surface burst. The TNT stack of this event was detonated July 23, 1970. More complete explanations of these test objectives in this blast follow.

The principal objective was to determine the weight and size distributions, and their interrelationship, of all the debris fragmented from typical trees and automobiles at overpressures between 10 and 50 psi in the Dial Pack blast. To meet this objective, three aspen (a representative broadleaf) and three spruce (a representative conifer) trees were subjected to the blast at both the 15-psi and 50-psi overpressure locations; and four automobiles were exposed at each of the 15-psi, 30-psi, and 50-psi locations, with one automobile located at 10 psi. Then after the shot, the weight and size of all the debris fragments were recorded. The reason for stationing multiple sources of the same kind or specie at the same overpressure was to obtain more reliable statistical averages of these distributions and approximations of the statistical variations from these means.

Secondary objectives were to determine the dispersion and lofting of the tree and automobile debris fragments at the overpressures where their respective sources were placed. The final ground positions of all the debris fragments were recorded, besides their weights and sizes, to estimate dispersion. The high-speed movies photographed the lofting of debris into the air since this is the most convenient method of determining the extent of lofting. The films were also taken to observe the fragmentation of certain sources and the dispersion of some debris during transport to aid in estimating this effect.

A minor objective was to situate various square blocks on the ground and measure their overall blast transport. The collecting of this data is part of a continuing study of the tumbling soil-fragment interaction toward refining the tumbling-mode transport calculations by the hazard prediction model.

CHAPTER 2

PROCEDURE

2.1 PRESHOT PREPARATION

Work at the test site began about 3 weeks before shot day. Briefly, the pre-shot activity consisted of readying the twelve trees, thirteen automobiles, tumbling blocks, and four high-speed movie cameras mounted on top of camera poles, in their appropriate positions.

Each tree was held firmly upright in position by a 14-inch-nominal steel pipe (1/4-inch wall thickness, 14-inch outer diameter) that encased the lower 4 feet of its trunk. It was an easy operation to place the twelve pipes in the ground and erect the trees in them. First, an 18-inch hole was bored 9 feet into the ground at each designated tree position. Then the pipes, each 13 feet in overall length, were lifted up and lowered into the holes so that only 4 feet of their lengths were visible above ground. Each pipe had four 3/4-inch bolt holes, 90 degrees apart, at both the 6-inch and 3 1/2-foot distances from one end. This end necessarily became the top end as each pipe was put into a hole. Next grout was poured between the walls of the holes and the outer pipe surfaces until the grout reached ground surface, making sure that the longitudinal axes of the pipes were vertical. After the grout set, soil was shoveled into the pipes to backfill them up to ground level. When each tree arrived at the site, it was painted and subsequently hoisted up and lowered 4 feet into its proper pipe. Eight bolts were then threaded through the eight bolt holes and adjusted accordingly until the tree was vertical and centered in the pipe. Finally, grout was packed into the void between the tree trunk and inner pipe surface until the grout became flush with the top end of the pipe. In effect, the pipe-holding scheme simulated a well developed root system because the trees were prevented from spinning with respect to the ground and from being uprooted when struck by the blast-wave drag forces. This simulation was intended to obtain the maximum tree fragmentation as a function of root development, though the variation is probably only slight.

About 10 days before the shot, six full-size Quaking Aspens and six full-size White Spruces were selected on a section of land owned by the Albertan Province and located about 20 miles west of Didsbury. These aspen and spruce species were chosen because they are representative broadleaf and coniferous tree species, respectively, and readily available in the Albertan forests. The botanical names of the two test tree species are listed in Table 2.1. Certain constraints, besides the qualification that the trees had to be full-sized, guided the selection of the six aspens and six spruces: The trees chosen had to be growing close to one another in the forest to simplify and speed the cutting and shipping operations; they had to be less than 50 feet tall to prevent them from greatly overhanging the 40-foot flatbed trailers used during transit; their maximum trunk diameters had to be no more than 12 inches so they fit into the pipes with space for the grout; and structurally, the trees had to be well-developed and not sparsely foliaged since a large quantity of tree debris was needed to observe tree-fragmentation trends. Some approximate properties or characteristics of the selected trees appear later in Table 2.2.

The tree operations in the forest began just two days before the blast was set off. The cutting of the spruce trees was started first, some 50 hours before shot time. After the initial two spruces were cut and loaded (each tree was loaded directly following its cutting) onto a 40-foot flatbed trailer in the alternate fashion of one treetop forward and the other to the rear, they were wrapped in polyethylene sheets, tied down, and then hauled 250 miles to the test site. Similarly, the other four spruces were cut, loaded, and transported in pairs. The cutting and loading procedure took, on the average, about an hour per tree. The next day, the aspens were likewise cut, loaded, and shipped in twos between the 26- to 20-hour period before the blast. Special care was taken throughout the cutting and loading operations to minimize the breakage of branches, especially in the case of the less pliant aspen branches; for example, following cutting, the spruces were lowered slowly to the ground using rope and then lifted and carried to the trailers by a bulldozer while, for the aspen trees, the blade of the bulldozer was first clamped near their trunk bases, after which they were cut and then carried in a vertical position to the trailers. The trees were cut as close to shot time as possible and wrapped for transit to keep their preshot drying to a minimum.

The trees arrived at the site approximately 7 hours after shipment, but unloading was sometimes delayed because the site was evacuated several times due to passing thunderstorms. Once the trees were ready to be unloaded, a crane was used to individually hook them about two-thirds of the way up their trunks, lift them off the flatbed trailers, and set them down slowly until their trunk bottoms rested on the ground and their tops were about 15 feet off the ground. This crane-held position proved convenient for stripping any damaged branches and for spray painting the trees each with a different color latex paint, while safeguarding the undamaged branches. After a thorough paint coating, the trees were raised vertically and lowered into the pipes by the crane. Finally, the trees were anchored securely in the pipes as mentioned. All the trees were in position 8 hours before zero hour.

A photographic summary of the work in the forest and at the test site toward readying the trees is shown in Figure 2.1.

Preparation of the automobile part of the project did not entail as much effort as the tree portion. After the thirteen automobiles were procured, descriptions of their conditions were recorded (Appendix D) and their major parts were code-marked with either paint or a felt pen for postshot identification. The automobiles were not oriented at their spots until the day before the firing so that they would not interfere with the preshot vehicle movement of other projects.

Four different kinds of tumbling blocks were placed in the blast. The block types were 1-foot-square solids differing only in weight (or density) and material composition. Some blocks weighed 65 pounds and were made of 3/4-inch plywood outer shells filled with cement. The other weight-material types were constructed of 10-pound flexible polyurethane foam, 2-pound flexible polyurethane foam, and 2-pound rigid styrofoam. The 65-pound blocks were made at the test site and the others were specially ordered. After acquisition, the only preparation was to paint each of the tumbling blocks a different color or pattern. The tumbling blocks were not positioned until the morning of the shot because they also would have restricted the preshot vehicle movement of other projects, and moreover the lighter tumbling blocks were susceptible to being blown about by any moderate preshot wind conditions.

Four high-speed movie cameras viewed certain sections of the project area during the blast. Two high-speed cameras were mounted on a 50-foot pole and the other two were mounted singularly on 20-foot poles. Putting the three poles in the ground was routine. However, it was necessary to stabilize the poles to prevent them from being shaken, and perhaps broken, by the blast forces. Stabilization of the poles was accomplished using a guy-wire arrangement: at each pole position, three 8-inch bell anchors were driven and secured well into the ground (6 to 8 feet deep at about 30- to 40-degree angles with vertical), after which three wire ropes were hung between fasteners bolted near the top of the pole and the turnbuckles attached to the bell anchor connecting rods, and lastly, the guy-wire ropes were tightened by threading the turnbuckles. The positions of the bell anchors relative to each pole were chosen so the strung wires made approximately 45-degree angles with respect to the pole and, when looking down from above, went out from the pole in directions 120 degrees apart, with one of the wires pointing toward ground zero. The cameras were housed inside protective aluminum boxes clamped near the top of the poles above the guy-wire fasteners. To conclude the preparation of these camera poles, the camera timing-signal power connections were made and the cameras were aimed, focused, and checked in test runs. Figure 2.2 shows the two camera boxes and the guy-wire arrangement of the 50-foot pole. In this figure, the cameras are being loaded with dummy film for a test run.

2.2 INSTRUMENTATION AND REQUIRED DATA

The only instrumentation set up specifically for this project consisted of the four high-speed movie cameras. Project LN101 provided support instrumentation, in accordance with the objectives of that project, by wiring and cementing a self-recording pressure transducer into the ground at both the 15-psi and 50-psi tree group positions to corroborate the overpressure levels attained there. Further details regarding the type, operation, and setup of the two pressure transducers appear in the Preliminary Project Officers Report of Project LN101 (Reference 8).

Each tree group was viewed from a distance by a high-speed movie camera pointed toward ground zero and by a high-speed movie camera from aside at right angles to the radial plane through the center of the group. The two cameras aimed toward ground zero, each mounted on a 20-foot pole, were to photograph the dispersion of tree debris at 15 psi and 50 psi, accordingly. The two cameras mounted on the 50-foot pole were focused on the radial or expected planes of tree bending to photograph the tree responses in these planes and the lofting of tree debris at 15 psi and 50 psi, correspondingly. The exact location and viewing angles of the cameras are shown in the next section. Although the cameras were sighted on the tree groups, the lofting and dispersion of some automobile debris hopefully would be seen since some automobiles were in view or nearly in view.

All four high-speed movie cameras were Hycam unregulated models with 100-foot film capacities. The two cameras on the 20-foot poles were fitted with 2-inch lenses and the two on the 50-foot pole with 4-inch lenses. All the lenses were opened to aperture readings of $f/2.8$. Anscochrome D-500 was used. The cameras were run on 120 volts, resulting in approximate exposure rates of 4000 frames per second once the films were up to speed. Timing marks were superimposed on the films every millisecond for accurate time-reference purposes. The cameras were all started at 0.75 second before time zero (-0.75 second) so the films were up to speed when the blast wave struck the trees in view.

The required data from this project were these film records, a complete description (weight, size, postshot location, and original source) of all the tree and automobile debris, and the postshot positions of the tumbling blocks. As mentioned in the Objectives section of Chapter 1, the high-speed films were taken to help estimate the lofting and dispersion of tree and automobile debris. The complete debris description was needed to determine the weight and size distributions (and their interrelationship) and also to estimate the dispersion of the debris fragmented from the trees and automobiles. The purpose of placing the tumbling blocks in the blast was to measure their blast-wave transport. While the film records were exposed during the blast, the tabulation of the debris data and the transport data could not begin until after the shot. The tumbling transport distances of the tumbling blocks were easy to determine by surveying, but the debris data collection required the use of special methods that are described in the Postshot Activity section of this chapter. Though the pressure-transducer records were not physically obtained in this project, they were supplementary project data requirements to verify the overpressure levels at each tree group.

2.3 FINAL TEST SETUP

An aerial view of the overall project setup is shown in Figure 2.3. The TNT stack is visible in the upper righthand corner. The six trees placed at 50 psi and the six trees placed at 15 psi are distinguishable in this photograph, with the 50-psi tree group obviously being closer to the stack. The three trees on the right in each group are the aspens, while the three leftmost trees in the groups are the spruces. All thirteen automobiles that were positioned in the blast can be seen in the figure too. With respect to the directional view of the picture, the four automobiles that were situated at 50 psi are between and to the left of the 50-psi trees; the four automobiles placed at 30 psi are between ground zero and the 15-psi trees; the four positioned at 15 psi are to the left of the 15-psi trees; and the one put at 10 psi is to the extreme left in the photograph. The 10-psi automobile was side-on to the blast, while two automobiles were oriented side-on and two were oriented front-on at each of the other three overpressures where the automobiles were stationed. The intention was to see if perhaps the orientation of the automobiles might have some noticeable effect on their fragmentation.

Figure 2.4 is a scaled drawing of the project layout. Indicated are the positions of the twelve trees, the thirteen automobiles, the tumbling blocks, the two support pressure transducers, the three camera poles, and two 25-foot distance-reference poles used to establish a distance-scale relation on the high-speed movie films. The basic features and approximate viewing angles of each high-speed movie camera are noted.

For easy reference purposes, numbers are assigned to the trees and automobiles as shown in Figure 2.5. The trees were numbered by proceeding from right to left in Figure 2.3, starting with the 15-psi trees. No special method was used to number the automobiles. This figure is just an enlargement of the 15- to 50-psi region of Figure 2.4, with just the trees and automobiles drawn.

The exact locations of the trees and their approximate characteristics are presented in Table 2.2. The table is arranged according to ascending tree numbers. The surveyed tree positions are given by listing their ground range or radial distances from ground zero, and their bearings or clockwise angles from "called

North" at ground zero. The four basic tree characteristics that are tabulated denote approximations: The approximate average breast-height trunk diameters were found by dividing the approximate trunk circumferences at breast height by π; the tree heights were estimated by comparing the trees with the 25-foot distance-reference poles in still photographs; the tree weights were roughly calculated by summing the weights of postshot debris and remains of each tree including estimates of the trunk weights in the pipes; and the branchwood weights were determined by subtracting the approximate tree-trunk weights from these computed totaled tree weights correspondingly.

In Table 2.4, the makes, preshot orientations, and approximate preshot locations (center of gravity) of all thirteen automobiles in the blast are presented. The automobiles are listed in order of increasing referral numbers.

Table 3.2 presents information on the number and types of tumbling blocks placed at various overpressure levels, along with the tumbling transport results.

2.4 POSTSHOT ACTIVITY

Immediately after the blast, the four exposed reels of film were recovered and the final locations of the lighter tumbling blocks were marked with stakes to prevent their being blown by the plain wind. Eventually, the other tumbling blocks were staked, and all the markers were surveyed for position.

Before any debris was picked up following the shot, a grid network composed of 10- by 10-foot squares was staked out covering the spread of the debris from the 15-psi trees, and a grid network of 40- by 40-foot squares was arranged covering the area of the debris from the 50-psi trees (and all the automobiles). A Cartesian coordinate system for each grid network was first set up. The origin for the 15-psi coordinate system was chosen halfway between the initial positions of the trees located exactly on the 15-psi overpressure arc, trees numbered 2 and 5. Similarly, the 50-psi origin was selected midway between the initial positions of the trees numbered 3 and 11. The Y-axes were designated as the radial lines through the origins with increasing values going away from ground zero. This designation also specified the X-axis directions for right-handed Cartesian coordinate systems. Using these coordinate axes, the two grid networks were marked on the ground by merely staking all the grid-square corners. The arrangement schemes of the two networks are drawn in Figure 2.6. Note, the subscripts 15 and 50 are used to differentiate the 15-psi and 50-psi coordinate axes, respectively. To distinguish the different grid squares of a given network, each grid square was related to by the coordinates of its corner with the smallest algebraic X- and Y-values in terms of grid-square units; examples of referencing grid-square areas are shown in Figure 2.6

also. In Figure 2.7, the relative differences between the two grid systems and the relation of the initial tree and automobile positions to the systems are shown. The reason for the larger 50-psi grid squares is explained later in this section.

To simplify the tree-debris pickup, classification groups were conceived so only the non-branch-end fragments and the large branch-end fragments (greater than 36 inches in princip ngth where principal length refers to the arc length of the main branch portion of the fragment) had to be individually weighed and measured. The measureme. .s taken were the principal lengths and the mid-principal-length diameters of the fragments. The smaller branch-end fragments were classified or lumped into groups of discrete principal-length bounds and the cones from the spruce trees were also grouped together. An average weight, length (principal), and diameter (mid-principal-length) of these fragments in each non-individual-characteristics group were determined from a large random sampling. Each of the fragments in these groups was assigned the determined average group properties, and the variations of the properties within the groups themselves were disregarded. Hence, only the number of fragments in each non-individual- or averaged-characteristics group had to be recorded, a much simpler task than weighing and measuring all of them separately. This assumes quite reasonably that the weight and diameter of a small branch-end fragment are related quite directly to its principal length, and those of a cone to its principal axis. The aspen tree-debris group types are listed in Table 2.4, and the spruce types in Table 2.5. The group-average weights, lengths, and diameters of the smaller branch-end fragments and cones, found from the random samplings, are also indicated. The samples of the 15-psi tree fragments were of the same specie, while the 50-psi tree-debris samples were taken from the debris of each tree singularly. This further breakdown was made since the amount of 50-psi tree debris in each averaged-characteristics group was relatively small and therefore, with specie samples, some debris weight might have been erroneously shifted and totaled with the debris from another 50-psi tree of the same specie. In Figures 2.8 and 2.9, typical fragments in the different classification groups of the aspen and spruce debris are pictured. The examples shown are typical 15-psi tree debris. The 50-psi fragments were similar except that secondary branching and the leaves or needles were much more noticeably missing.

The gathering of the 15-psi tree debris began 5 days after the shot. Taking one grid square at a time, the debris was gathered, separated into the proper classification group and color (tree) combinations, and tabulated. Once the reference coordinate numbers of the grid square were noted, tabulation was just the process of recording the types of debris fragments found in that grid-square area. For the fragments in the averaged-characteristics group, the number (and/or total weight) of the fragments in each group-color combination was recorded. For those fragments that belonged to an individual-characteristics group, the group-color combinations were separated further into similarly sized fragments (similar mid-principal-length diameters and principal lengths). Finally, the number, total weight, average length, and average diameter of all the fragments in each group-color-size combination were recorded. Using this method, the 15-psi tree-debris tabulation was finished 13 days after the blast. This recorded raw data appears in Appendix A.

The collection and tabulation of the 50-psi tree debris began immediately following the completion of the 15-psi tree-debris pickup phase. However, the procedure was slightly modified to be quicker and more efficient. A grid network with 40- by 40-foot squares was used as the 50-psi tree debris was distributed over a much larger area than that at 15 psi. The A1, A2, and S2 classification groups were not collected although their contribution is estimated for the results. The fragments in the individual-characteristics groups were just measured in each grid square: their weights in each grid square were estimated from their dimensions for the results. After all this debris was collected from all the grid squares, it was separated into group-color-size combinations which were weighed. Otherwise, the tabulation of the 50-psi tree debris was identical to the 15-psi tree debris, and was completed 21 days after the shot. The 50-psi tree-debris measurement data that was logged grid square by grid square and the color-group-size weighings of all this debris after it was all collected are included in Appendix A also.

Activity on the postshot automobile phase of the project was conducted simultaneously with the 50-psi tree-debris gathering. The weight, the originating automobile, the postshot surveyed position, and a description were recorded for each large automobile debris part (≈10 pounds or greater). The entries that were logged for each of the smaller automobile debris parts were the originating-automobile overpressure group (usually this debris could not be traced to its originating automobile because of difficulty in identification), the 50-psi grid square where the debris was found, and a description. After all the small debris was collected, it was weighed in similarly sized bunches according to originating-automobile overpressure group. The recorded data of the small and large automobile debris is contained in Appendix B. Postshot descriptions, approximate postshot orientations, and approximate postshot positions of all thirteen automobiles were also noted. The preshot and postshot automobile conditions are compared in Appendix D, and the final approximate automobile orientations and positions are included in the Results and Discussion chapter.

Table 2.1 COMMON AND BOTANICAL NAMES OF TEST TREES

Common Specie Name	Botanical Specie Name	Number In Test
Quaking Aspen	Populus tremuloides Michx.	6
White Spruce but could have been variety:	Picea glauca (Moench) Voss	6
Western White Spruce	Picea glauca var. albertiana (S. Brown) Sarg.	

Table 2.2 PRESHOT TREE LOCATIONS AND APPROXIMATE TREE CHARACTERISTICS

Tree Number	Tree Specie	Nominal Overpressure Location (psi)	Actual Ground Range (feet)	Actual Bearing (degrees)	Approximate Average Outside-Bark Trunk Diameter at Breast Height (inches)	Approximate Tree Height With Respect to Ground (feet)	Approximate Tree Weight (pounds)	Approximate Branchwood Weight (pounds)
1	Quaking Aspen	15	810.62	226.90	9.6	38	580	150
2	Quaking Aspen	15	839.48	229.04	10.3	45	790	200
3	Quaking Aspen	15	869.90	230.99	10.2	42	710	180
4	White Spruce	15	810.61	233.43	9.1	48	670	96
5	White Spruce	15	840.30	235.51	9.4	32	570	82
6	White Spruce	15	870.23	237.49	10.3	44	720	100
7	Quaking Aspen	50	509.80	240.82	10.9	42	700	200
8	Quaking Aspen	50	540.26	244.04	10.8	39	630	150
9	Quaking Aspen	50	569.95	247.07	9.6	41	580	140
10	White Spruce	50	510.52	250.20	9.2	49	560	85
11	White Spruce	50	541.20	253.50	9.7	49	590	80
12	White Spruce	50	570.36	256.56	9.5	49	710	94

Table 2.3 PRESHOT AUTOMOBILE ORIENTATIONS AND APPROXIMATE LOCATIONS

Automobile Number	Automobile Type	Initial Overpressure Location (psi)	Orientation	Approximate Ground Range of Center of Gravity (feet)	Approximate Bearing of Center of Gravity (degrees)
1	1949 (?) DeSoto	50	Side-On	542	254.6
2	1946-1948 Dodge	30	Side-On	648	230.2
3	1960 Chrysler Saratoga	15	Side-On	846	244.4
4	1959 Chrysler	15	Front-On	844	245.6
5	1959 Pontiac Laurentian	50	Front-On	546	257.5
6	1950 Chevrolet	15	Front-On	843	247.0
7	1958 Chevrolet Biscayne	50	Front-On	541	251.6
8	1961 Dodge Dart	50	Side-On	542	262.3
9	1960 Pontiac Laurentian	10	Side-On	1001	253.2
10	1958 Mercury Monterey	15	Side-On	838	248.6
11	1959 Plymouth Belvedere	30	Side-On	649	235.0
12	1950 Chevrolet	30	Front-On	652	233.0
13	1958 Plymouth Fury	30	Front-On	653	227.8

Table 2.4 ASPEN-DEBRIS CLASSIFICATION GROUPS AND GROUP PROPERTIES

Fragment Group Code	Fragment Group Type*	Average Principal Length of Fragments in Group (inches)	Average Diameter† of Fragments in Group (inches)	Average Weight of 15-psi Fragments in Group (pounds)	Average Weight of 50-psi Fragments in Group Tree No. 7/Tree No. 8/Tree No. 9 (pounds)
A1	0.5-inch to 3-inch Branch Ends	1.8	0.13	0.001	Group Not Collected
A2	3-inch to 6-inch Branch Ends	4	0.16	0.003	Group Not Collected
A3	6-inch to 12-inch Branch Ends	8	0.20	0.0087	0.0075/0.0065/0.0060
A4	12-inch to 24-inch Branch Ends	16	0.27	0.029	0.027/0.028/0.029
A5	24-inch to 36-inch Branch Ends	28	0.42	0.12	0.096/0.098/0.086
A6	Non-Branch Ends	Individual Groups Measured After Subgrouping According to Size		Individual Groups Weighed After Size Subgrouping	
A7	36-inch or Greater Branch Ends	Individual Groups Measured After Subgrouping According to Size		Individual Groups Weighed After Size Subgrouping	

*Each indicated length refers to principal length (ℓ)

†(d), measured at mid-principal-length and includes bark

Table 2.5 SPRUCE-DEBRIS CLASSIFICATION GROUPS AND GROUP PROPERTIES

Fragment Group Code	Fragment Group Type*	Average Principal Length of Fragments in Group (inches)	Average Diameter† of Fragments in Group (inches)	Average Weight of 15-psi Fragments in Group (pounds)	Average Weight of 50-psi Fragments in Group Tree No. 10/Tree No. 11/Tree No. 12 (pounds)
S1	1-inch to 6-inch Branch Ends	3	0.15	0.0018	Group Not Collected
S2	6-inch to 12-inch Branch Ends	8	0.2	0.012	0.005/0.005/0.008
S3	12-inch to 24-inch Branch Ends	17	0.29	0.062	0.019/0.029/0.017
S4	24-inch to 36-inch Branch Ends	28	0.43	0.22	0.055/0.070/0.057
S5	Cones	1.6‡	0.87	0.0037	0.003/0.003/0.003
S6	Non-Branch Ends	Individual Groups Measured After Subgrouping According to Size		Individual Groups Weighed After Size Subgrouping	
S7	36-inch or Greater Branch Ends	Individual Groups Measured After Subgrouping According to Size		Individual Groups Weighed After Size Subgrouping	

*Each indicated length refers to principal length (ℓ)

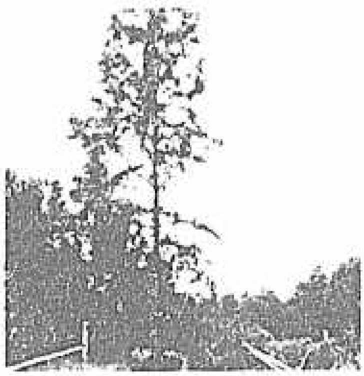
†(d), measured at mid-principal-length and includes bark

‡ Average length of major cone axes

Pipes ready in ground at 15 psi

Spruce tree being carried to a flatbed trailer

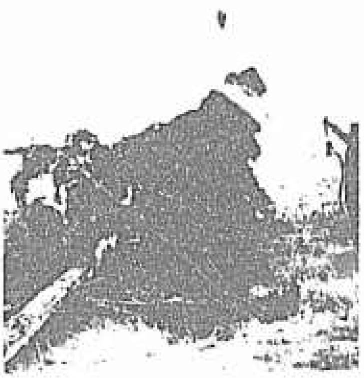
Spruce tree being loaded on a flatbed trailer



Aspen tree being carried to a flatbed trailer

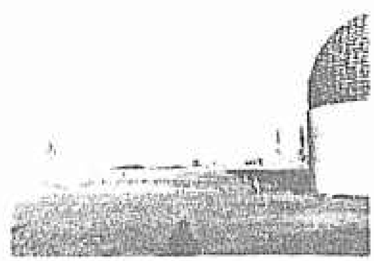
Aspen tree being loaded on a flatbed trailer

Spruce tree being unloaded from a flatbed trailer



Spruce tree being spray-painted

Spruce tree being lowered into its pipe



Preshot photograph of trees ready in position

Figure 2.1. Work involved in readying the trees

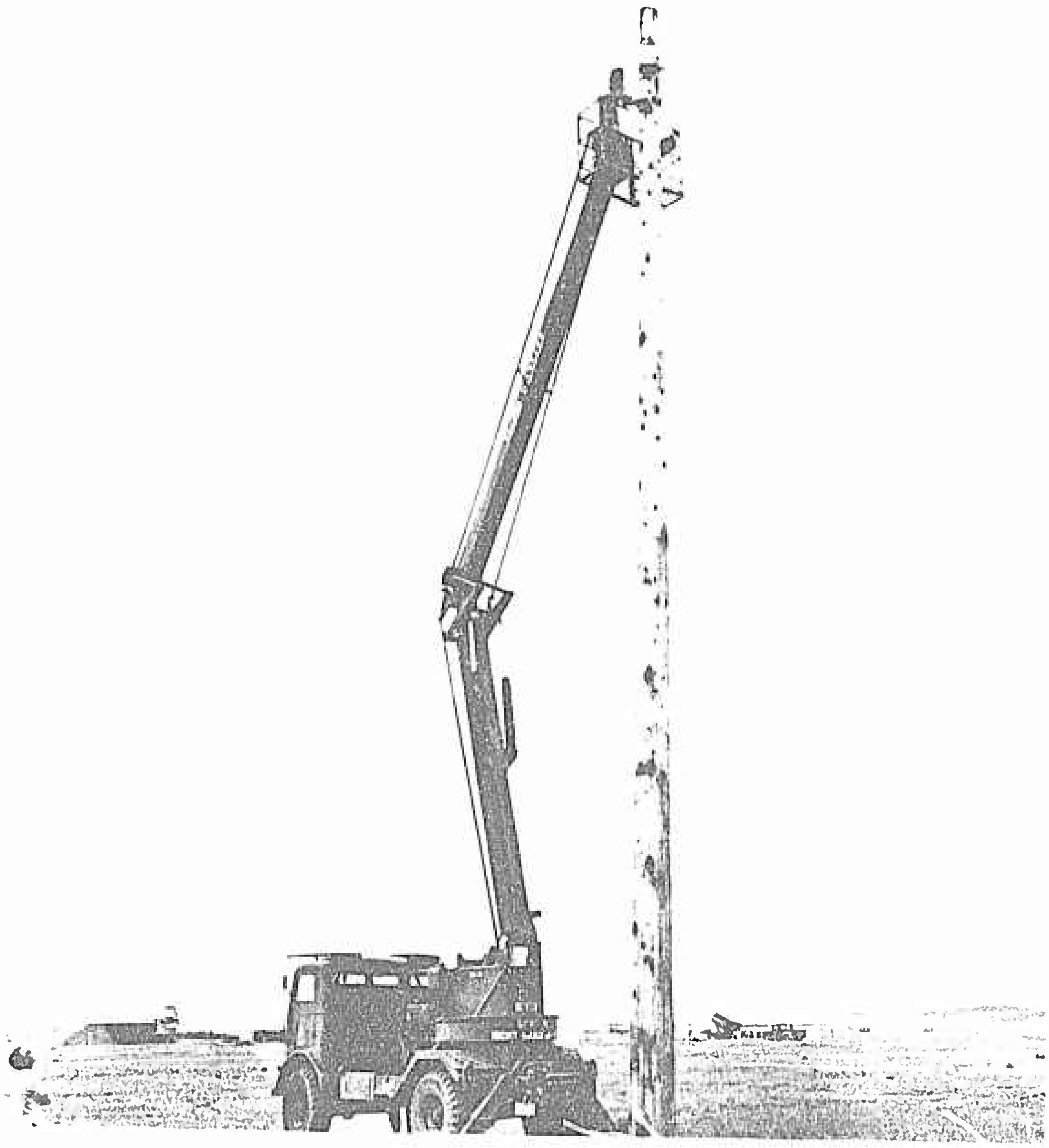


Figure 2.2. Camera boxes and guy-wire arrangement of 50-foot pole

Figure 2.3. Aerial view of overall project setup

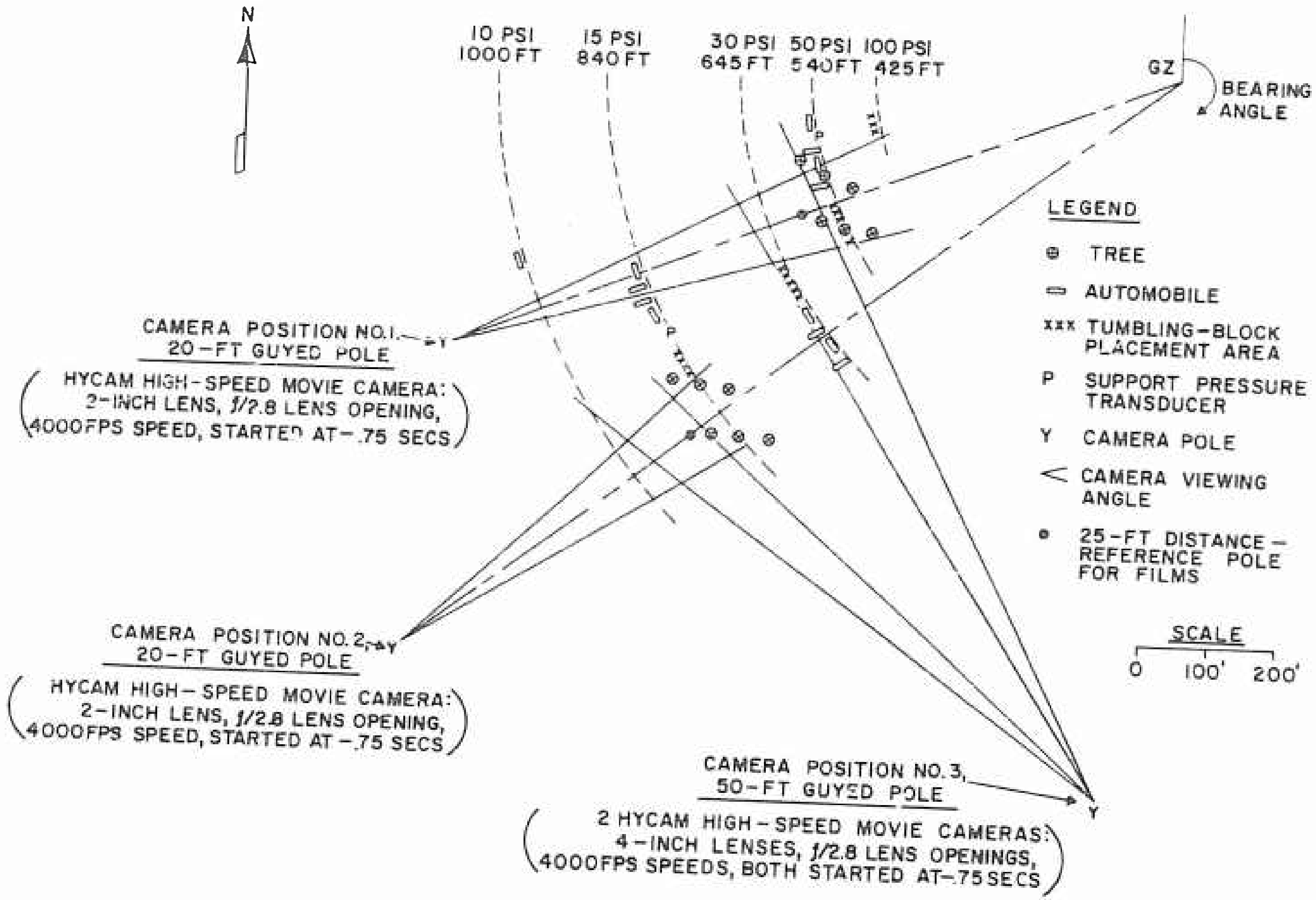


Figure 2.4. Scale drawing of project layout

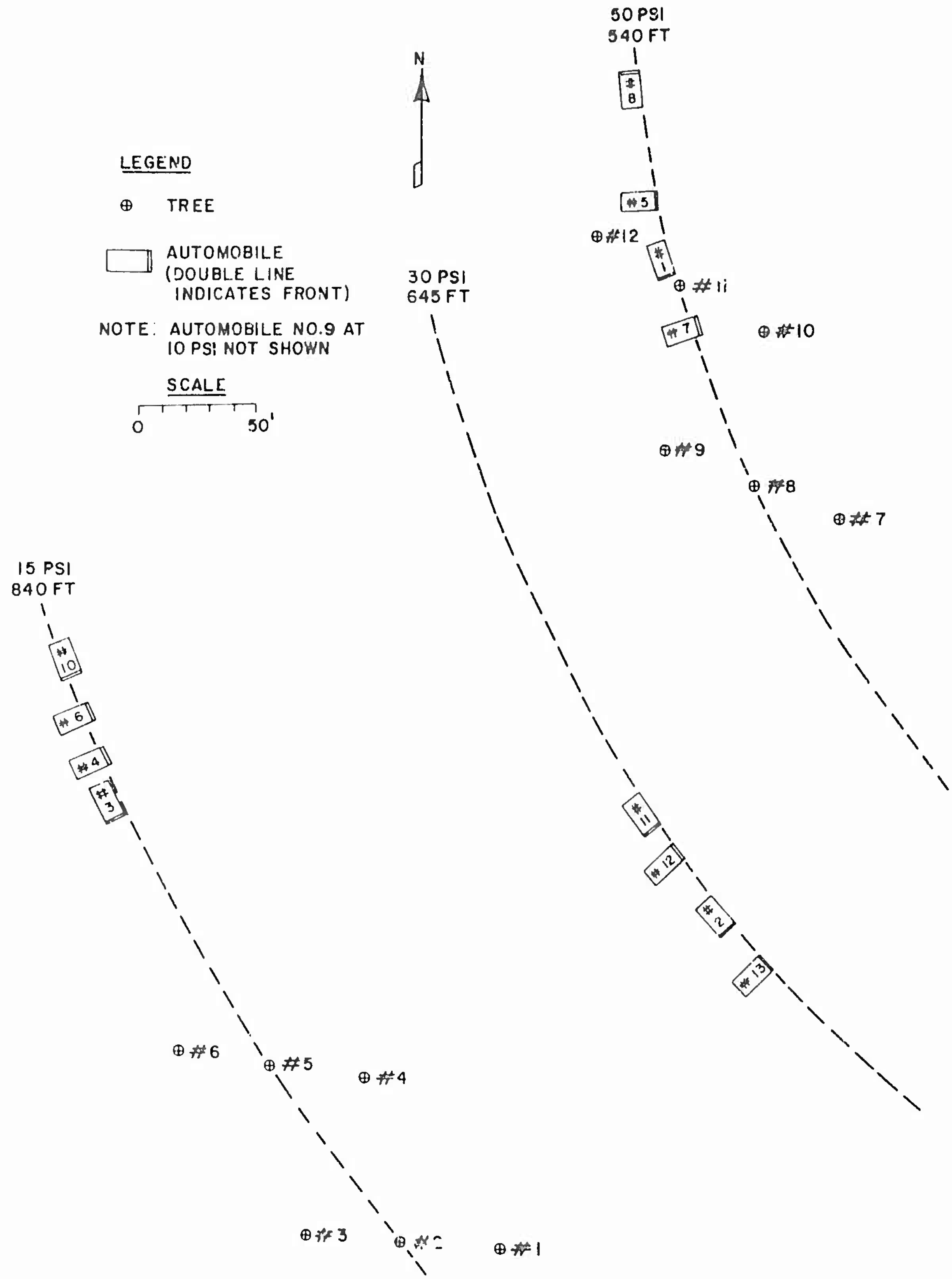
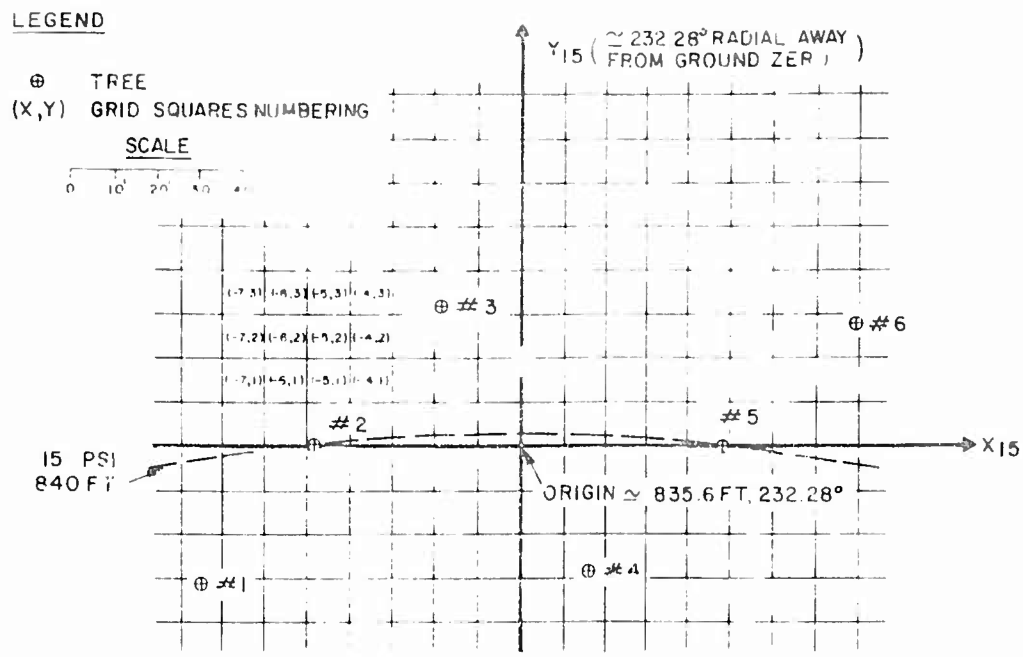
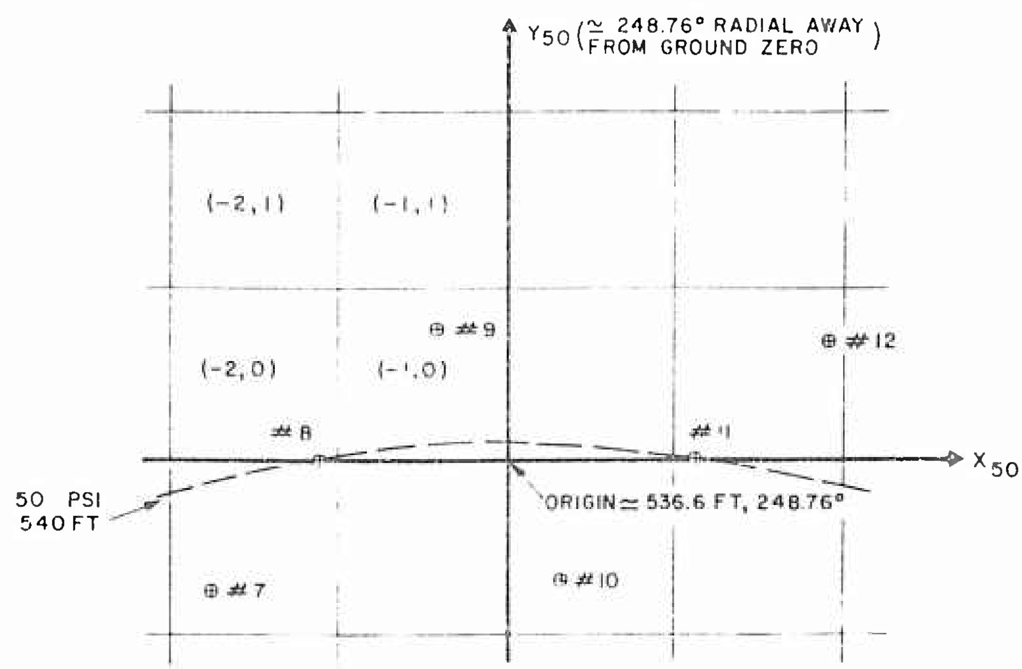


Figure 2.5. Referral numbers of trees and automobiles relative to their initial positions



(a) 15-PSI GRID NETWORK ON GROUND: 10-FT x 10-FT GRID SQUARES



(b) 50-PSI GRID NETWORK ON GROUND: 40-FT x 40-FT GRID SQUARES

Figure 2.6. 15-psi and 50-psi grid networks

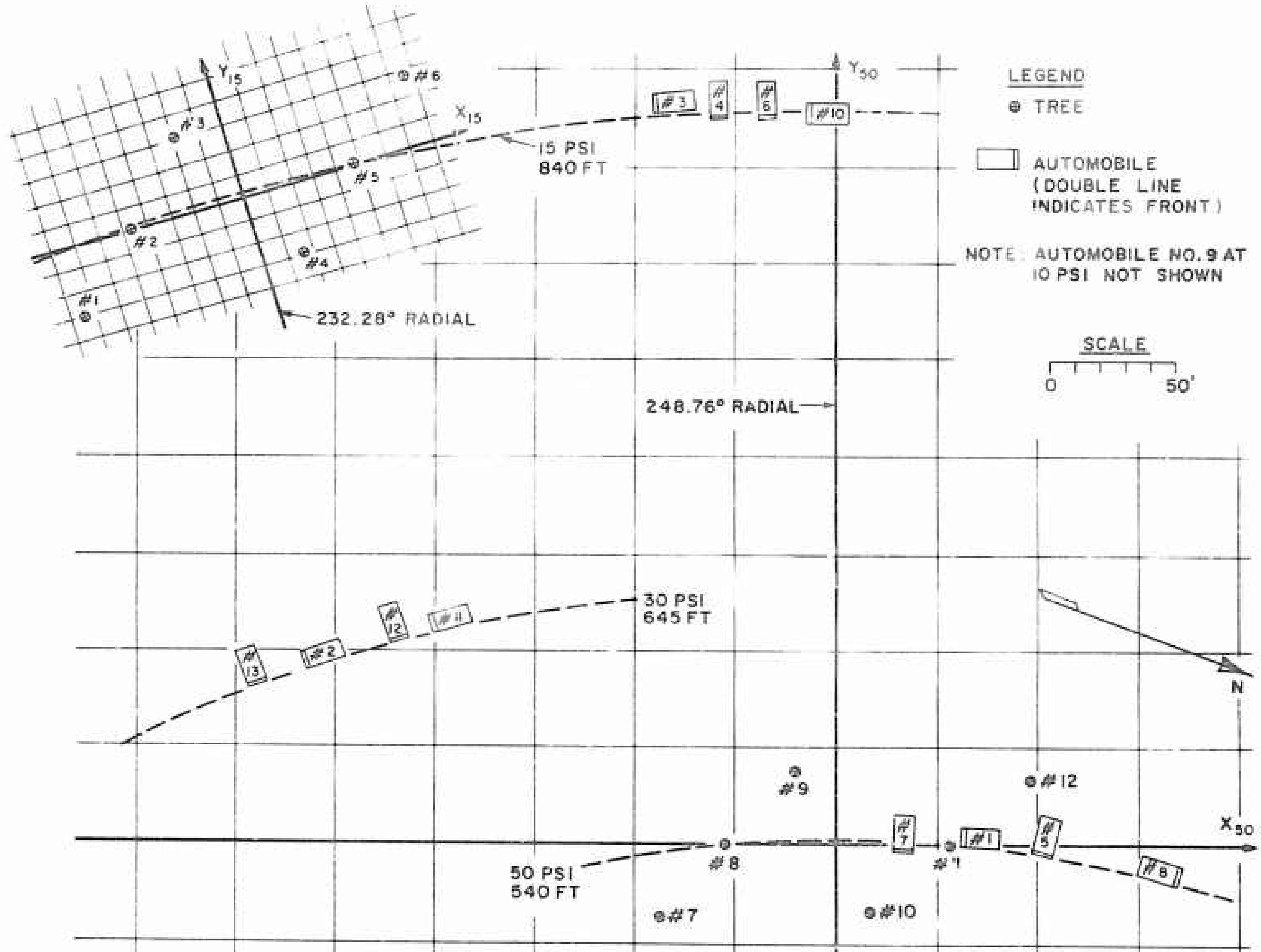


Figure 2.7. Difference between the 15-psi and 50-psi grid networks

Group A1: 1/2- to 3-inch branch ends

Group A2: 3- to 6-inch branch ends

Group A3: 6- to 12-inch branch ends

Group A4: 12- to 24-inch branch ends

Group A5: 24- to 36-inch branch ends

Group A6: Non-branch ends

(15-inch ruler in photographs of groups A1 through A6)

Group A7: 36-inch and greater branch ends

(60-inch tape measure in photograph of group A7)

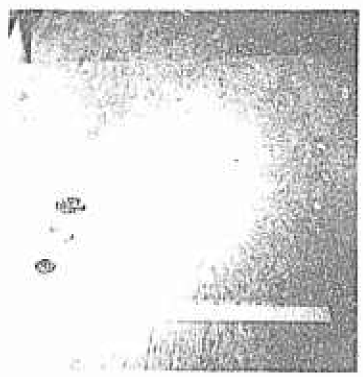
Figure 2.8. Photographs of typical 15-psi aspen fragments in aspen-debris groups

Group S1: 3- to 6-inch branch ends

Group S2: 6- to 12-inch branch ends

Group S3: 12- to 24-inch branch ends

Group S4: 24- to 36-inch branch ends



Group S5: Cones

Group S6: Non-branch ends

(15-inch ruler in photographs of groups S1 through S6)

Group S7: 36-inch and greater branch ends

(60-inch tape measure in photograph of group S7)

Figure 2.9. Photographs of typical 15-psi spruce fragments in spruce-debris groups

CHAPTER 3

RESULTS AND DISCUSSION

3.1 TREE DEBRIS

The tree-debris results obtained and the related discussion are the contents of this section. Briefly, the natures of the blast wave that occurred at the 15-psi and 50-psi tree group positions are discussed in the first subsection. The subsections on Visual Observations, Weight Distributions, and Fragment Sizes adequately characterize the tree fragmentation that resulted at 15 and 50 psi. The Ground Distribution subsection describes the tree-debris transport and gives a good indication of the tree-debris dispersion that took place at 15 and 50 psi. Comments on the extent of lofting and dispersion of the tree debris at 15 and 50 psi seen on the high-speed movie films and on the problems encountered in the tree phase of this project are covered last.

3.1.1 Natures of Blast Wave at Tree Positions. Tracings of the overpressure-versus-time histories recorded by the support pressure transducers at the 15-psi and 50-psi tree group positions are presented in Figure 3.1 (Reference 8). The time scales are relative to blast arrival time at the transducer positions, and the positive overpressure durations and decays are apparent. The two recordings show, after comparing them with overpressure-time plots of a classical blast wave, that the blast-wave overpressure trace sensed at the 15-psi pressure-transducer location was quite classical, and that monitored at the 50-psi transducer position was somewhat low relative to classical form initially. Therefore, since the self-recording pressure gages were placed right next to each tree group (Figure 2.4), the nature of the blast wave that struck each tree can be assumed to have been roughly classical in overpressure except where a strong anomaly existed. Moreover, the natures of the blast wave at the trees can be reasonably assumed to have been classical in other blast-wave properties, as dynamic pressure, where anomalies were absent. It was determined in Project LN102 (Reference 9) that a luminous jet occurred at a bearing around 240 degrees and traversed out to about the 600-foot ground range. This jet is noticeable, in the high-speed movie films taken by this project, scorching tree number 7 and parts of tree number 8. This implies that the blast wave was non-classical at the initial position of tree number 7 and probably at the initial position of tree number 8, but the extent is unknown. The other initial tree positions probably experienced a quite classical blast wave.

3.1.2 Visual Observations. The debris and trunk remains of the 15-psi aspen trees are pictured in the photographs of Figure 3.2, and those of the 15-psi spruce trees are shown in the photographs of Figure 3.3. Ground zero is evident in the far background of each of these photographs. The trunks of the three 15-psi aspen trees snapped above the holding pipes, while the 15-psi spruces broke off right at the top ends of their pipes (noticeable in the near backgrounds of the pictures in Figure 3.3). The overall fragmentations of the aspen and spruce appear quite similar to each other. The significant observation to note is the fact that the general tree fragmentation was only moderate at 15 psi; a large number of branches still remained attached to the tree trunks after the shot.

The main trunk remains of the 50-psi aspen and spruce trees are shown in the photographs of Figures 3.4 and 3.5. Again, all the pictures were taken with ground zero in the background. All six of the 50-psi trees broke off at their top pipe ends, as did the 15-psi spruce trees. The trunk remains of the 50-psi aspen and spruce trees are similar. These trunks were stripped of almost all their branches to the extent that nearly all the branchwood of the 50-psi trees became debris. Note how the 15-psi trunk remains differed. Visually, it can be concluded that tree fragmentation increased with overpressure as was expected.

Another discernible feature was the difference between the 15-psi and 50-psi tree debris. The 50-psi fragments were stripped of almost all their secondary branching off their principal or main segments, and leaves and needles were missing from almost all the 50-psi aspen and spruce fragments correspondingly. In contrast, the 15-psi fragments (typical ones are pictured in Figures 2.8 and 2.9) had much more secondary branching and they retained many more leaves and needles, relative to their coinciding 50-psi fragments. The variation, on the average, between the secondary branching on the 15-psi and 50-psi tree debris is treated mathematically in the subsection on Fragment Sizes.

3.1.3 Weight Distributions. The cumulative weight distributions of the branchwood debris and trunk remains from the 15-psi aspen trees, 15-psi spruce trees, 50-psi aspen trees, and 50-psi spruce trees are presented in Figures 3.6, 3.7, 3.8, and 3.9, respectively. The abscissa and ordinate scales have been normalized with respect to tree weights in these figures so that rational comparisons can be made between the curves. It can be seen that these normalized tree-debris cumulative weight distributions that resulted from this test project are quite similar for trees of the same specie placed at the same overpressure.

These plots were fairly easy to derive. With the raw tree-debris data of Appendix A coupled with the average weights given in Tables 2.4 and 2.5 for those fragments in the averaged-characteristics groups, the weights or approximate weights of all the gathered debris fragments originating from each tree were known. So, it was a simple matter to separate the fragments from each tree into ascending weight order. Then, for any given maximum fragment weight and specific tree, the cumulative weight of all the debris fragments, from that tree, which weighed less than the given fragment weight was determinable. Hence, with maximum fragment weight as an independent variable, the curves of Figures 3.6 to 3.9 are no more than plots, normalized with respect to the tree weights, of the cumulative weight of the tree debris weighing less than this running variable for each of the trees. The actual plots were monotonically increasing steps: the smaller steps corresponding to the lightweight fragments, the branchwood fragments, have been smoothed while the larger ones corresponding to the heavier fragments, the trunk fragments perhaps with branchwood attached, have not been smoothed. Also, the estimated weight of the trunks remaining in the pipes, whose trees broke off right at the pipe top ends (trees numbered 4-12), have been correspondingly added to the weight of the lower trunk fragments of those trees. The reasoning behind this is that these trees would have broken off at the ground level or uprooted had it not been for the pipe support. The last minor modification was to approximate the cumulative weight of the 50-psi tree debris in the classification groups that were not collected: Groups A1, A2, and S1. This approximation was accomplished by adding the specie-averaged normalized cumulative weight of the 15-psi tree debris collected in these three groups to each of the 50-psi cumulative weight distributions, according to the proper specie. The rationale for this adjustment is indicated later in this subsection.

The curves in this format are not too difficult to comprehend. In fact, understanding the derivation of the curves just discussed helps in their interpretation. As mentioned, the continuous sections of the curves relate to the branchwood fragments and the discontinuous steps are associated with the trunk fragments with branchwood attached, perhaps. Horizontal portions of a curve indicate that no tree debris was found over that fragment weight range. Also, when comparing two curves, the lower of the two signifies less fragmentation. To illustrate how to read the curves, consider the one for tree number 2 in Figure 3.6. Here it can be noted that 14 percent of the tree weight was fragmented into debris fragments weighing less than one-hundredth the tree weight, while 10 percent of the tree weight became debris weighing less than one-thousandth the tree weight. In other words, since tree number 2 weighed about 800 pounds (Table 2.2), the total weight of the debris from tree number 2, weighing between 0.8 and 8 pounds, was (14% - 10%) × 800 pounds, or 32 pounds. This debris was all branchwood, which is perceptible from Figure 3.6. It can be proven that if the cumulative weight curve is linear between two (maximum) fragment weight values, then the average fragment weight is approximately 0.32 times the fragment weight difference above the lighter fragment weight. For this example, this implies that the average fragment weight in the 0.8- to 8-pound weight range is 3.1 pounds and, therefore, that the fragments in this weight range numbered about ten or eleven. In actuality, based on the raw data, there were thirteen fragments in this range whose average weight was 2.4 pounds.

The averages of the normalized cumulative tree-debris weight distributions graphed in Figures 3.6 to 3.9, corresponding to the three trees of each specie-overpressure combination, are compared in Figure 3.10. The conclusion that tree fragmentation increased with peak overpressure (or actually dynamic pressure impulse) at Event Dial Pack is evident from this figure. This was a visual observation previously in subsection 3.1.2. As noted with reference to Figures 3.4 and 3.5, nearly all the branchwood was fractured from the trunks of the 50-psi trees. Combining this fact with Figure 3.10, it can be deduced that the branchwood of the aspen and spruce trees weighed, on the average, about 26 percent and 15 percent of their tree weights, respectively (reading the maximum non-trunk cumulative weights from the corresponding 50-psi curves). Comparing in Figure 3.10 the average branchwood weight fractured from each specie at 15 psi, with the average fractured from the same specie at 50 psi, shows that around 60 percent of the branchwood weight was fractured from the 15-psi trees.

The question of whether the spruce trees or the aspen trees were fractured more at the same overpressure is not obvious from Figure 3.10. The aspens seemed to have been, but this misleading appearance is due to the fact that the branchwood of the aspen trees made up a larger percentage of their tree weights. The answer becomes plain in Figure 3.11 which shows the same curves as Figure 3.10 except they are normalized with respect to tree branchwood weight. Here it can be seen that the two tree species were fragmented similarly at the same overpressure, relative to their branchwood weights.

The normalizations of Figures 3.6 to 3.10 with respect to tree weight and Figure 3.11 with respect to branchwood weight have a major connotative advantage plus a strong implicit cautioning restriction. Though the trees in the test weighed between 560 to 790 pounds, the normalization of these curves makes them roughly applicable to lighter trees and heavier trees. However, this extrapolation only holds if the ratios of branchwood weight to tree weight are somewhat the same as the test species: 0.26 for the aspen and 0.15 for the spruce. The reason for this ratio restriction is because these curves would be different for sparse trees or sections of trees, for the abscissa values would be much different. The application of these curves to diverse tree weight ranges, with the same ratio of branchwood weight to tree weight, assumes that the weak fracturing points of a tree remain approximately the same as the tree grows, which is a rational assumption: because the potential fragments grow somewhat proportionally with tree weight. These remarks should be kept in mind when using these figures.

The cumulative tree-debris weight distributions from this project can be compared to those obtained in the URS shock tunnel as part of the preliminary planning and troubleshooting of this project (Reference 5). These shock-tunnel tests were mentioned in the Introduction chapter of this report. Eight-foot tree trunk sections (larger tree sections cannot fit into the URS shock tunnel) were subjected to 10-psi peak overpressure shock waves, with positive durations of about 100 msecs, in the shock tunnel. Hence, the tree-debris cumulative weight distributions from the shock tunnel should be quite similar to those obtained at 15 psi in this project provided they can be compared on common grounds. Actually, the curves from the shock tunnel should be slightly lower, indicating less fragmentation, than the 15-psi curves because of a lower peak overpressure. Now as stated before, the cumulative weight distribution curves of Figures 3.10 and 3.11 are not applicable for tree sections. However, the curves of these figures can be used for tree sections in certain situations if their abscissas are not normalized. The curves of Figure 3.11 are redrawn without a dimensionless abscissa in Figure 3.12. This latter curve can be applied to tree sections only if the maximum-weighted branch in the tree section weighs about the same as the maximum-weighted branch of the comparable tree in this project. Unlike Figures 3.10 and 3.11, the curves of Figure 3.12 do not apply to larger and smaller trees as there is no growth factor inherent in the ordinate and abscissa scales. Since the tree sections in the URS shock tunnel were cut from trees similar in size to the aspen and spruce trees used in this project, a comparison is justifiable. Therefore, three curves derived from the shock-tunnel tests are also plotted in Figure 3.12 with the section branchwood weight as the normalizing ordinate factor for these curves.

A couple of fundamental conclusions are implied from the two different types of curves in Figure 3.12. The shock-tunnel curve for the Douglas Fir compares quite remarkably to the 15-psi spruce curve determined in this project. This is to be expected since the two species are similar in nature. This close comparison shows that the shock-tunnel results are reasonable, the first major deduction. In the shock tunnel, little branchwood was fractured from the 8-foot oak tree section. This result could have been anticipated because of the toughness of oak wood. It can also be noted that not much small debris, but mainly large branches, were fractured from the alder tree section in the shock tunnel. Therefore, the shock-tunnel results along with those of this project help prove the second main conclusion: Tree fracturing appears quite specie-dependent. The oak curve and the 15-psi spruce curve are probably approximate lower and upper bounds, respectively, for tree fracturing of 10-inch-diameter 50-foot-high trees at 15 psi from a 1-kiloton nuclear yield. Hence, comparing the shock-tunnel results with those of this project infers that tree fracturing is specie-dependent and that this fracturing can be determined in a large shock tunnel as opposed to expensive field tests.

The curves of Figures 3.6 to 3.12 describe tree fracturing in a 1-kiloton nuclear yield, except that some of the very light tree debris would invariably be burned by thermal radiation in a nuclear burst. The fragmentation of trees at the higher nuclear-attack yields is of basic concern. Larger yields cannot be tested and, consequently, the fragmentation at larger yields can only be estimated. At a given peak overpressure, a longer positive velocity phase duration (a larger dynamic pressure impulse) occurs with a larger yield. This implies that the fragmentation of a debris source at a specific peak overpressure would increase with yield because of the following:

1. Primarily, the longer duration blast would tend to blow apart the debris source more, especially the slower-responding segments.
2. Secondarily, because of the longer duration, the debris fragments would obtain greater velocities and would tumble along the ground at these higher velocities for longer distances. Therefore, they would break up more.

For these reasons, the data presented in Figures 3.6 to 3.12 represent lower bounds of the expected tree fragmentation at the designated peak overpressures for yields exceeding 1 kiloton. The fragmentation of the small and medium tree branches (secondary branches) would probably not increase much more for larger yields though, with regard to the prime cause stated in the first condition above. This hypothesis follows from the fact that photographs taken during tests conducted in the URS shock tunnel (Reference 5) and at Distant Plain (Reference 10) showed that branches of this size fully respond or break off in a time period after shock front arrival which is relatively short compared with the positive phase durations experienced at 15 psi and 50 psi in Event Dial Pack. The main branches of the trees and the tree trunks have response times that are not small compared with these phase durations. Hence, the fragmentation of the main branches from the tree trunks and the main tree trunks themselves would probably increase for a larger yield (longer duration) than the 1 kiloton of this project. Even though the 50-psi environment was more severe than the 15-psi environment at Event Dial Pack, in the form of a larger dynamic pressure impulse, note that the 15-psi and 50-psi branchwood fragmentation curves of Figure 3.11 and 3.12 are quite similar in the small-fragment region. This closeness tends to support the above reasoning.

In summary, the average tree-debris cumulative weight distributions for aspen and spruce trees at 15 psi and 50 psi of the 500-ton TNT explosion at Event Dial Pack are presented in three different formats, Figures 3.10 to 3.12. These results equally apply for a 1-kiloton nuclear yield except for the minor differences caused by the fact that the very light tree debris would undoubtedly be burned by thermal radiation in such an instance. The distribution curves are normalized with respect to tree weight in Figure 3.10, they are normalized with respect to branchwood weight in Figure 3.11, and they are essentially not normalized in Figure 3.12. Because of the different dimensionalizing, Figures 3.10 and 3.11 can be applied to larger and smaller trees than the ones used in this project as long as the ratio of branchwood weight to tree weight remains the same. They cannot be linked to tree sections. Conversely, Figure 3.12 can be applied to tree sections cut from trees of the size in this project, but not to larger and smaller trees. With these restrictions, the curves can be related to trees similar in nature to the aspen and spruce specie types. Except for the fact that some of the small tree debris would probably be burned by thermal radiation in a nuclear yield, these curves represent lower bounds to the fragmentation expected at the designated peak overpressures for yields exceeding 1 kiloton. It has been reasoned that only the curve sections relating to the large-branch and trunk fragments would be altered upward in a larger-yield explosion.

3.1.4 <u>Fragment Sizes.</u> The tree-debris fragment sizes are characterized in this subsection. For the fragments of each specie-overpressure group, the relation between the principal length (ℓ) and the mid-principal-length diameter (d) of the main fragment segments is described, and the average amount of secondary branching still attached to the main segments is approximated.

The average and variation of the ratio of principal length to mid-principal-length diameter (ℓ/d) versus mid-principal-length diameter (d), for the 15-psi aspen debris fragments, are plotted in Figure 3.13. Those for the 15-psi spruce debris are plotted in Figure 3.14, for the 50-psi aspen debris in Figure 3.15, and for the 50-psi spruce debris in Figure 3.16. The average ratio curves are drawn over the entire range of recorded fragment diameters. But the ratio variations are only shown for fragment diameters greater than 1/2 inch since this variation was not determined for the averaged-characteristics groups: fragments in these groups had average diameters less than 1/2 inch, as seen in Tables 2.4 and 2.5. The ratio variations are indicated by graphing their lower bounds, quarter bounds, medians, three-quarter bounds, and upper bounds. At a fixed fragment diameter, the ratio variation appears to closely resemble that of a log-normal distribution. It can also be observed that the average ratio curves are nearly independent of fragment diameter, except at the smaller diameter values. Considering fragments of the same specie-overpressure combination, this means that for any fragment diameter but a very small one, the fragment length is a constant multiple of diameter on the average.

The average ratio curves of Figures 3.13 to 3.16 are replotted in Figure 3.17 for comparison. The similar average ratio curves for the tree-debris fragments generated at 10 psi in the URS shock tunnel (Reference 5) are drawn in this figure also, though they are not too reliable since there were not that many fragments in each diameter range. These curves show that the ratio constant varies according to tree specie, and this constant decreases with higher peak overpressures. This inverse constant-overpressure relationship for a given specie is expected since debris should be broken up additionally for a more severe environment.

To give an idea of the amount of secondary branching on the tree fragments, the average effective density of the fragments is graphed in Figure 3.18 as a function of fragment diameter for each specie-overpressure group. Here, effective fragment density refers to the fragment weight divided by the volume of the main fragment segment. Letting w represent fragment weight, the effective density definition is mathematically equal to $4w/\pi l d^2$. Obviously, as the amount of secondary branching becomes smaller, the effective density of a fragment approaches the density of the specie wood: 37.2 lbs/ft^3 for Quaking Aspen and 33.1 lbs/ft^3 for White Spruce in the green condition (Reference 11). On the average, the weight quantity of secondary branching on a fragment of a given diameter is proportional to the difference between the curve value at that diameter and the specie wood density. In the absence of secondary branching, the curves of Figure 3.8 would be horizontal, independent of diameter, with constant values equal to their respective specie wood densities. The curves in this figure were fairly easy to obtain since the average weights and measurements were recorded for every 15-psi and 50-psi tree fragment. (The 50-psi tree debris was remeasured when it was weighed, Appendix A). From this figure it can be seen that the effective density decreases with an increase in fragment diameter, with some exceptions. The 50-psi curves are lower than the corresponding 15-psi curve of the same specie, which indicates less secondary branching on the 50-psi tree fragments compared to similarly sized 15-psi ones. (A small portion of the curve reduction is probably attributable to the fact that the 50-psi tree debris dried out more than the 15-psi tree debris because the 50-psi tree debris was gathered later.) This agrees with visual observations when gathering the debris since the 15-psi tree fragments had quite a bit of secondary branching, Figures 2.8 and 2.9, while the 50-psi tree fragments had little secondary branching. In general, the reduction of the secondary branching of a specie with an increase in peak overpressure is to be expected.

The results of this subsection can be easily summarized. The average principal lengths, average mid-principal-length diameters, and average effective densities of the aspen or spruce fragments, in any given weight range, that were obtained in this project, can be determined from Figures 3.17 and 3.18 using an iterative approach. The number of fragments in this weight range can be read from the curves of the previous subsection. It can be assumed that the average lengths, diameters, and effective densities of fragments from species similar to aspen or spruce would have been accordingly similar under the same environmental conditions.

3.1.5 Ground Distributions. The ground weight distributions of the debris from the twelve trees in the appropriate grid squares are presented in the figures of Appendix C. There, the total weight of the debris from each tree found in each grid square is indicated. The estimated weights of the tree trunks remaining in the holding pipes are included in these figures at the pipe positions. The 15-psi ground weight distributions were not difficult to derive as the weights of the 15-psi fragments were determined during the pickup phase in each grid square accordingly. The derivation of the 50-psi ground weight distributions was a little more involved: the 50-psi effective density functions of Figure 3.18 were employed to compute these distributions since the 50-psi fragments were only measured, and not weighed, while they were gathered grid square by grid square.

With some slight modifications, the weight densities of debris from each tree on the ground can be obtained from the correspondi . ground distributions of Appendix C. Typical ground weight densities of the debris from a 15-psi aspen (tree number 3) and a 15-psi spruce (tree number 6) are shaded in Figure 3.19, and typical ground weight densities of the debris from a 50-psi aspen (tree number 9) and a 50-psi spruce (tree number 11) are drawn in Figure 3.20. The ground weight density format is more suitable for comparing the 15-psi and 50-psi ground debris spreads since the grid-square areas of the two grid networks were unequal.

The overall transport of the debris from the twelve trees is essentially presented in the figures of Appendix C. The displacements and orientations of all the trunk fragments weighing 10 pounds or more are more distinctly displayed in Figure 3.21. The maximum radial transport of the tree debris can be noted in the appendix figures. The debris from the 15-psi trees was found up to 230 feet downwind from its originating-tree initial position and the debris from the 50-psi trees was transported as large as 1200 feet in the radial direction. The maximum radial transport of tree debris can be expected to be specie-independent, which is partially substantiated by the tree-debris transport results of this project.

The dispersion of the tree debris can be estimated at 15 psi and 50 psi from the figures of Appendix C also. As with maximum radial tree-debris transport, tree-debris dispersion is also basically specie-independent. Now in general, from these appendix figures and the raw data of Appendix A, it can be deduced that the heavier the tree fragments, the less their dispersion. At 15 psi, for example, no tree fragments weighing more than 1 pound were dispersed more than 30 degrees (the arc tangent of their sideward transport relative to their radial transport) while the lightest tree fragments, with a minimum of 25-foot radial transport, were dispersed up to 60 degrees. The dispersion at 50 psi bore a resemblance: the 1-pound tree fragments were not dispersed more than 25 degrees and the lightest fragments, with a minimum of 100-foot radial transport, were not dispersed more than

55 degrees. If only heavy tree fragments are considered, the dispersion of tree debris is relatively small.

The dispersion of tree debris at large weapon yields is of interest. The tree-debris dispersion at a large yield would probably be quite similar to that at a small yield and the same overpressure, except for the lightweight fragments that would be blown back significant distances (not negligible relative to overall radial transport) toward ground zero by the negative velocity phase. For these lightweight fragments in a small yield as one kiloton, the reductions in their radial transport due to the finite times required for them to break from their source are not small compared to their overall radial transport. This implies that these fragments would have a larger ratio of sideward transport compared to radial transport at low yields than at much higher yields. Hence, the dispersion obtained in this project for the lightweight fragments is an upper bound of that expected at the same peak overpressures but larger yields. The dispersion of the heavier fragments would be similar, considering such a change in environment.

3.1.6 Remarks About High-Speed Movie Films. Little useful information was derived from the high-speed movie films. The reason was that the trees were covered in dust a short time after the blast reached their positions, even though prospective dust areas were wetted down with oil prior to the shot. Nevertheless, the delay lasted long enough to observe the small fragments breaking off the trees, the initial dispersion of these fragments, and the fact that the lofting of tree debris was negligible at 15 and 50 psi. The high-speed movie film from camera position number one (Figure 2.4) photographed the 240-degree luminous jet engulfing tree number 7 and partially scorching tree number 8, both 50-psi aspen trees.

3.1.7 Problems Encountered. Some minor difficulties were encountered in the tree portion of this project. The obscuring of the trees by dust in the high-speed movie films and the scorching of two 50-psi aspens by a luminous jet were mentioned in the previous subsection. Most of the dust might have been avoided if a more thorough oil coating was applied to the potential sources. Due to the luminous jet occurrence, a large amount of the debris from tree number 7 and part of that from tree number 8 was burned and their paint blackened, complicating their identification if not making it impossible.

Another problem was caused by the drying of the tree fragments. As the fragments dried, their moisture content and therefore their weights dropped slightly. In addition, a little over a week after the blast, the fragments started becoming brittle from drying and, as a result, increasingly more difficult to collect and handle without damage. About this time, moreover, the aspen and spruce fragments began losing their leaves and needles. The leaves and needles contributed largely to the weight of the 15-psi aspen and spruce fragments, but the 50-psi fragments lost most of theirs during the blast so the drying loss of the remaining few was not that important. The moisture loss from the 15-psi fragments in the averaged-characteristics groups and the leaf and needle loss from the 15-psi fragments in these groups were compensated for because the average weights of the fragments in these groups were determined from large samplings which were taken before these losses became significant. If the debris pickup had begun sooner and had proceeded at a faster rate, the fragment drying would have been less of a problem.

The tree pipe-holding scheme probably had little influence on the tree fragmentation results. Intuitively, such a scheme mainly influenced tree trunk fragmentation. From theory, the natural periods of the test trees, with their trunks well-rooted or pipe-held, were large compared to the blast durations at 15 and 50 psi. Hence tree fragmentation would have been somewhat identical in either of these two cases of trunk support for yields or durations of the magnitude of the Dial Pack blast.

3.2 AUTOMOBILE DEBRIS

The automobile-debris results from this project are presented with relevant discussion in this section, having an arrangement identical to the tree-debris Results and Discussion section. First, the natures of the blast wave that prevailed at the initial automobile positions are discussed. Following this, the automobile fragmentation that occurred at 10, 15, 30, and 50 psi is described in the subsections on Visual Observations, Weight Distributions, and Fragment Sizes. The transport and dispersion of automobile debris at 15, 30, and 50 psi are presented and commented on in the Ground Distribution subsection. The results from the high-speed movie films and the problems experienced with relation to the automobile phase of this project are remarked upon in the final two subsections.

3.2.1 Natures of Blast Wave at Automobile Positions. The support pressure transducers near the 15-psi and 50-psi tree group positions were also close to the automobiles placed at 15 and 50 psi, accordingly. Since no anomalies were noted at these automobile positions (Reference 9), the same reasoning can be used as in the tree situation to deduce that the blast wave was approximately classical at these spots. In the automobile-debris Ground Distribution subsection, it is shown that the automobiles at 15 and 50 psi were all displaced radially with little dispersion and nearly equally at the same overpressure. This implies hardly any bearing variation of the blast at these positions which is evident in a classical blast wave. Also, if the blast is classical, the automobiles would be transported in the radial direction only since they have small lift and thrust components relative to their drag component. As stated, this was the case at 15 and 50 psi.

No pressure gages were installed in the ground near the 30-psi automobile group position. Hence, there is no overpressure recording to indicate whether the blast wave was classical in that vicinity. In Reference 9, it was determined that a nonluminous jet at a bearing of 232 degrees traveled out to a ground range of about 780 feet before it was overtaken by the main shock front. There is no doubt that the 30-psi automobiles were affected by this jet anomaly: the displacements of the 30-psi automobile debris and bodies shown in the automobile-debris Ground Distribution subsection tends to corroborate this because they had large sideward transport components (Figures 3.27 and 3.28). Unfortunately, no statement can be made about the strengths of this anomaly at the initial positions of the 30-psi automobiles.

3.2.2 Visual Observations. As with the trees in the Dial Pack blast, the damage and fragmentation of the automobiles in this blast were greater the higher the overpressure.

Postshot views of the automobile stationed at 10 psi, automobile number 9, are shown in Figure 3.22. The only debris originating from this automobile were glass fragments from the blown-out large windows and a few pieces of chrome trim; around 15 pounds of glass fragments were on the ground with the rest being inside the automobile. This scant amount of debris is in the foreground, on the ground, in the expressed photograph of the figure.

The blast damage incurred by each automobile initially at 15 psi is pictured in Figure 3.23. The automobile parts that were blown off these four automobiles are apparent and consisted of hoods, headlights, taillights, chrome trim, and nearly all the window glass. The roof was torn off automobile number 10. The conglomerate of debris, excluding hoods and the roof, from the four 15-psi automobiles is seen piled up in a separate photograph of this figure. The hood from automobile number 3 can be seen 250 feet away in the background of the photograph showing the postshot view of that automobile. Also, notice that a significantly longer positive duration at this overpressure (significantly higher yield), some larger automobile parts would have been ripped off these automobiles, namely some roofs, along with more smaller debris too.

In Figure 3.24, the postshot appearances of the four automobiles originally positioned at 30 psi are shown. The automobile parts typically fragmented from these automobiles included hoods, roofs, fenders, seats, and a large amount of small debris parts: chrome trim, lights, very light engine parts, and window glass. Perceptible in the fifth photograph of this figure is the assemblage of all the 30-psi automobile-debris parts minus the large sheet-metal parts such as hoods, roofs, and fenders.

The damage sustained by the four automobiles initially placed at 50 psi is evident in Figure 3.25. Missing from the 50-psi automobiles were hoods, roofs, fenders, trunk lids, doors, firewalls, seats, moderately weighted engine parts, and an accordingly larger amount of small automobile debris than that derived from the 30-psi automobiles. Except for the large sheet-metal fragments, the 50-psi automobile debris was collected in a pile and is discernible in the indicated photograph of Figure 3.25.

3.2.3 Weight Distributions. The cumulative weight distributions of the automobile debris generated at 15, 30, and 50 psi are plotted in Figure 3.26. Each curve is the per-automobile average of the debris from the four automobiles at the specified overpressure. Hardly any parts were blown off the automobile positioned at 10 psi as stated previously, and hence no 10-psi cumulative weight distribution is graphed.

The curves of Figure 3.26 are analogous to those of Figures 3.10, 3.11, or 3.12 for tree debris, and were derived in a similar manner. The raw automobile data in Appendix B and Table 3.1 on the weights of the small and large automobile parts was used to obtain these curves. The weight of the automobile debris from each originating-automobile overpressure group weighing less than various discrete maximum fragment weights were divided by four to put these curves on an average-per-automobile basis. Instead of small-step curves, straight lines were drawn over the weight ranges between the various discrete maximum fragment weights selected.

The correlation between automobile fragmentation and peak overpressure from this project is readily apparent in Figure 3.26. As with trees, it can be seen that the automobile fragmentation increased considerably with overpressure in the 10- to 50-psi range, especially for the heavier weight groups. As cited in this figure, an average of 100 pounds of automobile debris was blown off each of the 15-psi automobiles; an average of 160 pounds of automobile parts originated from each of the 30-psi automobiles; and about 400 pounds of debris came from each of the 50-psi automobiles on the average. An average of 18 pounds per 15-psi automobile was attributable to two spare tires from the trunks of two of these automobiles. Since most of the other automobiles did not have loose spare tires in their trunks, 80 pounds is a more comparable indication of the weight of the debris from each 15-psi automobile. It can also be observed that the maximum-weighted automobile-debris fragments that originated at 15, 30, and 50 psi were 64 pounds, 57 pounds, and 360 pounds, respectively. Many parts were blown loose from the automobiles stationed above 10 psi, in general, indicating that automobiles are a significant debris source above this level in a 1-kiloton yield.

For the larger nuclear-attack yields, it is expected that there will be a significant increase in the automobile fragmentation at each overpressure compared to that found in this project. The reasons are the same as the two mentioned in the tree-debris Weight Distributions subsection. More debris would have been blown off the automobiles with a longer duration blast because a large number of automobile parts were hanging and nearly ripped off after the Dial Pack blast. Moreover, the automobile bodies would have tumbled and broken up even more in a much larger yield. Tumbling fragmentation was not simulated at all in this project because of the short automobile-body transport distances due to short positive phase durations. The automobile fragmentation data obtained in this project, as with tree fragmentation data, represents a lower bound of the automobile fragmentation anticipated at the same overpressures but for larger-yield detonations.

3.2.4 Fragment Sizes. The automobile fragments were rather diverse, and are described and listed in Appendix B and Table 3.1. Because of their diversity, the mathematical characterizations of their shape, size, and weight-shape relation cannot be attempted as in the case of the tree fragments. About the only comment that can be made in these respects regarding the automobile fragments is that those weighing more than 10 pounds were, except for possibly seats and spare tires, invariably sheet-metal types of fragments. On the other hand, the lighter fragments had a large variation of surface area to weight ratio, a basic aerodynamic parameter. They have to be treated on an individual basis in regards to these characeterizations.

3.2.5 Ground Distributions. The approximate ground weight distributions of the debris from the 15-, 30-, and 50-psi automobiles are presented in Figure 3.27, with the automobile bodies excluded. In this figure, the debris from the four automobiles at each overpressure level has been taken into account and just the magnitude of the sideward transport of the debris is indicated. In addition, this debris is distinguished according to whether it weighed more or less than 10 pounds. The exact final ground positions (with magnitude of sideward transport) of the automobile parts weighing 10 pounds or more are designated since their postshot positions were surveyed and they were traceable to their originating automobile whose initial position was closely known (Table 2.3). Only the approximate bounds of the regions where the automobile debris parts weighing less than 10 pounds were found are contoured. These contour bounds are only approximate for these parts because usually the originating automobile could not be identified and the 50-psi grid square was noted instead of their exact postshot location. In the drawing of the contours in this figure, these automobile debris parts were assumed to have final positions in the center of their recorded grid squares and to have been generated from the automobile that gave minimum transport. There is no further weight breakdown in these figures, as in the tree cases, since the automobile debris parts were not weighed according to grid squares and were not sufficiently measured to estimate their weights from their dimensions.

The exact weights and displacements of the automobile-debris parts weighing more than 10 pounds are listed in Table 3.1. These results were used in Figure 3.27. The transports of the automobile bodies are also given in Table 3.1 and are illustrated in Figure 3.28, along with the automobile orientations.

The overall transport of the automobile debris is apparent from Figure 3.27. The maximum radial transport of this debris can be noticed to have been 260 feet, 250 feet, and 550 feet at 15, 30, and 50 psi, respectively.

The dispersion of this automobile debris at 15, 30, and 50 psi can be grossly estimated from Figure 3.27. No automobile debris parts were dispersed more than 30 degrees at 15 psi, some parts were dispersed a maximum of 90 degrees at 30 psi, and none were dispersed more than 78 degrees at 50 psi. It can generally be observed that the dispersion of the heavier fragment parts are comparable and sometimes larger than the lighter ones; there is no inverse weight-dispersion relation as found for the tree debris. The reason for this is the flat geometric nature of the heavy automobile-debris parts which allows them to develop high lift forces.

The transport results at 30 psi should be disregarded because of the occurrence of the nonluminous jet mentioned previously. This obviously caused the large sideward transport of the 30-psi automobile bodies and automobile debris, and the large negative radial transport of some of this debris.

3.2.6 Remarks About High-Speed Movie Films. The lofting of some automobile debris was observable in the high-speed movie films taken, despite the strong obscuration by dust. In these films, debris parts from the 50-psi automobiles can be seen up to 60 to 70 feet in the air. Six large sheet-metal fragments and numerous small ones were evident, with the larger ones attaining heights just as high as the smaller ones. A few small sheet-metal fragments and one large one from the 30-psi automobiles were also photographed, but they were only 30 to 40 feet above the ground at maximum. No 15-psi automobile fragments were visible in these films because of the camera viewing directions. Besides the lofting in the films, several 50-psi automobile fragments could be seen moving sideways with high velocity.

3.2.7 Problems Encountered. The difficulties incurred in the automobile phase of the project have been mentioned or suggested. Only the approximate initial automobile positions were recorded. After each automobile overpressure contour was staked near the automobile placement areas, the automobiles were parked by visually sighting them along these contours near the stakes. So, the positions in Table 2.3 might be in error by a couple of feet. A second difficulty was that the 232-degree nonluminous jet reached the 30-psi automobiles and definitely affected the 30-psi automobile-debris results, though to an unknown extent. The transport results of the 30-psi automobile debris seemed to have been influenced mostly by this jet. Another problem was that the smaller lighter automobile parts could not be traced to their originating automobile because most had felt-ink pen markings that faded in many cases. Fortunately, the overlapping of this debris from each automobile overpressure group was small, allowing it to be differentiated in this respect. Another trouble was the dust obscured many of the automobile debris parts from view in the high-speed movie films.

3.3 TRANSPORT OF TUMBLING BLOCKS

The weight and blast-wave transport of all the tumbling blocks of this project positioned in the Dial Pack shot are listed in Table 3.2. The transport results appear quite rational and reliable except for those expressed below.

Only the approximate radial transport distances of the tumbling blocks were determined. These displacements are only approximate because after each appropriate overpressure station was surveyed and indicated with a stake near the tumbling-block placement areas, the suitable tumbling blocks were initially placed by eyeing them along the according overpressure arcs near the stakes. In other words, the exact initial positions of each tumbling block were not marked, though the resultant positions of each were surveyed. This implies their initial locations could have been a couple of feet or so from their designated overpressure arcs. The sideward transport of the tumbling blocks could not be measured since their initial positions were not precisely marked. In general, from visual observations, their sideward displacements were quite small as anticipated.

The blast wave was probably quite classical at the 15-, 50- and 100-psi tumbling-block placement areas as no anomalies occurred thereabouts. But, as with the 30-psi automobiles, the tumbling blocks at 30 psi were unquestionably affected by the nonluminous jet at the 232-degree bearing angle. Therefore, the recorded radial transport distances for the 30-psi tumbling blocks are likely quite different from those that would be obtained in a 1-kiloton classical blast, especially the distances determined for the lighter 30-psi tumbling blocks.

The tumbling blocks in their final positions can be noticed in some of the postshot photographs of the trees and automobiles, Figures 3.2 to 3.5 and 3.23 to 3.25. For instance, the three 2-pound styrofoam blocks originally located at 15 psi are observable in the postshot picture taken of tree number 6 presented in Figure 3.3.

The reason for collecting these tumbling-block transport distances at Event Dial Pack, and the blast-transport of other objects such as bricks in various test programs, is to use these results to approximate the tumbling soil-fragment interaction forces. An inverse method outlined in the Preliminary Project Officers Report of this project (Reference 12) is one possibility for estimating this interaction. A mathematical representation of this interaction is assumed in this method and adjusted accordingly using iteration until a verified blast-transport analysis, employing this representation, agrees with the transport test results. The determined mathematical interaction would have to corroborate with other treatments of this subject, as with Reference 13. This analysis and correlation still remains to be done.

Table 3.1 WEIGHTS AND TRANSPORT OF HEAVY AUTOMOBILE-DEBRIS PARTS

Automobile Number	Automobile Initial Overpressure Position (psi)	Automobile Debris Part	Part Weight (pounds)	Displacement (feet) Radial*	Tangential†	Total‡
1	50	Automobile Body	—	53	5	54
		Upper Body Frame with Doors	360§	142	-29	145
		Front Seat	70§	78	-92	121
		Hood	61	215	-68	226
		Roof	45	345	-89	356
		Seat	35	110	-31	114
		Seat	35	77	-6	77
		Driver-Side Front Fender	28	50	-7	51
		Driver-Side Rear Fender	21	71	10	71
		Passenger Side Front Fender	21	167	-32	170
		Trunk Lid Shell	19	37	209	212
2	30	Automobile Body	—	19	-1	19
		Roof	57	126	206	242
		Seat	37	29	0	29
		Passenger-Side Front Fender	28	9	-154	154
		Trunk Lid Shell	25	115	137	179
		Left Front Guard Panel	16	57	-145	156
		Driver-Side Hood Half	13	92	-156	181
		Right Front Guard Panel	13	169	-186	252
		Passenger-Side Hood Half	12	31	-59	67
		Passenger-Side Rear Fender	12	150	-66	164
3	15	Automobile Body	—	10	-1	10
		Hood	52	167	-63	179
		Spare Tire	35§	24	4	24
4	15	Automobile Body	—	4	0	4
		Hood Shell	42	198	-6	198
		Hood Hinges and Brace	13	257	24	258
5	50	Automobile Body	—	51	-9	52
		Roof	65	78	-61	99
		Hood Framework	35	209	9	209
		Hood Shell	33	78	-57	96
		Hood Latch and Panel	32	22	-1	22
		Driver-Side Front Fender	27	72	-20	75
		Passenger-Side Front Fender	25	189	-5	189
6	15	Automobile Body	—	5	0	5
		Passenger-Side Hood Half	19	42	7	43
7	50	Automobile Body	—	47	15	49
		Roof	59	193	4	193
		Hood	45	290	-96	306
		Passenger-Side Front Fender	25	222	-16	222
		Gas Tank	20	36	3	37
		Driver-Side Front Outer Fender	13	262	-98	280
		Driver-Side Front Inner Fender	10	358	26	359
8	50	Automobile Body	—	41	4	41
		Roof	39	133	-628	642
		Seat	35	46	9	47
		Trunk Lid Shell	30	176	-39	181
		Hood Shell	29	136	62	150
		Seat	27	14	0	14
		Coil Suspension Spring	12	36	15	39
9	10	Automobile Body	—	0	0	0
10	15	Automobile Body	—	6	-2	6
		Roof	64	5	8	10
		Spare Tire	35§	21	-1	21
11	30	Automobile Body	—	23	11	26
		Roof Shell	44	-282	-13	282
		Hood Shell	31	208	91	227
		Seat	29	-3	19	19
		Driver-Side Front Fender	23	11	-5	12
		Hood Framework	23	40	117	123
12	30	Automobile Body	—	4	19	19
		Trunk Lid Shell	24	-271	32	273
		Driver-Side Hood Half	16	-272	-34	274
		Passenger-Side Hood Half	16	15	-17	23
13	30	Automobile Body	—	-3	-22	22
		Hood Shell with Latch	40	17	104	106

*Positive indicates away from ground zero, negative indicates toward ground zero.

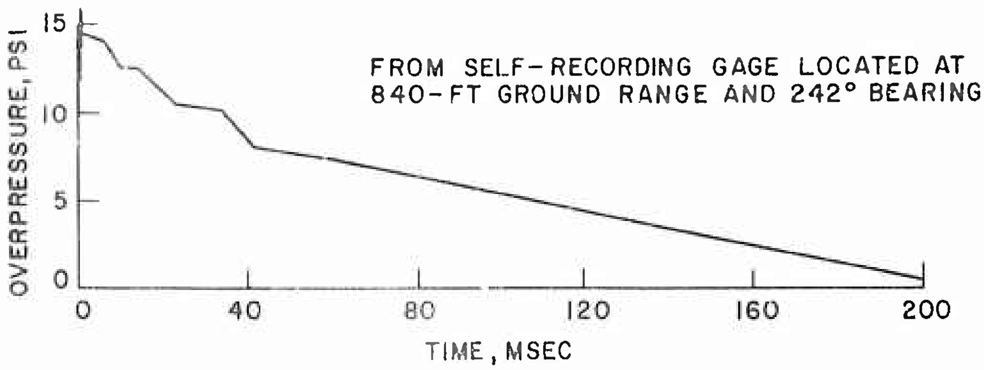
†Positive indicates an increase in bearing angle, negative indicates a decrease in bearing angle.

‡Magnitude

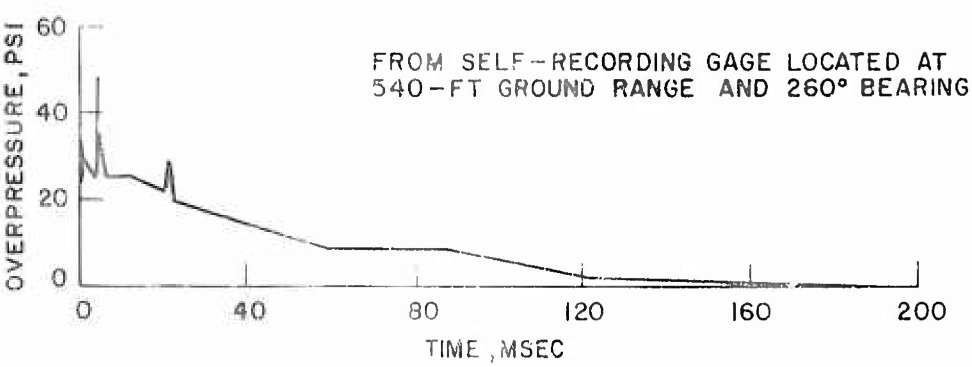
§Estimated, not weighed

Table 3.2. Weights and Transport of Tumbling Blocks

Tumbling Block Number	Tumbling Block Initial Overpressure Position (psi)	Nominal Weight and Type of Tumbling Block	Actual Weight (pounds)	Approximate Radial Transport Distance (feet)
1	15	65-Pound Plywood-Cement Composition	64.5	6.7
2	15	65-Pound Plywood-Cement Composition	65.5	7.3
3	15	65-Pound Plywood-Cement Composition	64.0	8.5
4	30	65-Pound Plywood-Cement Composition	63.0	36
5	30	65-Pound Plywood-Cement Composition	64.0	39
6	30	65-Pound Plywood-Cement Composition	61.0	43
7	50	65-Pound Plywood-Cement Composition	63.5	103
8	50	65-Pound Plywood-Cement Composition	63.5	150
9	50	65-Pound Plywood-Cement Composition	61.5	184
10	100	65-Pound Plywood-Cement Composition	Destroyed	
11	100	65-Pound Plywood-Cement Composition	63.5	230
12	100	65-Pound Plywood-Cement Composition	61.5	317
13	15	10-Pound Flexible Polyurethane Foam	8.2	128
14	15	10-Pound Flexible Polyurethane Foam	8.6	127
15	15	10-Pound Flexible Polyurethane Foam	8.8	113
16	30	10-Pound Flexible Polyurethane Foam	8.[illegible]	151
17	30	10-Pound Flexible Polyurethane Foam	8.5	96
18	30	10-Pound Flexible Polyurethane Foam	8.9	256
19	50	10-Pound Flexible Polyurethane Foam	Destroyed	
20	50	10-Pound Flexible Polyurethane Foam	Destroyed	
21	50	10-Pound Flexible Polyurethane Foam	Destroyed	
22	100	10-Pound Flexible Polyurethane Foam	8.8	432
23	100	10-Pound Flexible Polyurethane Foam	Destroyed	
24	100	10-Pound Flexible Polyurethane Foam	Destroyed	
25	15	2-Pound Flexible Polyurethane Foam	1.9	118
26	15	2-Pound Flexible Polyurethane Foam	1.9	87
27	15	2-Pound Flexible Polyurethane Foam	Disturbed	
28	30	2-Pound Flexible Polyurethane Foam	1.9	-176
29	30	2-Pound Flexible Polyurethane Foam	1.9	-179
30	30	2-Pound Flexible Polyurethane Foam	1.9	-189
31	50	2-Pound Flexible Polyurethane Foam	Destroyed	
32	50	2-Pound Flexible Polyurethane Foam	Destroyed	
33	15	2-Pound Rigid Styrofoam	1.8	114
34	15	2-Pound Rigid Styrofoam	1.8	98
35	15	2-Pound Rigid Styrofoam	1.8	122
36	15	2-Pound Rigid Styrofoam	1.8	103
37	30	2-Pound Rigid Styrofoam	1.8	100
38	30	2-Pound Rigid Styrofoam	1.8	93
39	30	2-Pound Rigid Styrofoam	1.8	98
40	50	2-Pound Rigid Styrofoam	1.8	8
41	50	2-Pound Rigid Styrofoam	Destroyed	
42	50	2-Pound Rigid Styrofoam	Destroyed	



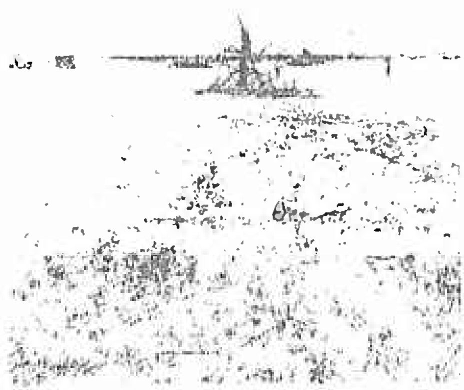
a) OVERPRESSURE RECORDING AT THE 15-PSI TREE GROUP POSITION



b) OVERPRESSURE RECORDING AT THE 50-PSI TREE GROUP POSITION

Figure 3.1. Overpressure recordings by the support pressure transducers at the 15-psi and 50-psi tree group positions

Tree No. 3



Tree No. 2

Tree No. 1

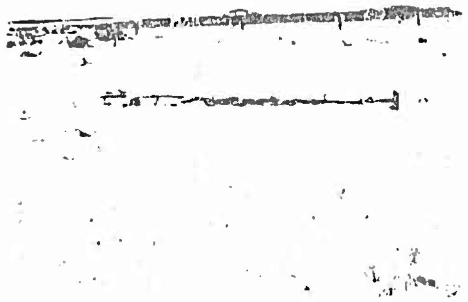
Figure 3.2. Postshot photographs showing remains of aspen trees placed at 15 psi

Tree No. 6

Tree No. 5

Tree No. 4

Figure 3.3. Postshot photographs showing remains of spruce trees placed at 15 psi

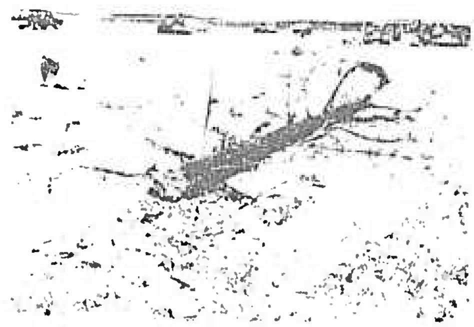


Tree No. 9

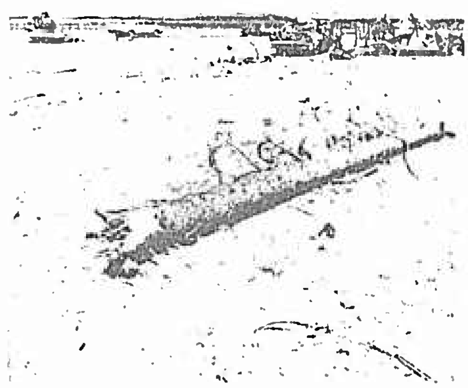
Tree No. 8

Tree No. 7

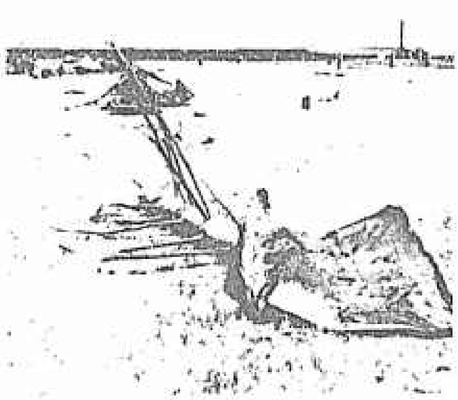
Figure 3.4. Postshot photographs showing trunk remains of aspen trees placed at 50 psi



Tree No. 12



Tree No. 11



Tree No. 10

Figure 3.5. Postshot photographs showing trunk remains of spruce trees placed at 50 psi

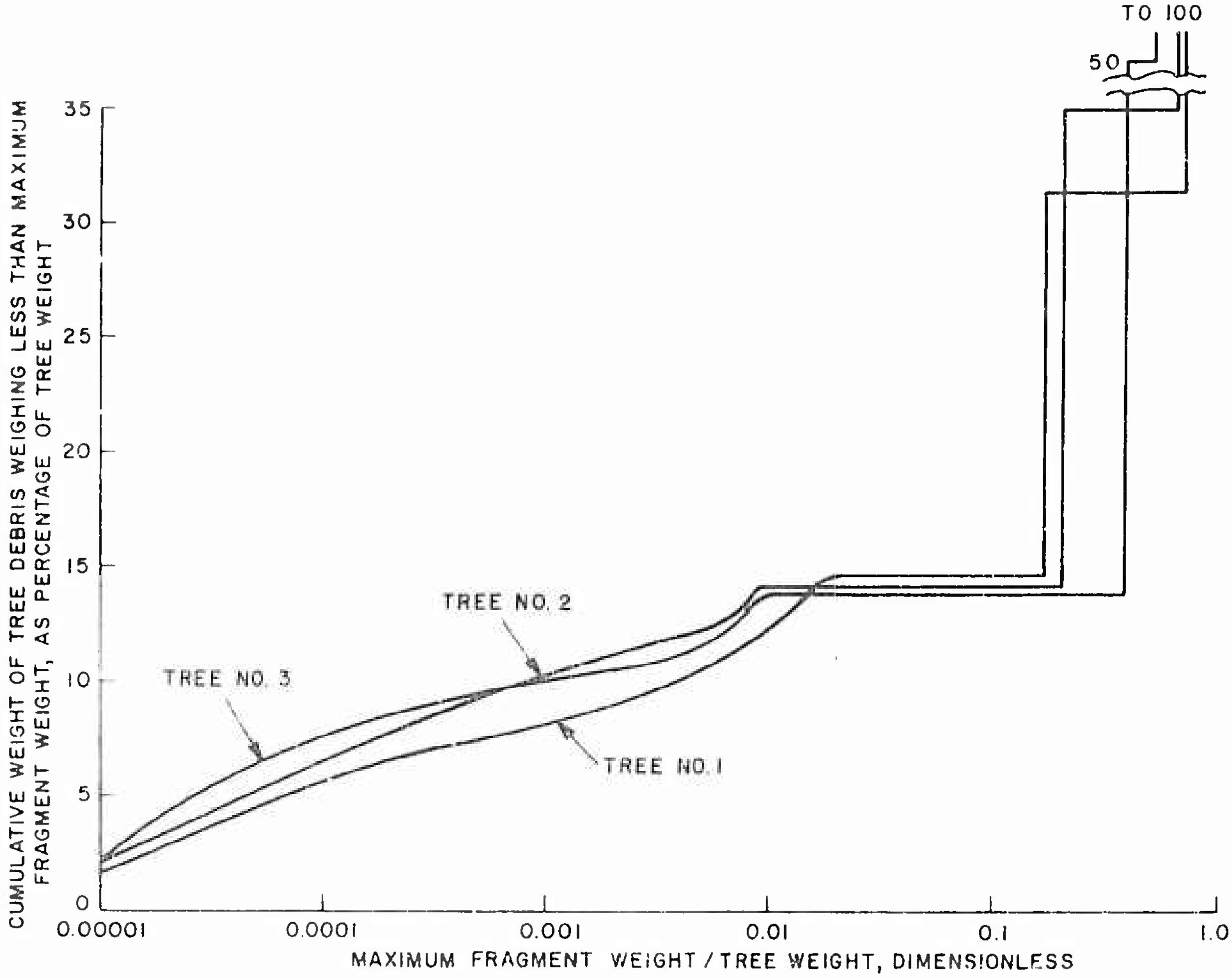


Figure 3.6. Cumulative weight distributions of debris from aspen trees placed at 15 psi. normalized with respect to tree weights

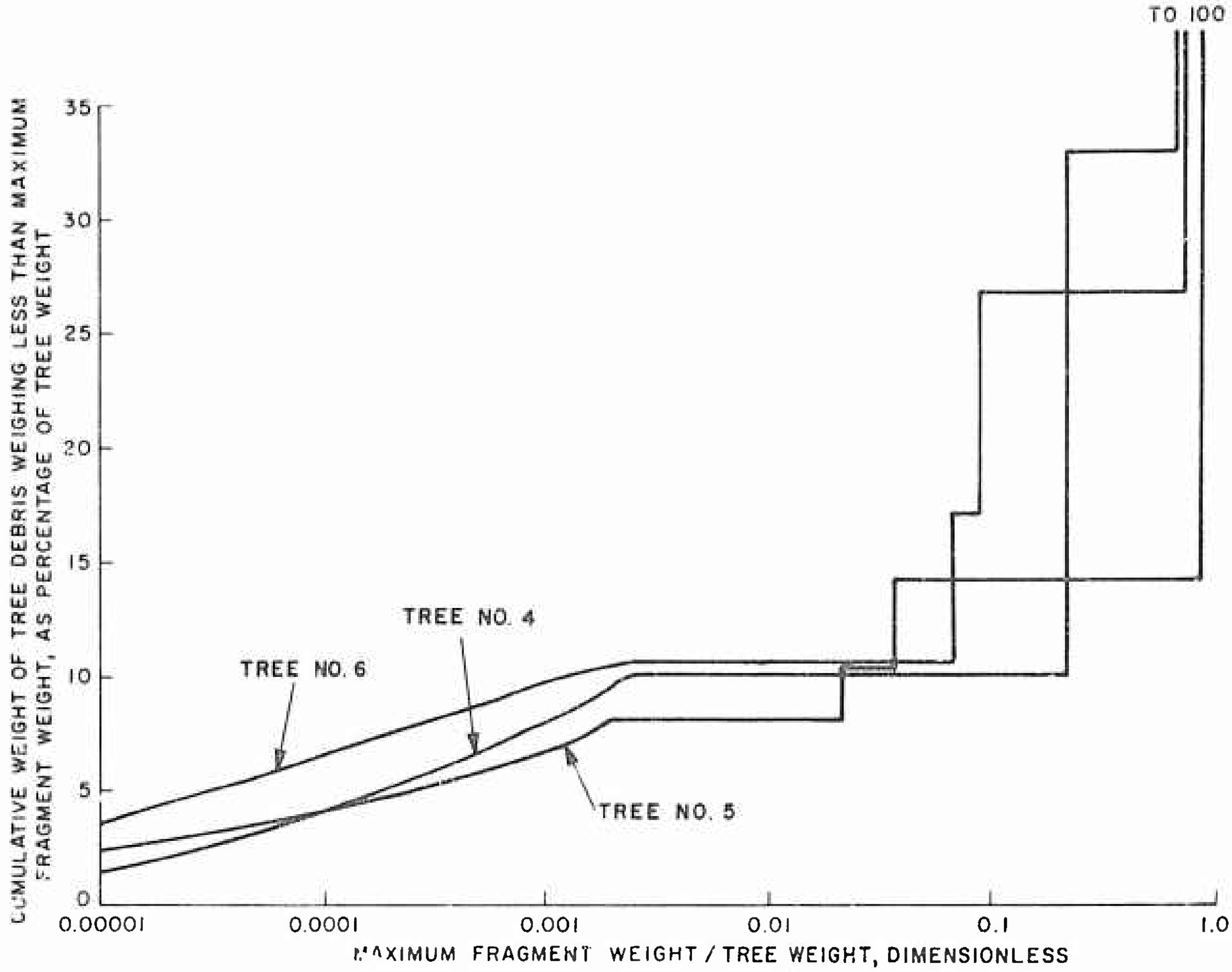


Figure 3.7. Cumulative weight distributions of debris from spruce trees placed at 15 psi, normalized with respect to tree weights

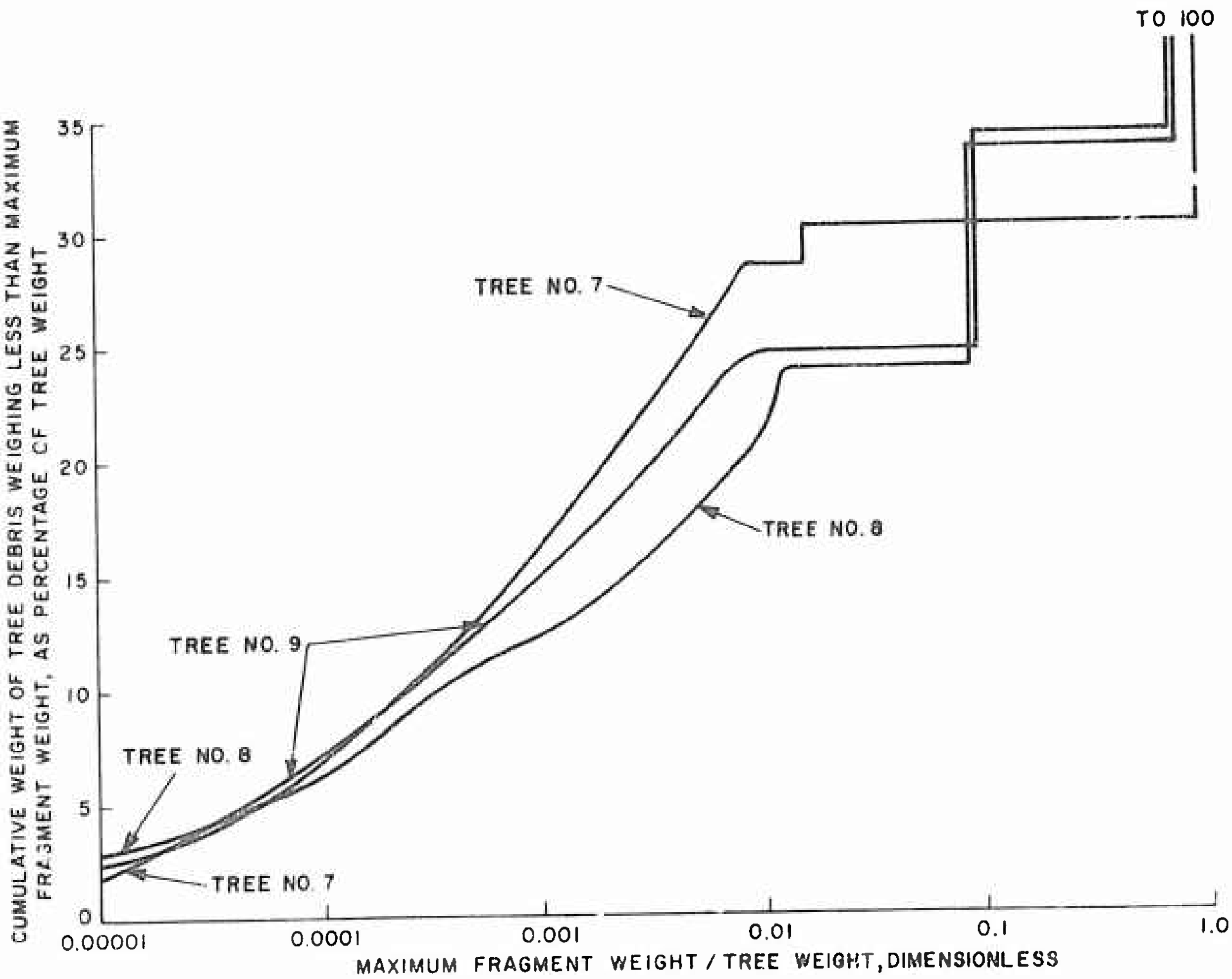


Figure 3.8. Cumulative weight distributions of debris from aspen trees placed at 50 psi, normalized with respect to tree weights

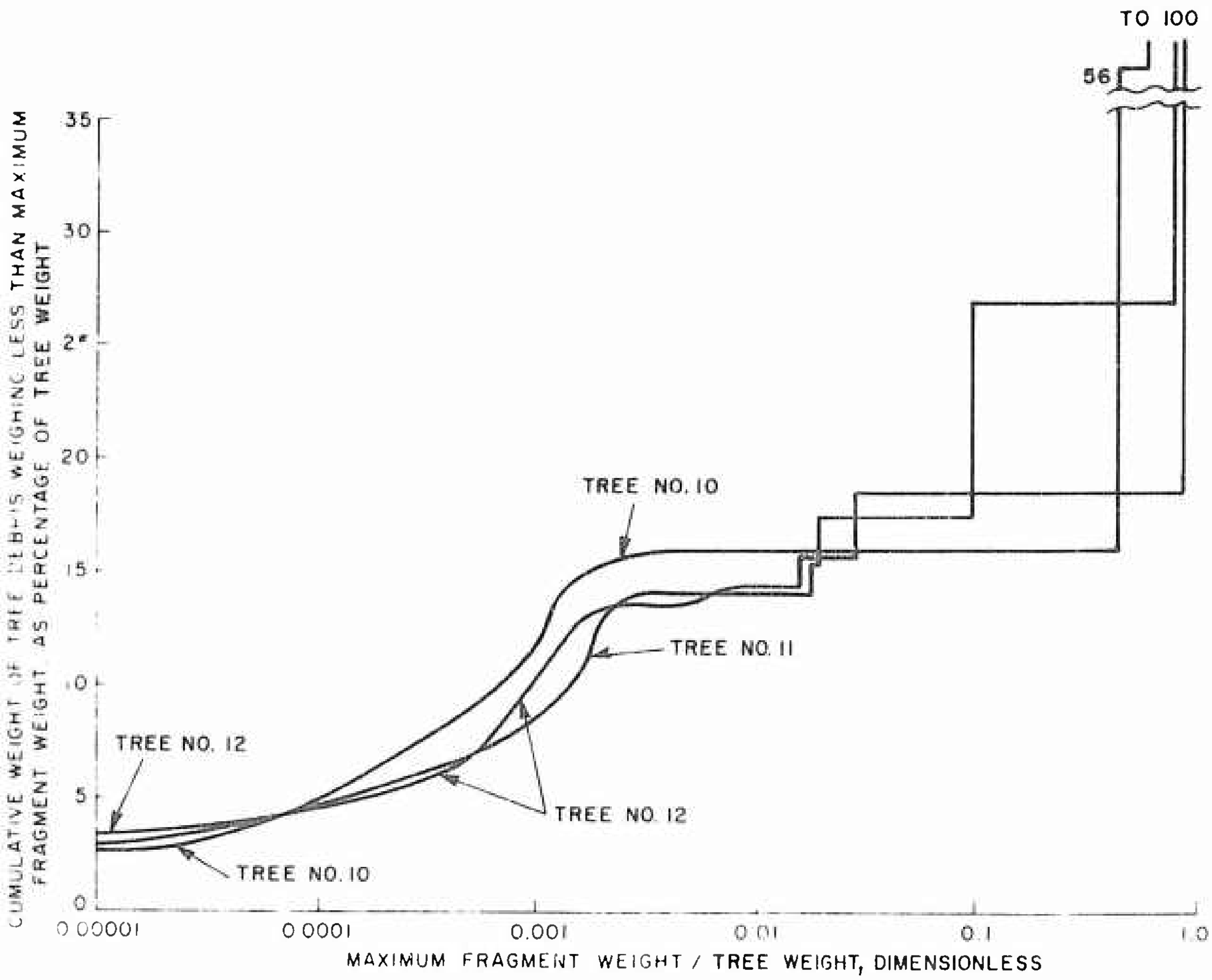


Figure 3.9. Cumulative weight distributions of debris from spruce trees placed at 50 psi, normalized with respect to tree weights

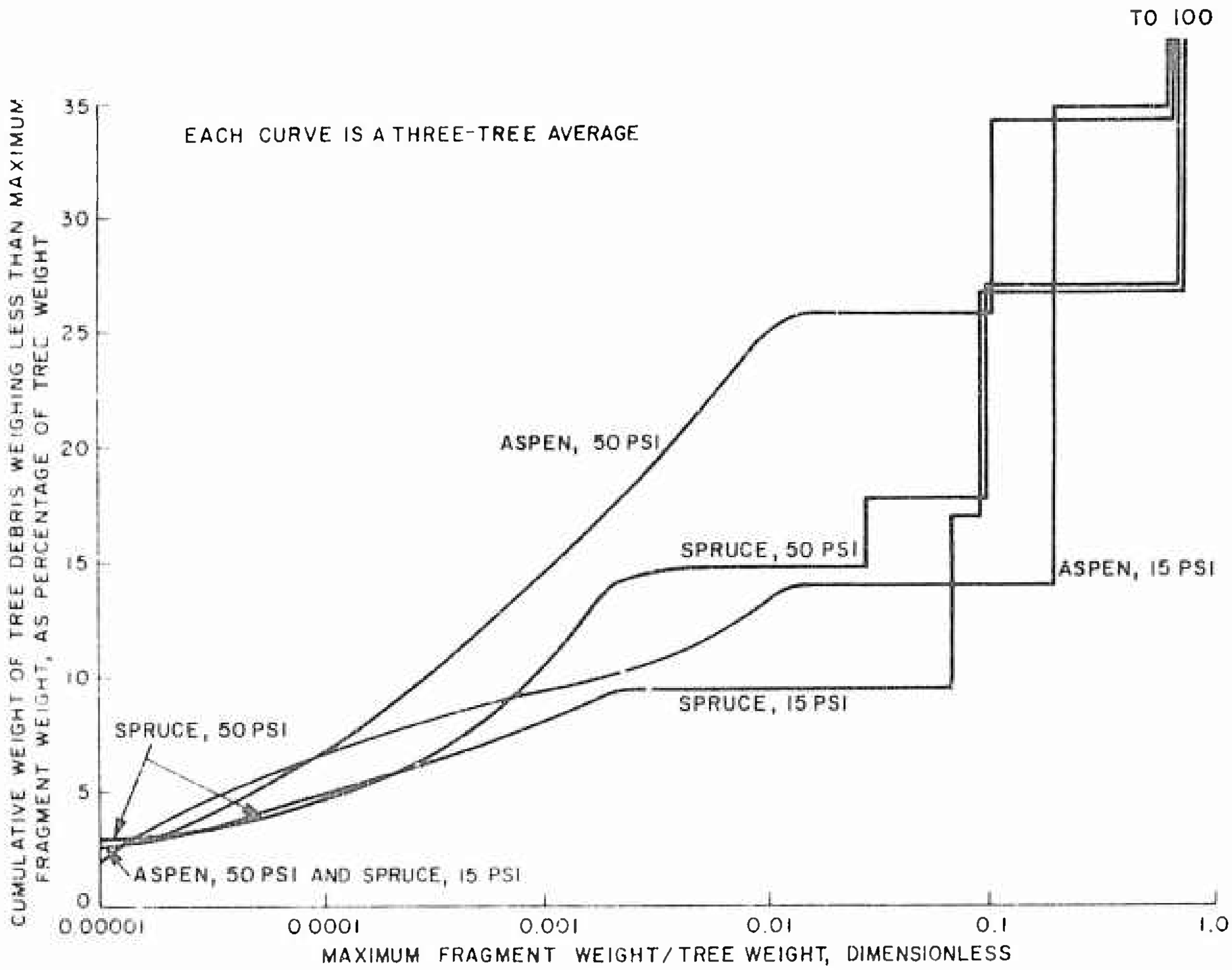


Figure 3.10. Average cumulative tree-debris weight distributions of each specie-overpressure combination, normalized with respect to tree weights

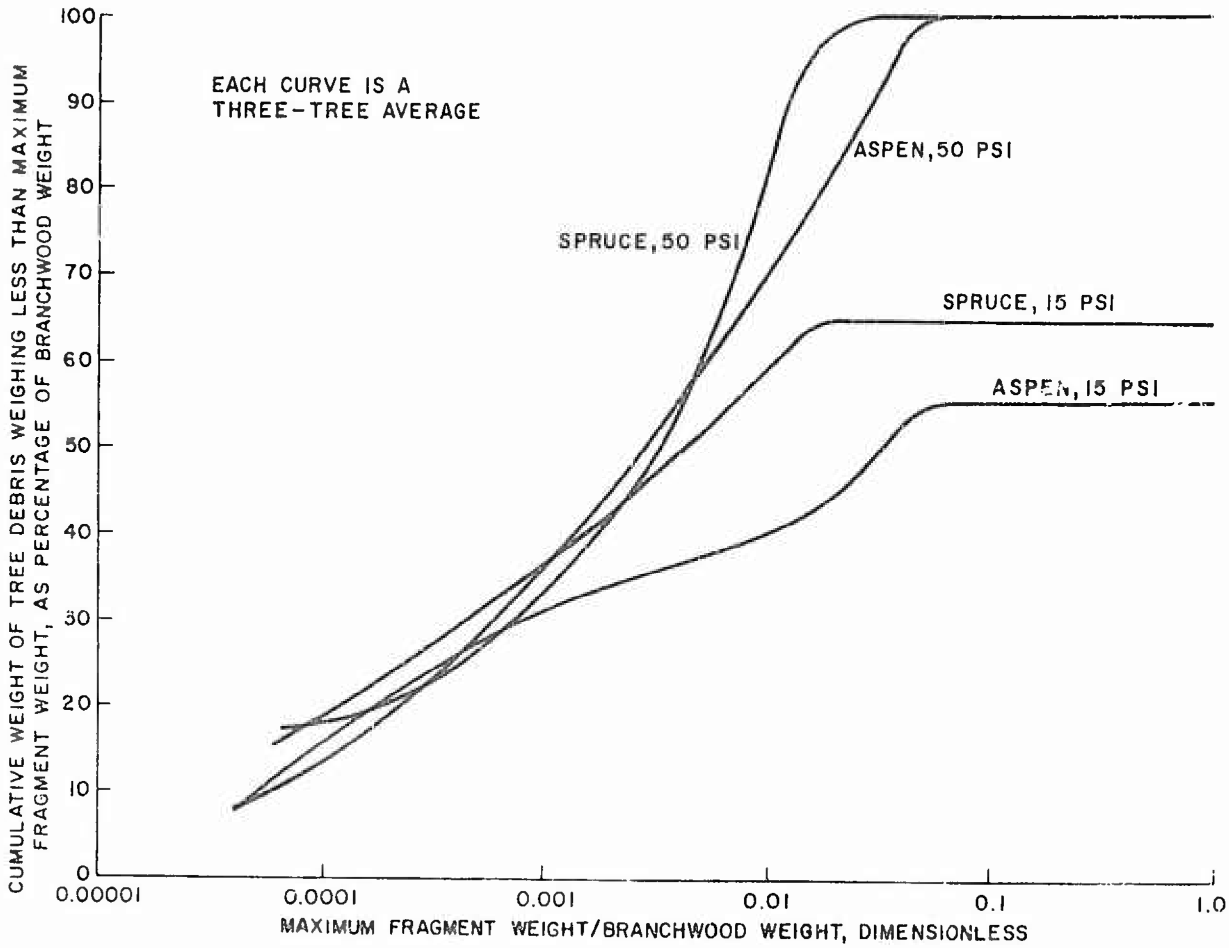


Figure ?.11. Average cumulative tree-debris weight distributions of each specie-overpressure combination, normalized with respect to branchwood weights

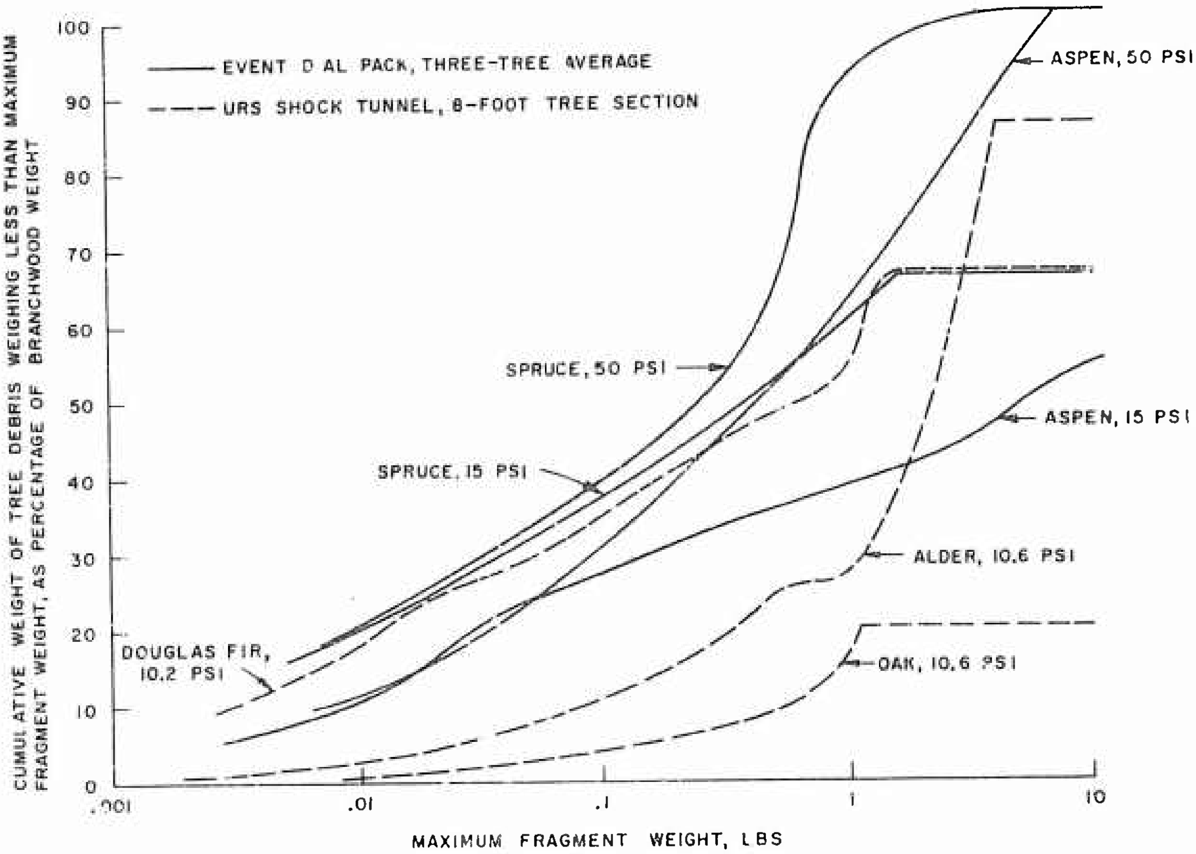


Figure 3.12. Comparison of average cumulative tree-debris weight distributions obtained in this project with similar distributions obtained in a shock tunnel, nonnormalized

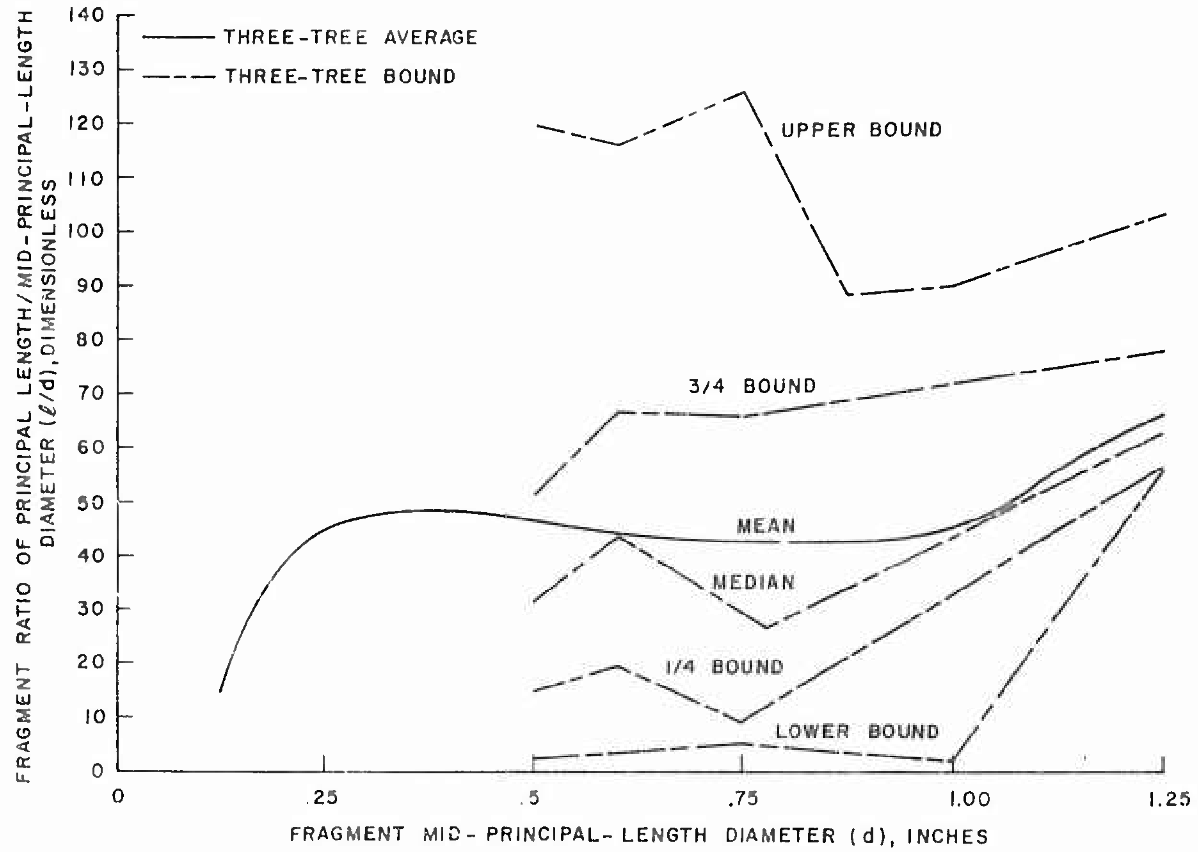


Figure 3.13. Length/diameter ratio variation versus diameter for debris from aspen trees placed at 15 psi

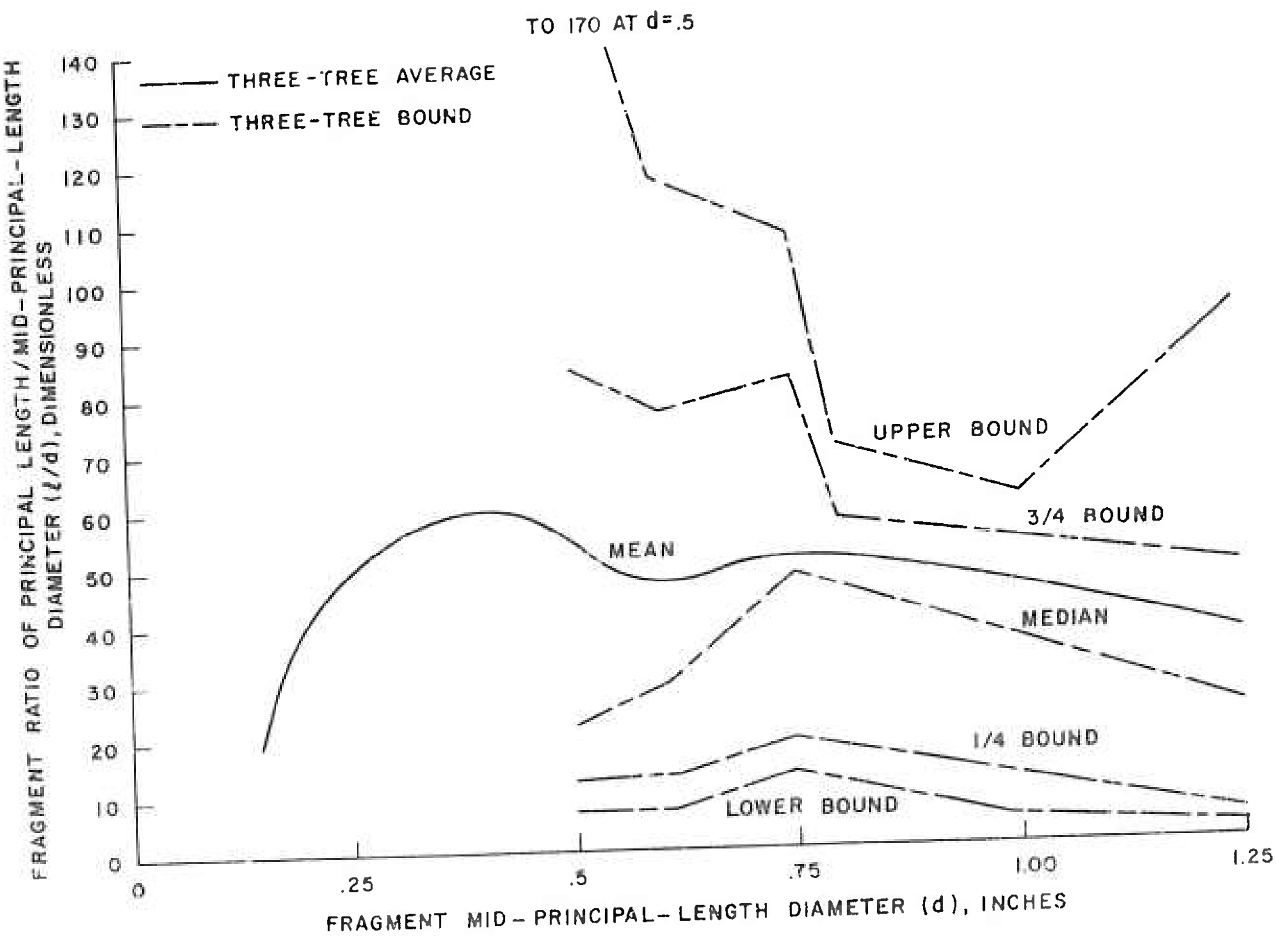


Figure 3.14. Length/diameter ratio variation versus diameter for debris from spruce trees placed at 15 psi

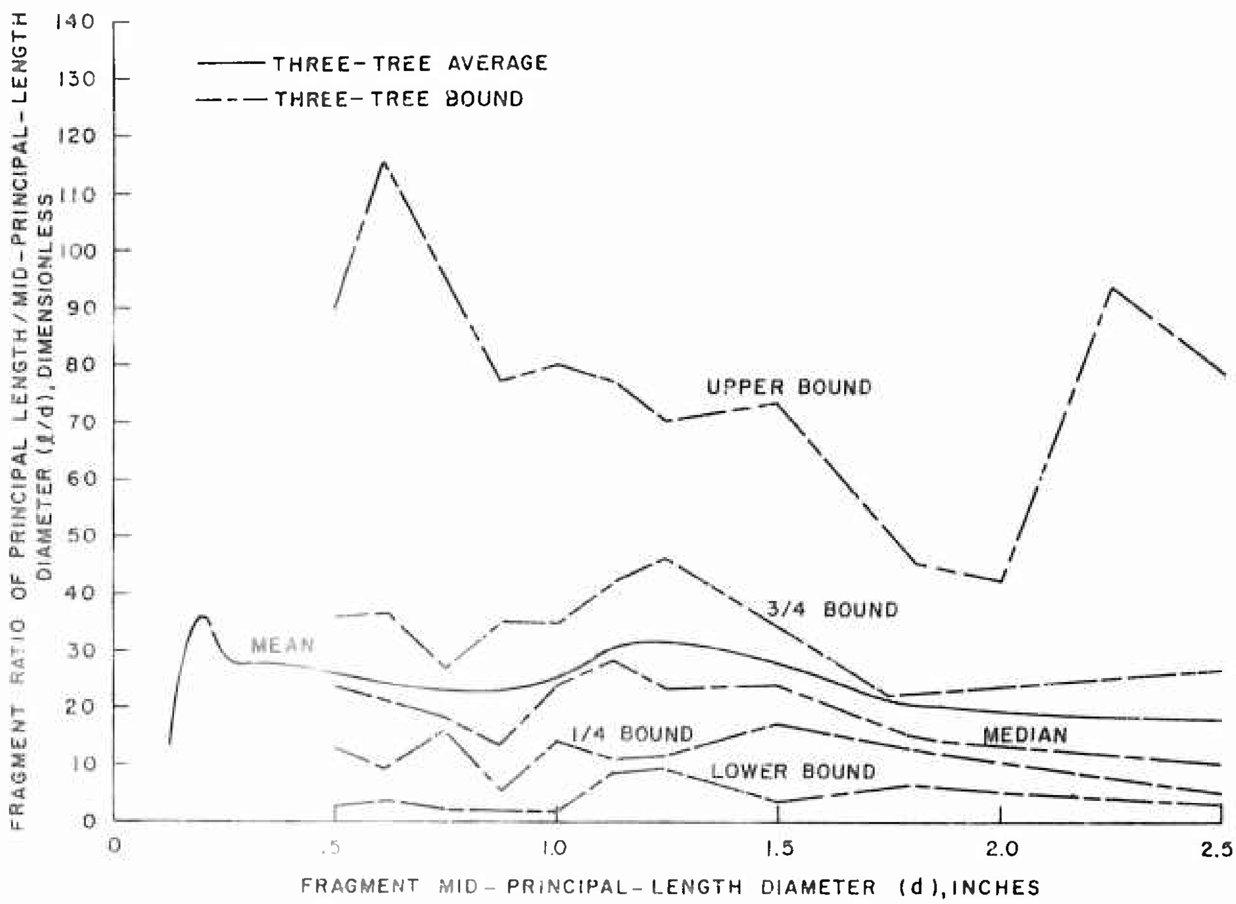


Figure 3.15. Length/diameter ratio variation versus diameter for debris from aspen trees placed at 50 psi

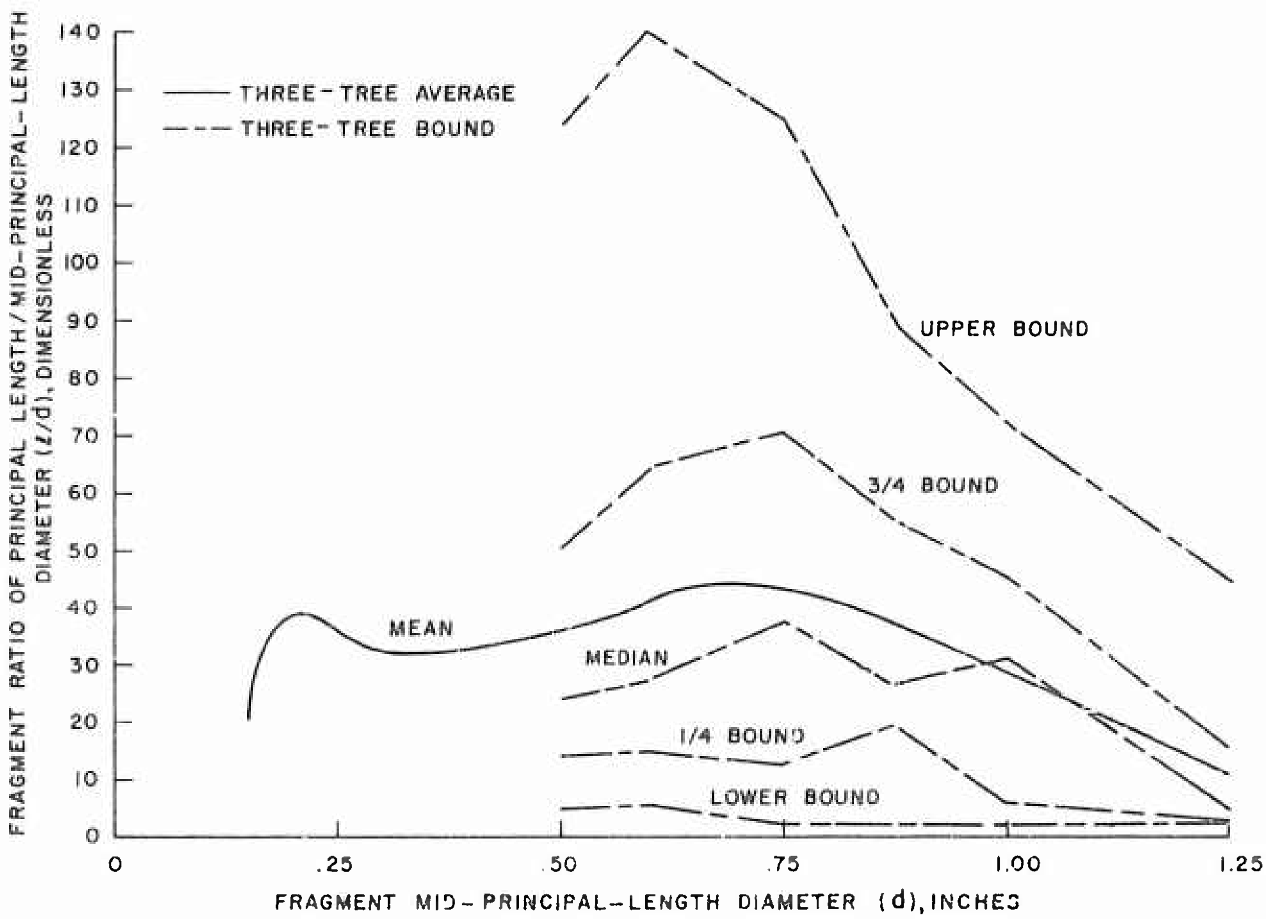


Figure 3.16. Length/diameter ratio variation versus diameter for debris from spruce trees placed at 50 psi

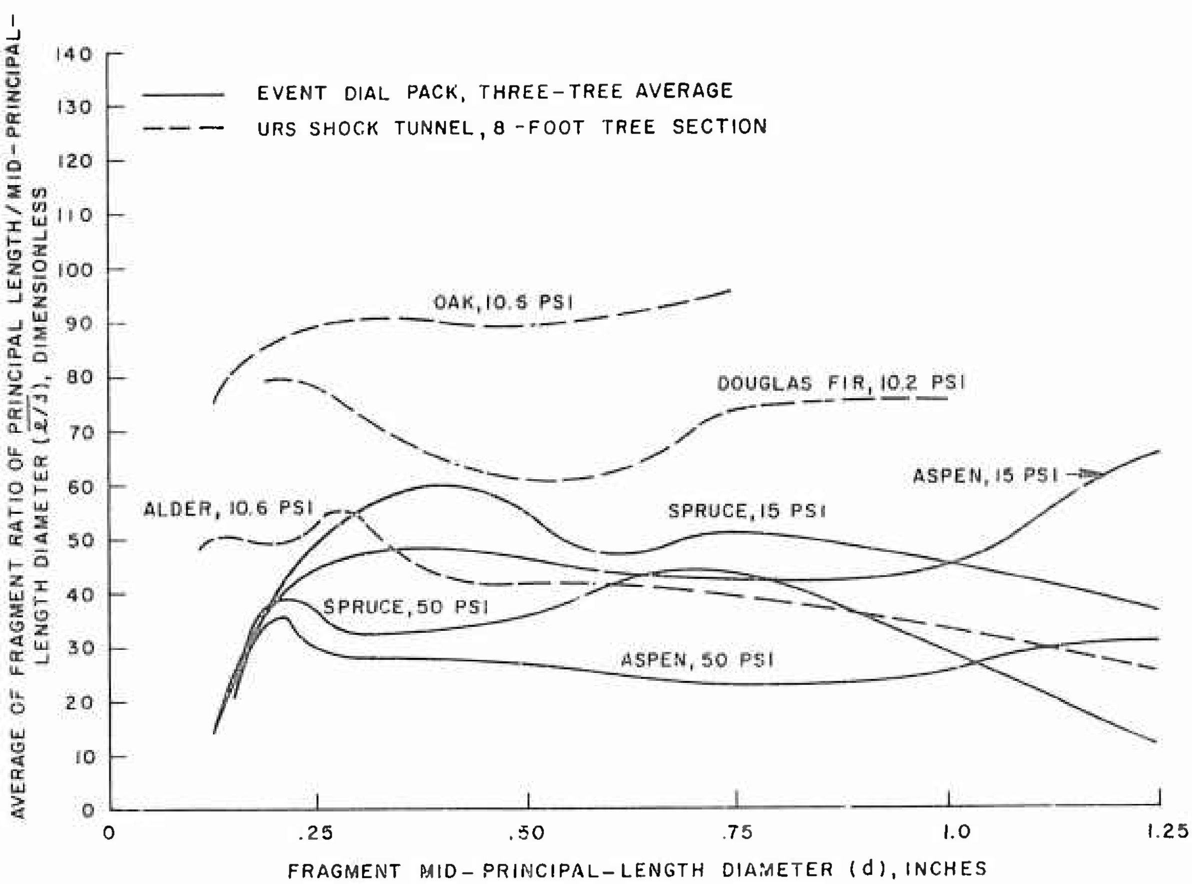


Figure 3.17. Comparison of average tree-debris length/diameter ratio versus diameter plots obtained in this project with similar plots obtained in a shock tunnel

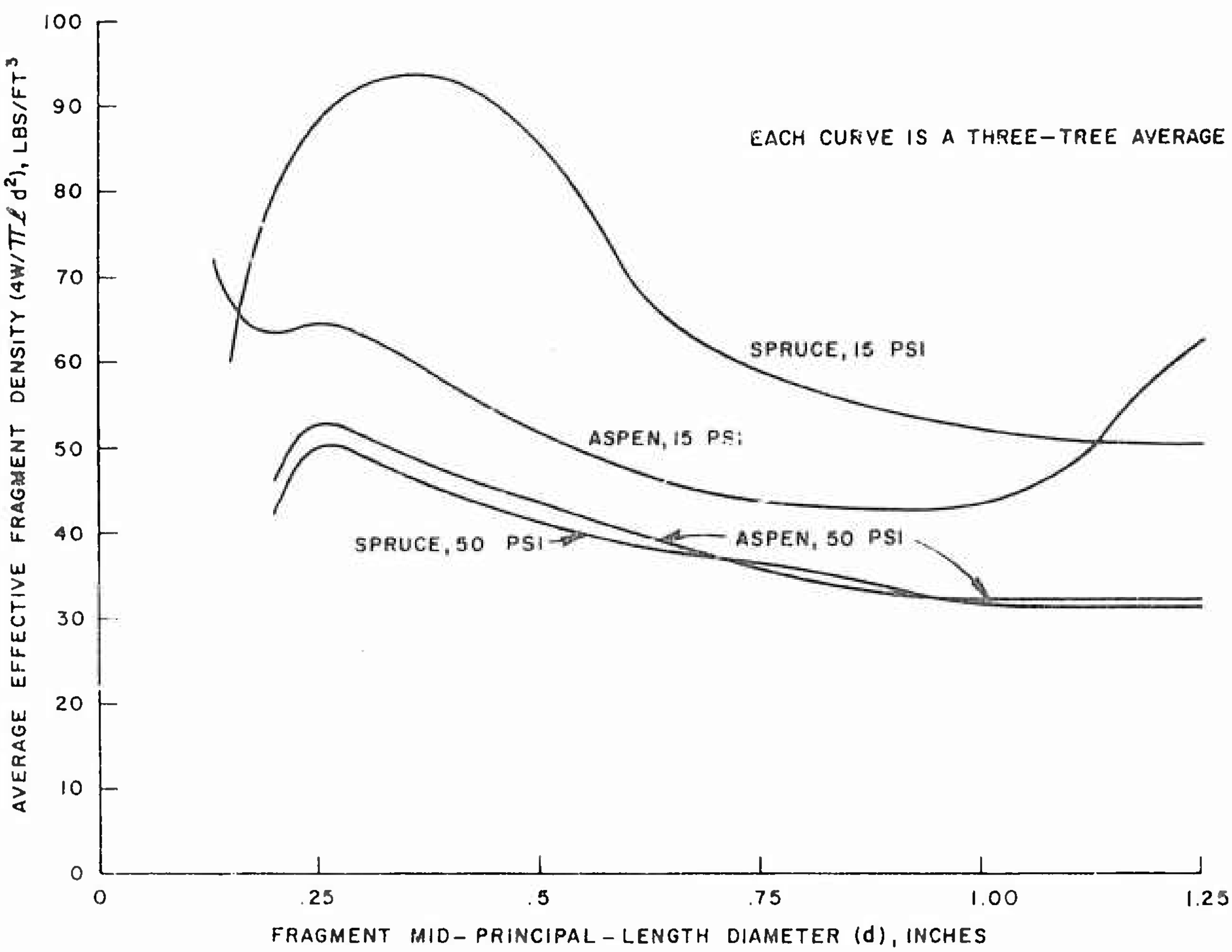


Figure 3.18. Average effective density versus diameter for tree debris of each specie-overpressure combination

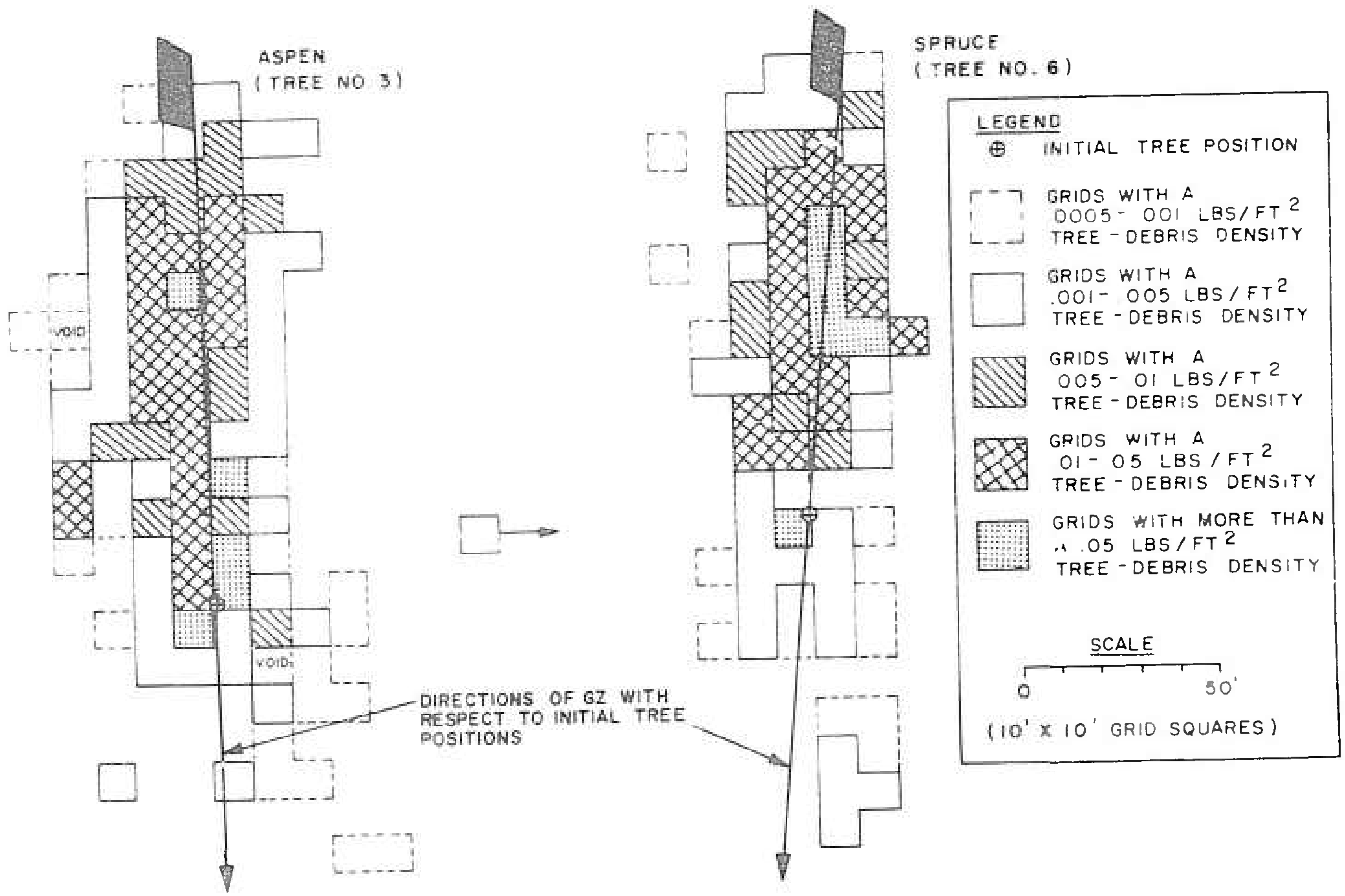


Figure 3.19. Typical ground weight-density distributions of debris from an aspen tree and a spruce tree placed at 15 psi

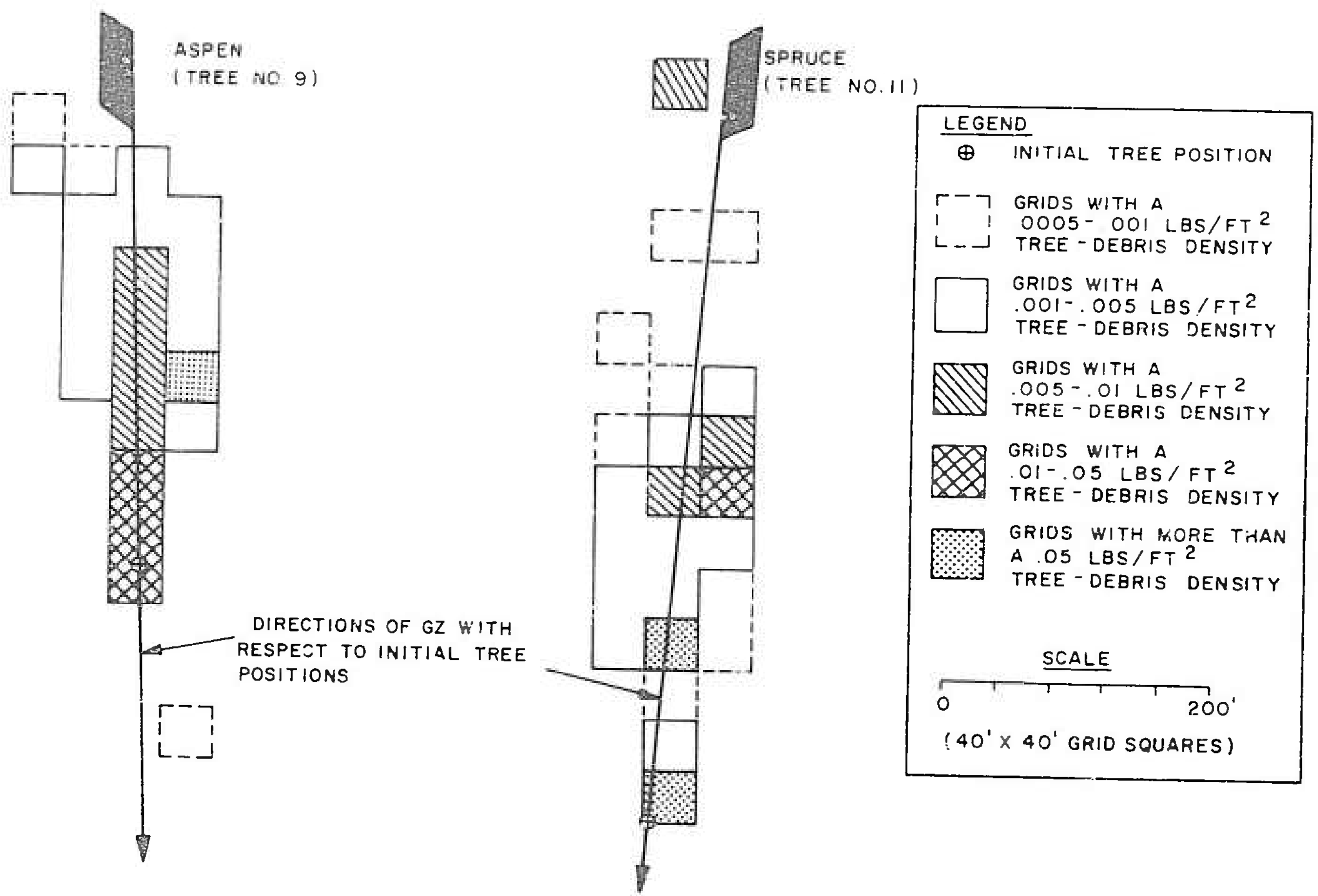


Figure 3.20. Typical ground weight-density distributions of debris from an aspen tree and a spruce tree placed at 50 psi

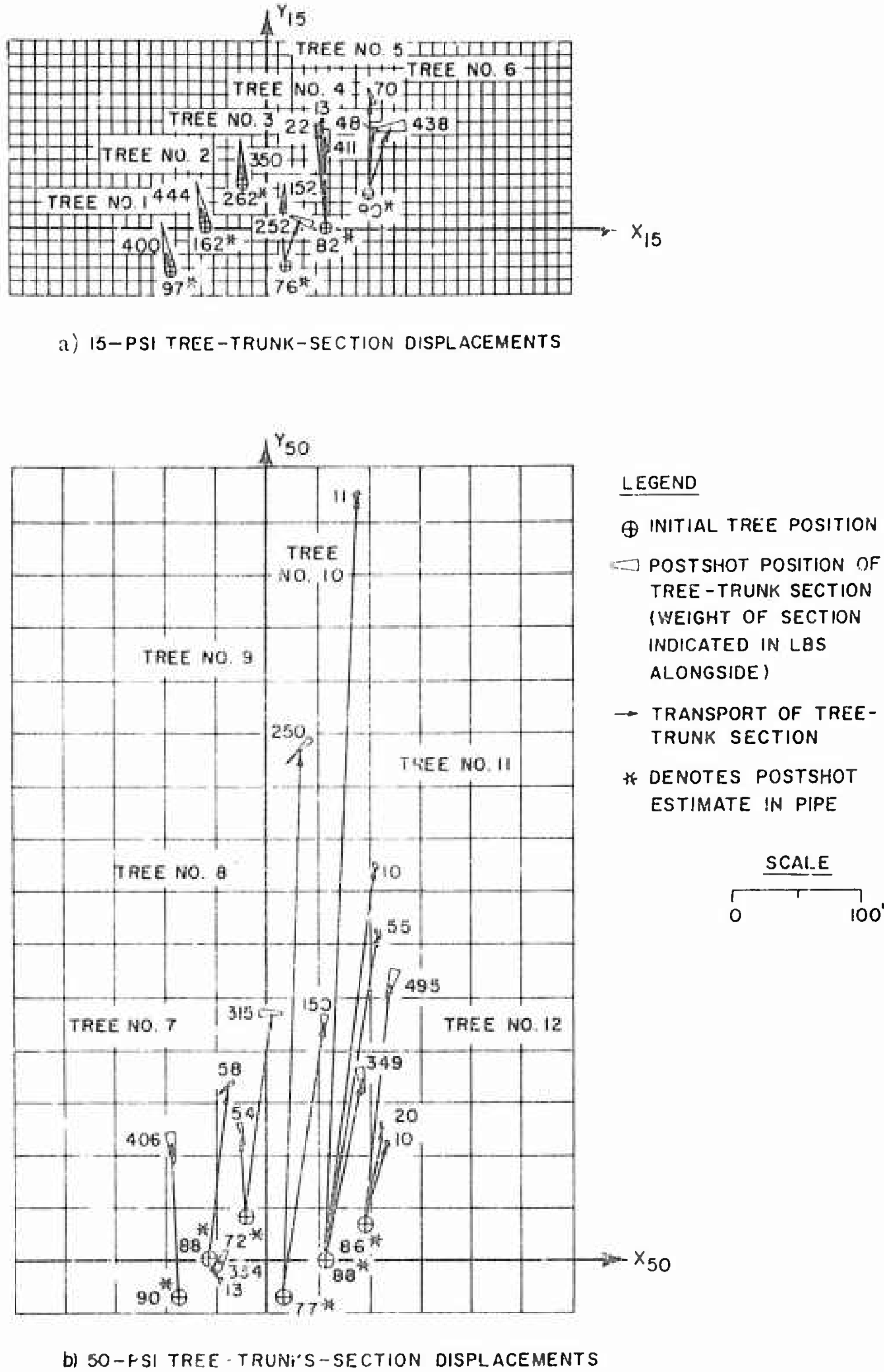
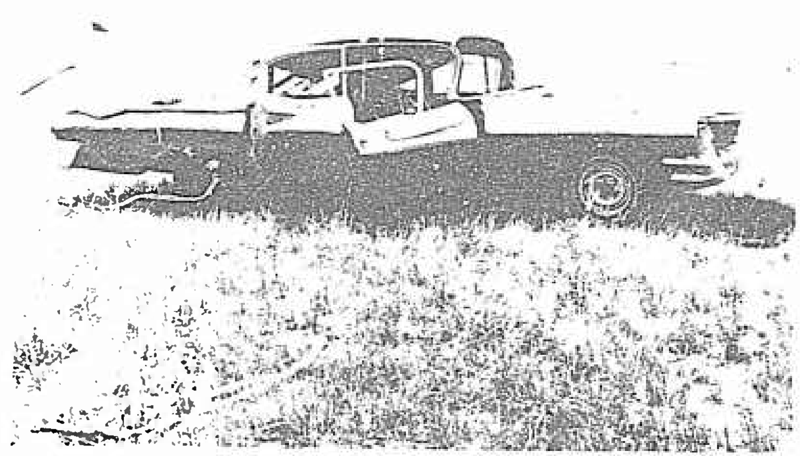


Figure 3.21. Transport and postshot orientations of trunk sections from trees placed at 15 and 50 psi

Automobile No. 9



Automobile No. 9 with debris originating from it in foreground

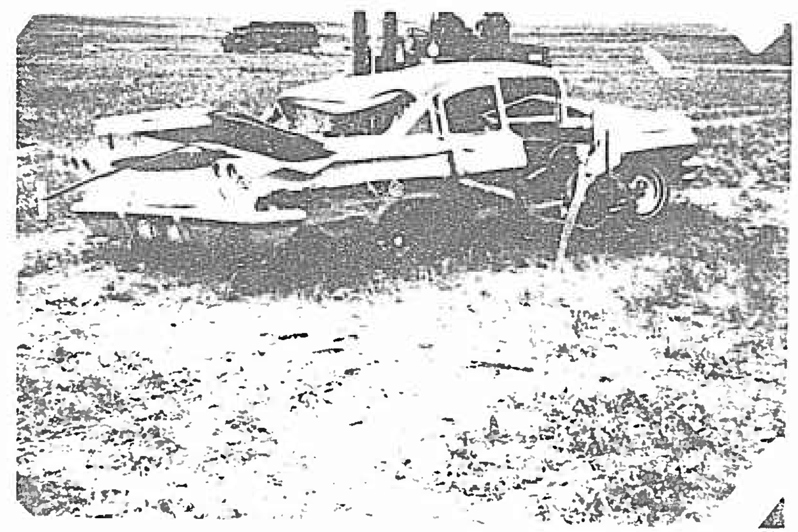
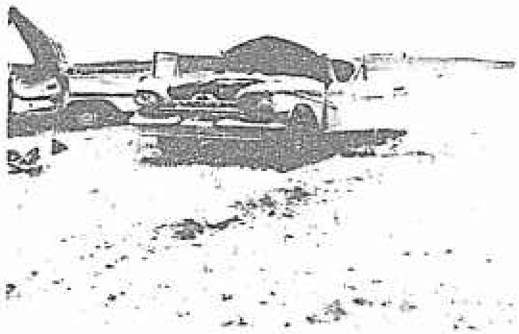
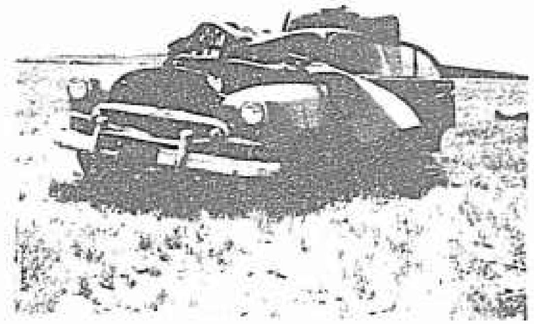


Figure 3.22. Postshot photographs of the automobile placed at 10 psi and the debris parts generated from this automobile

Automobile No. 4



Automobile No. 6



Automobile No. 3

Small debris from
the four autos at 15 psi

Automobile No. 10

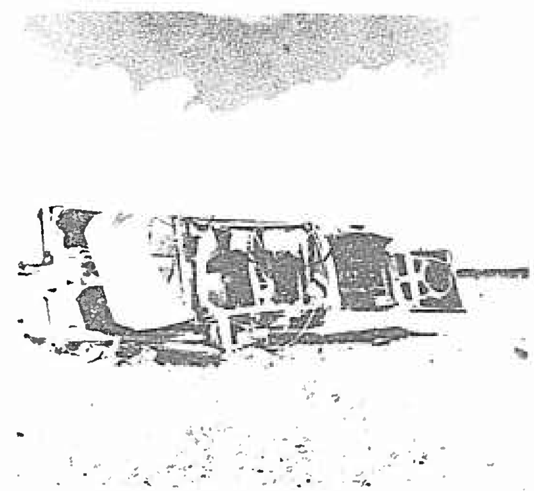
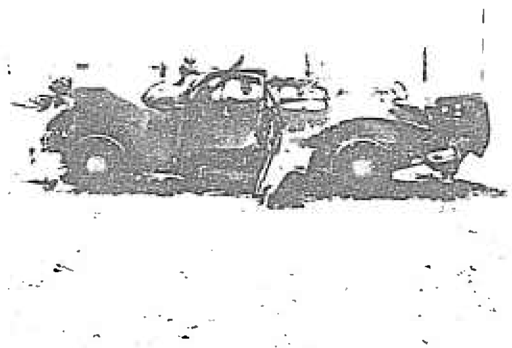
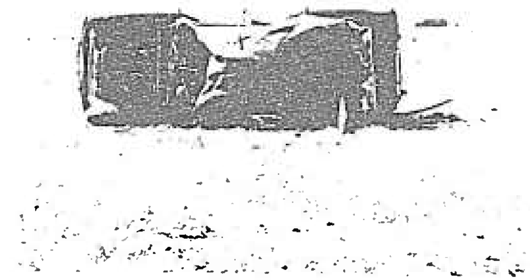


Figure 3.23. Postshot photographs of the automobiles placed at 15 psi and the small debris parts generated from them



Automobile No. 2

Automobile No. 12



Automobile No. 13

Automobile No. 11

Small debris from
the four autos at 30 psi

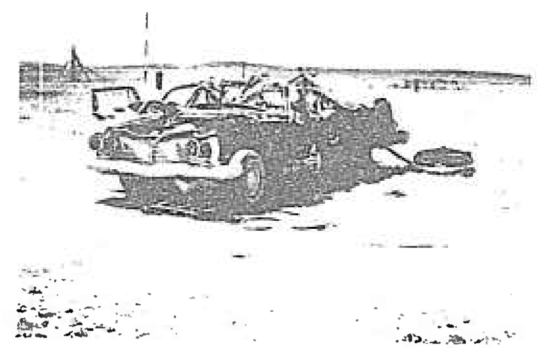
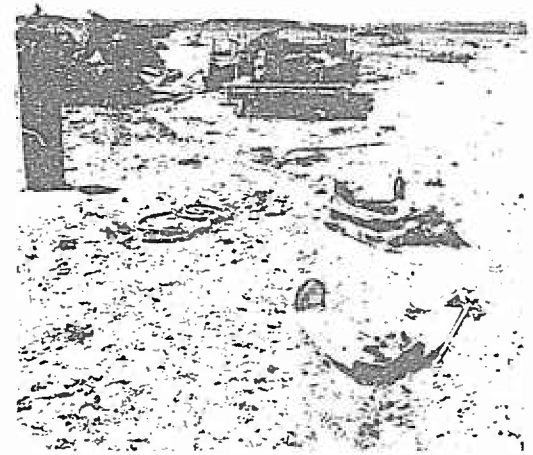


Figure 3.24. Postshot photographs of the automobiles placed 30 psi and the small debris parts generated from them

Automobile No. 1

Automobile No. 5



Automobile No. 7

Automobile No. 8

Small debris from
the four autos at 50 psi

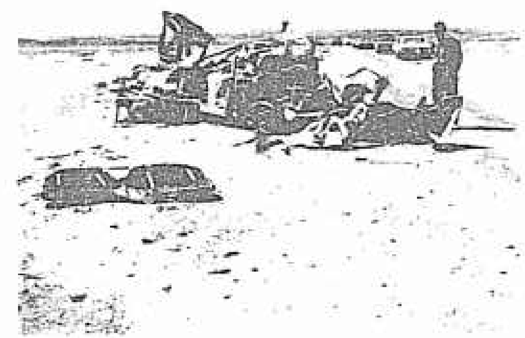


Figure 3.25. Postshot photographs of the automobiles placed at 50 psi and the small debris parts generated from them

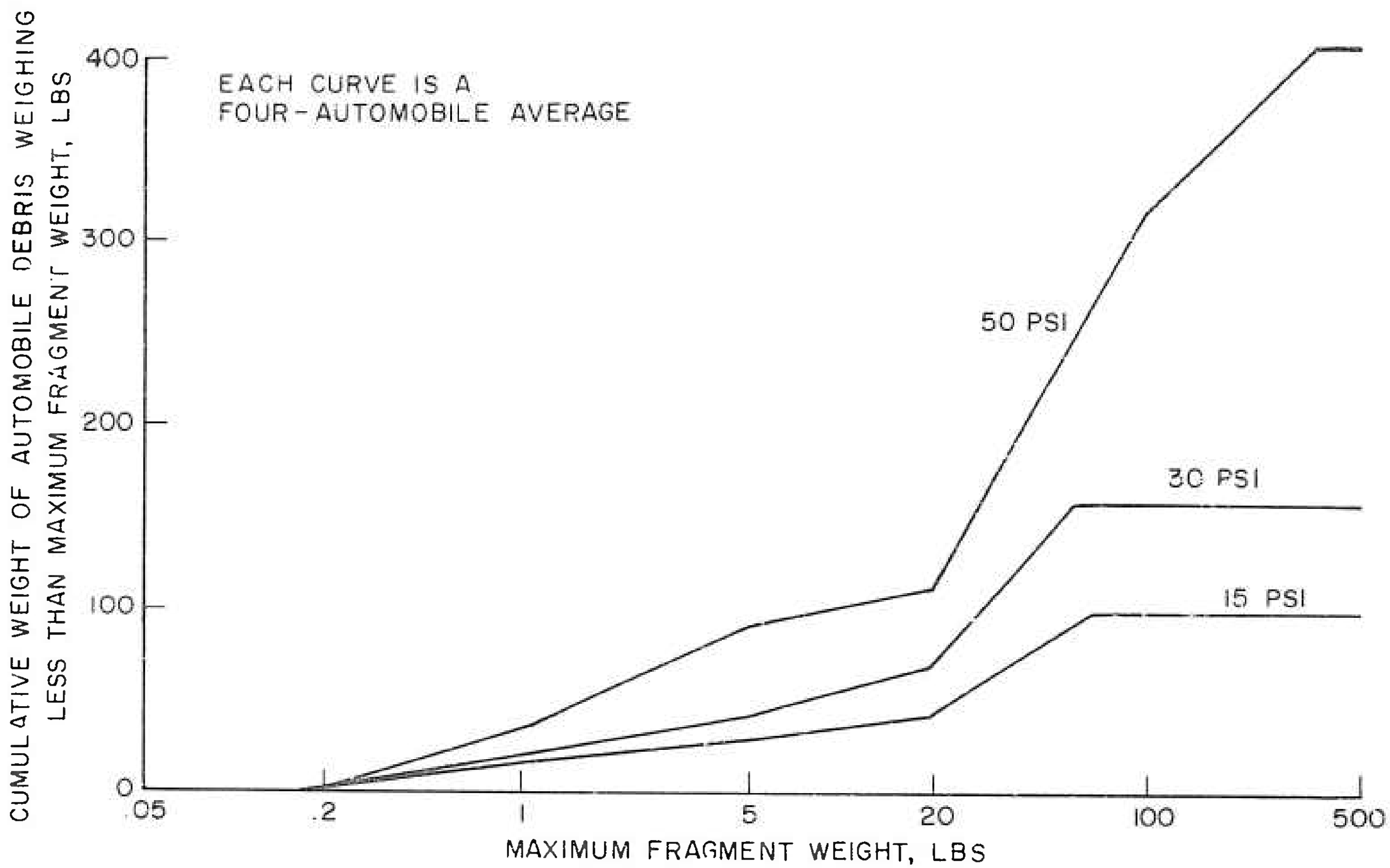


Figure 3.26. Cumulative weight distributions of debris from automobiles placed at 15, 30, and 50 psi

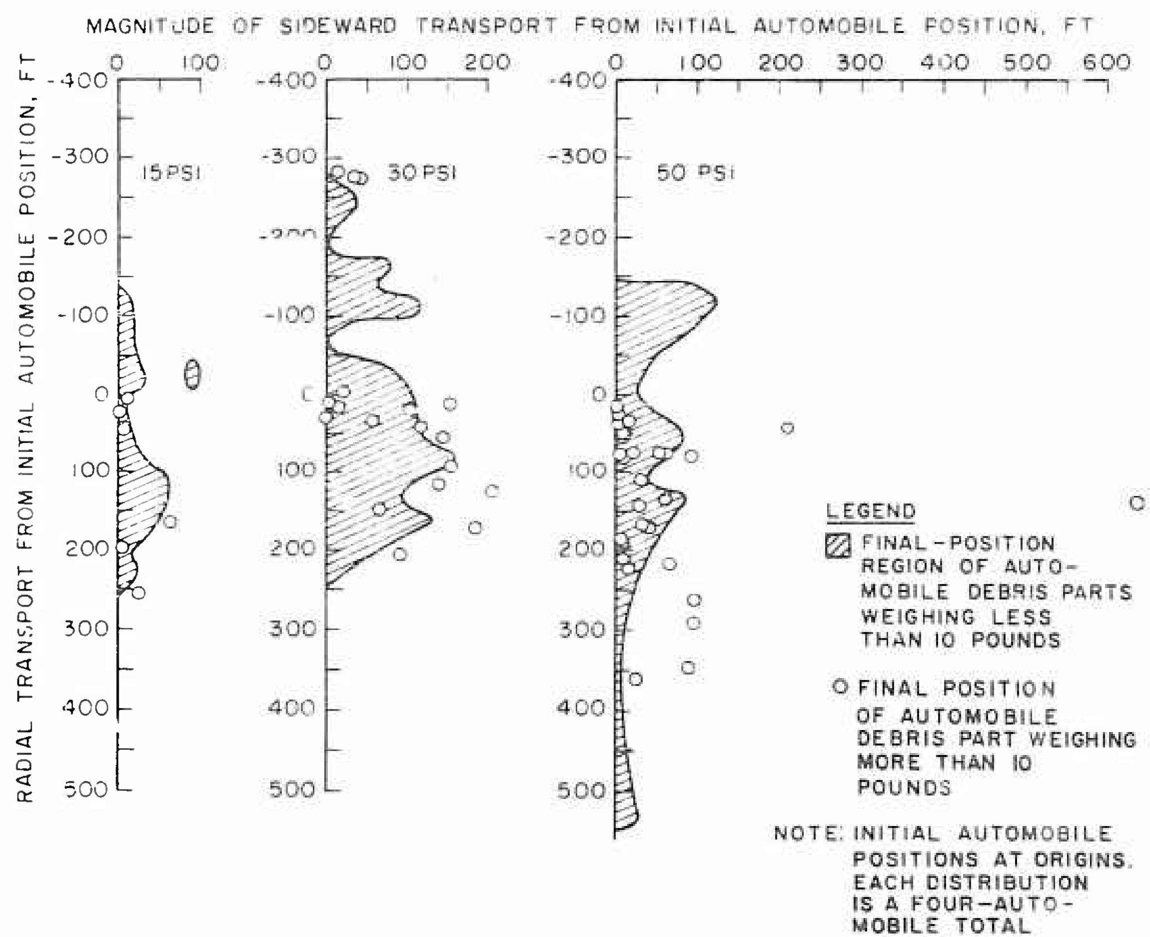


Figure 3.27. Ground weight distributions of debris from automobiles placed at 15, 30, and 50 psi

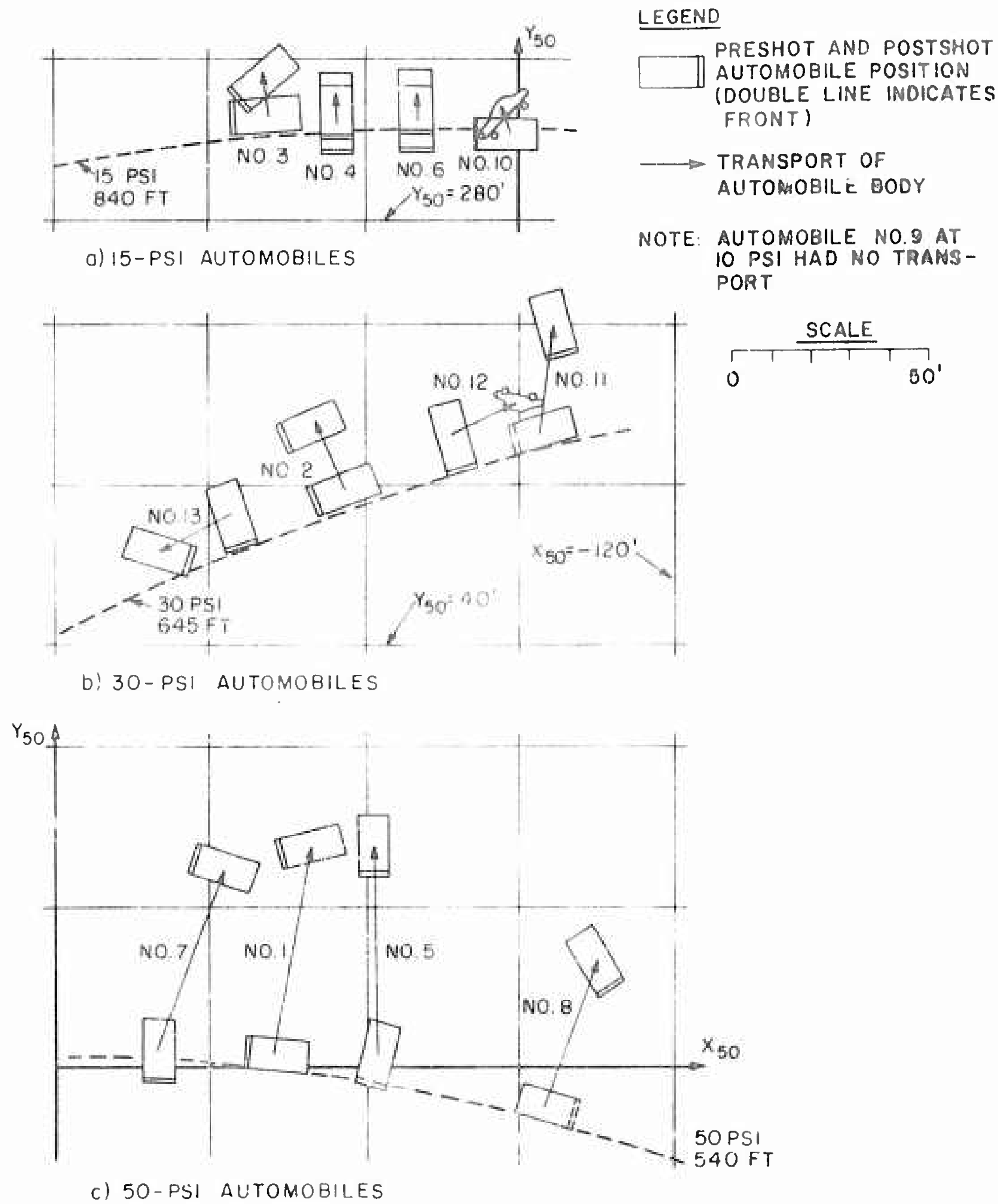


Figure 3.28. Transport and postshot orientations of automobiles placed at 15, 30, and 50 psi

CHAPTER 4

CONCLUSIONS AND RECOMMENDATIONS

Reliable extensive data on the fragmentation of aspen and spruce trees at 15 and 50 psi caused by a 500-ton classical high-explosive detonation were obtained in this project. Specifically, the acquired tree-fragmentation data were the cumulative weight distributions and mathematical size descriptions of the debris from each of these species at both peak overpressures. As one prominent conclusion, it was determined that about 60 percent of the branchwood weight was fractured from the trunk fragment sections of the trees placed at 15 psi, and nearly 100 percent of the branchwood weight was fractured from the trunk fragments of the trees placed at 50 psi. The reliability of these data is established since they represent an average of the individual results pertaining to each of the three trees of the same specie placed at the same overpressure and, in addition, these individual results were consistent for trees of the same specie-overpressure combination.

It was deduced that this obtained tree-fragmentation data would have been similar for tree species similar to aspen or spruce, correspondingly.

A comparison of the tree-fragmentation data results of this project with similar results from a shock tunnel indicates that fairly accurate tree-fragmentation data can be determined in shock tunnels. Shock-tunnel tests usually offer the advantages of less expense and more convenience in comparison with field tests. If further tree-fragmentation data is needed, the use of a shock-tunnel facility is recommended for its acquisition when practical.

The tree-debris cumulative weight distributions from this project represent lower bounds and the tree fragment sizes from this project represent upper bounds of those that would result for similar species at the same overpressures but larger-yield explosions. It is reasoned that the fragmentation of the small tree debris would not change much for larger yields, but basically just the fragmentation of the large branches and the tree trunks would change.

Also obtained in this project were accurate cumulative weight distributions of the debris from the automobiles placed at 10, 15, 30, and 50 psi in this blast. On the average, only about 15 pounds of debris was blown off the 10-psi automobile as mainly large windows were blown out; around 80 pounds of debris originated from each of the 15-psi automobiles; about 160 pounds of debris was generated from every 30-psi automobile; and nearly 400 pounds of debris came from each 50-psi automobile. The automobile-debris cumulative weight distributions plainly show that a considerable number of small automobile-debris parts, as well as quite a few large parts, were blown off the automobiles at 15 psi and higher overpressures. These distributions are quite reliable since they depict the average of the debris from four automobiles at each of the designated overpressures with the exception of the 10-psi distribution.

Unlike tree debris, the sizes of the automobile debris parts could not be mathematically described because of their marked diversity.

The automobile-debris cumulative weight distributions obtained in this project represent lower bounds of those expected at the same overpressures of higher-yield detonations. The reasoning is analogous to that used for the tree-debris cumulative weight distributions.

The dispersion and lofting of the tree debris at 15 and 50 psi in this blast were estimated in this project. The tree-debris ground distributions were used as the basis for these dispersion estimates. It was determined that the tree-debris dispersion was roughly the same at 15 and 50 psi for the spruce and aspen trees, but varied inversely with the weight of the tree fragments. From the high-speed movie films, the lofting of tree debris was seen to have been negligible at these overpressures.

The dispersion and lofting of automobile debris was also estimated where possible. The trends proved different than for tree debris. The dispersion of the automobile debris at 15, 30, and 50 psi was based on the corresponding ground distributions. This dispersion showed a tendency of increasing with overpressure and was just as large for the heavier parts as for the lighter ones. Considering just heavier fragments, the dispersion of automobile debris was considerably larger than the dispersion of tree debris. The lofting of the automobile debris parts was quite large at 50 psi, up to a 60- to 70-foot height, and slightly less at 30 psi, up to a 30-to 40-foot height; the lofting of the 15-psi automobile debris was not visible on the high-speed movie films. Flat sheet metal parts were the type of automobile parts which were dispersed and lofted the most.

The radial transport of various tumbling blocks placed at 15, 30, 50, and 100 psi were measured in this project. The transport distances seemed reasonable except that those at 30 psi were affected by a blast anomaly.

APPENDIX A

RAW TREE-DEBRIS DATA

The tabulated raw tree-debris data is contained in this appendix. The data consists of the 15-psi tree-debris data (weighings), recorded according to the 15-psi grid squares; the 50-psi tree-debris data (no weighings) logged according to the 50-psi grid squares; and the weighings of the 50-psi tree debris after it was all gathered from the 50-psi grid network.

In every 15-psi grid square, either the number or the total weight of the 15-psi fragments from each tree in each averaged-characteristics group was recorded, and the length, diameter, and weight of the 15-psi fragments in each individual-characteristics group were noted according to originating tree. The 50-psi tree debris in the 50-psi grid squares was tabulated similarly, except that the individual-characteristics fragments were just measured but not weighed. Instead, the weighings of this debris were made after it was measured in, and gathered from, the 50-psi grid squares. Note that only the group number was recorded (i.e., the group was 1 instead of S1 or A1) since the originating tree number indicates whether the fragments were spruce or aspen.

15-PSI RAW TREE-DEBRIS DATA, TABULATED ACCORDING TO 15-PSI GRID SQUARES

15-PSI GRID SQUARE X	Y	TREE NO.	GROUP NO.	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
10	-6	1	1	11			
		1	3	1			
		2	2	1			
-9	-6	2	1	1			
		2	2	1			
		1	1	10			
		1	4	1			
8	6	1	5	1			
		1	6	1		.	.066
		1	1	8			
		1	2	3			
		2	1	8			
		2	2	2			
-7	-6	2	1	7			
		2	2	3			
		2	3	1			
		1	2	1			
-6	-6	2	1	24			
		2	2	4			
		2	3	1			
		3	2	1			
-5	-6	2	1	34			
		2	2	5			
		2	3	1			
		3	1	4			
		3	2	1			
		3	3	1			
-4	-6	2	1	10			
		2	2	4			
		2	3	1			
		3	1	2			
-3	-6	2	1	3			
		2	2	2			
		3	1	2			
		4	1	1			
		4	2	1			
-2	-6	4	1	3			
		4	2	1			
-1	-6	4	3	1			
		4	4	7			
		4	1	40			
		3	1	2			
		2	1	1			
		5	1	1			
		3	2	1			
		2	3	1			
0	-6	4	1	20			
		4	2	7			
		4	3	2			
		3	1	1			
		3	2	1			
		3	3	1			
		2	4	1			
1	-6	5	1	5			
		4	1	21			
		4	2	5			
		3	2	2			
2	-6	5	1	3			
		4	1	14			
		4	2	4			
		3	3	2			
		3	4	1			
3	-6	4	1	1			
		4	2	1			
		4	3	1			
5	-6	4	1	1			
		4	2	1			
		4	3	1			
		5	1	7			
		6	1	2			
6	-6	4	1	1			
		5	1	4			
		5	3	1			
		6	1	3			
		6	5	2			
		6	2	1			
7	-6	6	1	1			
		5	1	3			
		4	1	2			
8	-6	6	1	23			
		5	1	9			
		6	2	3			
		6	6	1	9.	1.	.132
		6	6	1	12.8	.125	.022
9	-6	6	1	4			
		5	1	5			
		6	5	1			
		5	2	2			
-9	-5	1	1	3			
		1	3	1			
		2	1	1			
		2	3	2			
		1	2	3			
8	-5	1	1	9			
		1	2	2			
		1	3	1			
7	-5	2	1	14			
		2	2	6			
		2	3	3			
		1	2	1			
		1	1	1			
6	-5	2	1	13			
		2	2	5			
		2	3	2			
		2	2	1			
		3	3	1			
4	-5	2	1	8			
		2	2	10			
		2	3	3			
		2	1	4			
		3	2	2			
3	-5	3	1	4			
		3	1	2			
		2	1	3			
		2	2	1			
		2	2	1			
		1	2	1			
		[illegible]	1	1			
2	-5	4	[illegible]	8			
		4	2	1			
		4	3	1			
		4	4	1			
1	-5	4	1	45			
		4	2	6			

15-PSI GRID SQUARE X	Y	TREE NO.	GROUP NO.	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
-1	-5	2	3	1			
		3	1	3			
		3	2	1			
0	-5	4	1	46			
		4	2	9			
		4	3	5			
		4	4	1			
		5	1	3			
		3	1	3			
		3	2	1			
1	-5	4	1	21			
		4	2	7			
		5	1	2			
		3	1	1			
		3	3	1			
2	-5	4	1	32			
		4	2	11			
		4	3	4			
		5	1	5			
3	-5	4	1	7			
		5	1	3			
		4	2	1			
		4	3	2			
		4	4	1			
		3	3	1			
4	-5	4	1	6			
		5	1	6			
		4	2	1			
		4	2	2			
5	-5	5	1	23			
		6	1	3			
		4	1	3			
		4	2	3			
		6	2	1			
6	-5	5	1	17			
		6	1	13			
		4	2	1			
		5	2	1			
		6	2	1			
		4	3	1			
		5	3	1			
		6	5	1			
7	-5	6	1	16			
		5	1	10			
8	-5	6	1	80			
		5	1	8			
		4	1	1			
		6	2	6			
		5	2	1			
		6	6	1	4.25	.4	.022
		6	6	1	3.75	.5	.022
9	-5	6	1	35			
		5	1	21			
		6	2	4			
		5	2	2			
		6	3	1			
-10	-4	1	1	8			
		1	2	1			
		1	3	2			
-9	-4	1	1	11			
		1	2	8			
		1	3	1			
		2	2	1			
		1	6	1	4.	.5	.011
-8	-4	1	1	22			
		1	2	13			
		1	3	2			
		1	6	5		.	.11
		1	6	1		.	.165
		1	6	2	6.	.375	.033
		2	1	7			
		2	3	1			
		2	4	1			
		1	6	1	60.	9.6	97.
-7	-4	1	2	1			
		1	3	1			
		1	6	1		.	.022
		2	1	23			
		2	2	9			
		2	3	1			
		3	1	1			
		2	6	1	10.	.25	.022
-6	-4	2	1	7			
		2	2	8			
		1	2	1			
		2	3	2			
-5	-4	2	1	18			
		3	1	3			
		3	2	1			
		2	2	4			
		2	3	2			
-4	-4	1	2	2			
		2	1	16			
		2	2	6			
		2	3	2			
		3	1	8			
		3	2	2			
-3	-4	2	1	2			
		2	2	1			
		2	3	2			
		3	1	7			
		4	1	1			
-2	-4	4	1	51			
		4	2	6			
		4	3	2			
		3	1	1			
		3	2	1			
		3	3	1			
		2	1	2			
		2	2	1			
		2	3	1			
-1	-4	4	3	6			
		4	1	215			
		4	2	19			
		5	1	2			
		3	1	5			
0	-4	4	1	76			
		4	2	22			
		4	3	4			
		4	4	1			
		2	2	1			
		3	2	1			
		3	3	1			
1	-4	4	1	87			

15-PSI RAW TREE-DEBRIS DATA, TABULATED ACCORDING TO 15-PSI GRID SQUARES

15-PSI GRID SQUARE X	Y	TREE NO	GROUP NO	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
[illegible]	-4	4	[illegible]	[illegible]			
2	-4	5	[illegible]	[illegible]			
		[illegible]	6	[illegible]	9	1	.00[illegible]
		[illegible]	6	[illegible]	10	4	.055
		[illegible]	6	[illegible]	4.5	.25	.009
3	-4	[illegible]	[illegible]	[illegible]			
4	-4	[illegible]	[illegible]	[illegible]			
5	-4	[illegible]	[illegible]	[illegible]			
6	-4	5	[illegible]	35			
7	-4	[illegible]	[illegible]	[illegible]			
8	-4	[illegible]	[illegible]	34			
9	-4	0	[illegible]	25			
10	-4	6	[illegible]	[illegible]			
-10	3	[illegible]	[illegible]	[illegible]			
-9	-3	[illegible]	[illegible]	2[illegible]			
		[illegible]	6	[illegible]	3	3	.011
		[illegible]	6	1	17	5	.11
		[illegible]	6	1	1.75	.4	.011
-8	-3	[illegible]	1	37			
		[illegible]	6	1	8	.35	.033
		[illegible]	6	1	8.2	.33	.026
		[illegible]	6	1	34	.5	.198
		[illegible]	6	1	190	4.5	400
-7	-3	[illegible]	[illegible]	[illegible]			
		[illegible]	6	1	5.	.3	.024
-6	-3	1	6	[illegible]	3	.437	.022
		[illegible]	6	1	8	.375	.044
-5	-3	1	2	1			
-4	-3	[illegible]	[illegible]	[illegible]			
-3	-3	[illegible]	[illegible]	12			
-2	-3	[illegible]	[illegible]	[illegible]			
-1	-3	[illegible]	[illegible]	143			.276
		[illegible]	[illegible]	[illegible]	4.5	.25	.011
0	-3	[illegible]	[illegible]	10[illegible]			
		[illegible]	[illegible]	[illegible]	4	.4	.011
		[illegible]	[illegible]	[illegible]	41	.9	.76
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			

15-PSI GRID SQUARE X	Y	TREE NO	GROUP NO	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
2	[illegible]	4	7	1	43	.312	.082
		4	6	1	17	.375	.055
		5	1	10			
3	-3	4	[illegible]	8			
		[illegible]	1	19			
4	-3	[illegible]	[illegible]	[illegible]			
5	-3	[illegible]	1	55			
6	-3	5	1	[illegible]			
7	-3	6	[illegible]	11			
8	-3	6	[illegible]	34			
		6	[illegible]	1	5	.25	.011
9	-3	[illegible]	[illegible]	[illegible]			
		0	[illegible]	15			
10	-3	5	[illegible]	1			
-9	-2	[illegible]	1	14			
		[illegible]	6	1	10	.5	.165
		[illegible]	6	1	6	1.	.088
		[illegible]	6	1	12	.5	.088
		[illegible]	6	1	4	.75	.077
		[illegible]	6	1	6.	.75	.077
		[illegible]	6	1	5	[illegible]	.055
		[illegible]	6	1	4	1	.066
-8	-2	1	[illegible]	10			
		[illegible]	[illegible]	40			
		[illegible]	[illegible]	[illegible]	42	.375	.132
		[illegible]	6	[illegible]	7	.84	.099
		[illegible]	6	1	11	.4	.055
		[illegible]	6	[illegible]	6	.5	.044
		[illegible]	6	[illegible]	4.5	.55	.018
		[illegible]	6	[illegible]	3	.5	.018
		1	6	1	9	.33	.015
		1	6	1	14	.4	.066
		1	[illegible]	1	22	.5	.099
		[illegible]	6	12	5	.3	.132
		1	[illegible]	1	38	[illegible]	.331
		1	6	[illegible]	34	.6	.298
		1	6	[illegible]	34	.6	.265
		1	6	1	22	.6	.132
		1	7	1	46	.75	.485
		1	[illegible]	1	36	.65	.287
		1	[illegible]	1	80	.9	1.477
		[illegible]	[illegible]	[illegible]	76	1	2.0[illegible]
-7	-2	1	[illegible]	14			
		1	[illegible]	[illegible]	7	.25	.143
		1	[illegible]	[illegible]	14	.312	.143
		[illegible]	[illegible]	37			
		[illegible]	[illegible]	[illegible]	7	.312	.022
-6	-2	[illegible]	1	87			
-5	-2	[illegible]	[illegible]	[illegible]			
		[illegible]	6	1	12	.75	.121
-4	-2	[illegible]	[illegible]	[illegible]			
-3	-2	[illegible]	[illegible]	[illegible]			
		[illegible]	[illegible]	[illegible]	8	.75	.044
-2	-2	[illegible]	[illegible]	24			
		[illegible]	[illegible]	11			
		[illegible]	[illegible]	11			
		[illegible]	[illegible]	1	36	.75	.397
-1	-2	4	[illegible]	140			
		[illegible]	[illegible]	24			
		[illegible]	[illegible]	[illegible]	4	.5	.033
0	-2	[illegible]	[illegible]	[illegible]			.032
		[illegible]	[illegible]	16			

15-PSI RAW TREE-DEBRIS DATA, TABULATED ACCORDING TO 15-PSI GRID SQUARES

15-PSI GRID SQUARE X	Y	TREE NO.	GROUP NO.	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
0	-2	3	2	2			
		3	3	3			
		3	4	1			
		5	1	2			
		4	4	1			
1	-2	4	1	118			
		4	3	4			
		4	2	12			
		5	2	1			
		5		5			
		3	1	1			
		3	2	1			
		3	1	3			
2	-2	4	1	17			
		4	2	5			
		4	3	1			
		4	7	1	54	5	.926
		4	1	6			
		3	2	1			
3	-2	4	1	6			
		4	2	5			
		5	1	14			
4	-2	5	1	74			
		4	1	3			
		4	2	2			
		5	2	4			
5	-2	4	2	3			
		5	2	4			
		5	6	1	5.	1.	.375
		5	1				.485
			1	7			
			1	3			
6	-2		1	19			
			1	30			
7	-2	6	1	8			
		5	1	1			
		6	2	2			
8	-2	5	1	1			
		6	1	13			
		6	2	1			
9	-2	4	1	1			
		5	1	2			
		6	1	6			
		6	2	2			
10	-2	5	1	2			
			1	1			
		6	2	1			
		4	1	1			
11	-2	6	1	2			
		5		2			
		6	2	1			
-11	-1		2	2			
		1	1	1			
-10	-1	1	1	5			
		1	2	6			
		1	3	2			
		1	4	1			
		1	6	6	5.	.33	.077
-9	-1	1	7	1	72	.875	2.447
		1	1	15			
		1	2	15			
		1	3	9			
		1	4	8			
		1	5	4			
		1	6	10	3.	.187	.055
		1	6	8	7.	.312	.143
		1	6	1	20.	.75	.187
		1	6	1	16.	.5	.11
		1	6	1	2.	1.	.011
-8	1	1	4	29	12	.5	.794
		1	1	30			
		1	2	2			
		1	3	1			
		1	4	1			
		1	5	2			
		1		1	54.	1.	1.102
		2	1	3			
		2		3			
-7	-1	1	5	1			
		1		10			
		1	2	13			
		1	3	3			
		2	1	6			
		2	2	34			
		2	3	16			
		2	4	2			
		1	6	1	9.	.4	.035
		1	6	1	5.5	.3	.013
6	1	1	1	2			
		1	2	4			
		2	1	72			
		2	2	40			
		2		16			
		2		3			
		2	5	1			
			6	2	2.5	.375	.011
		2		1	44	.375	.132
		3	1	3			
-5	-1	2	3	4			
		2		5			
		3		6			
		3		1			
4	1	3	1	1			
		3		1			
		2	1	1			
		2		1			
3	1	2	1	1			
		2		1			
		1	3	3			
		2	6	1	2.5	.4	.011
2	1	4	1	29			
		4	2	6			
		4	3	4			
		4	3	3			
		4	1	1			
		1	4				
1	1	4	4				
		3	3				

15-PSI GRID SQUARE X	Y	TREE NO.	GROUP NO.	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
-1	-1	4	1	104			
		4	2	29			
		4	3	3			
		4	4	3			
0	-1	4	2	32			
		4	3	6			
		4	1				.478
		5	1	5			
		3	1	7			
		3	3	1			
		3	6	1	6.	.25	.033
		2	4	1			
1	-1	4	1	95			
		4	2	14			
		4	3	1			
		5	1	4			
		3	2	2			
		3	3	4			
		4	6	1			
		2	6	1	2.5	.3	.011
2	-1	4	1	25			
		4	2	4			
		4	3	1			
		5	1	6			
		3	2	2			
		3	1	1			
3	-1	3	1	1			
		4	1	23			
		4	2	3			
		4	3	3			
		5	1	23			
		5	2	3			
4	-1	4	1	16			
		4	2	6			
		4	7	1	48.	.375	.231
		5	1				.176
		5	2	9			
5	-1	5	3	1			
		5	1	132			
		6	1	22			
		6	2	4			
		4	1	5			
		4	2	2			
		5	2	10			
		4	6	1	3.5	.4	.022
		5	6	1	6.	.3	.022
		5	6	1	4.5	.3	.022
6	-1	6	1	62			
		6	2	2			
		5	1	15			
		5	6	2	3.5	.5	.022
		4	2	1			
7	-1	6	1	30			
		6	2	1			
		5	1	1			
		5	2	1			
8	-1	6	1	26			
		6	2	5			
		6	3	1			
9	-1	6	1	12			
		6	2	1			
		5	2	1			
		4	2	1			
		6	6	1	4.	.5	.022
-10	0	1	1	12			
		1	2	7			
		1	4	1			
		1	6	4	2	.25	.011
-9	0	1	7	1	64.	.7	1.354
		1	1	75			
		1	2	25			
		1	3	7			
		1	4	5			
		1	5	1			
		1	6	12	5	.25	.066
		1	6	1	11	.35	.022
		1	6	1	18.	.62	.121
-8	0	1	7	1	88.	.75	.992
		1	1	75			
		1	2	34			
		1	3	7			
		1	4	5			
		1	5	1			
		1	6	8	4.5	.75	.132
		2	2	2			
		2	2	4			
		2	3	1			
		1	7	1	70	1.25	6.5
		1	7		100	1.5	11.
-7	0	1	6		50	.5	.419
		3	2	1			
		3	4	1			
		1	1	8			
		1	2	16			
		1	3	1			
		2	2	13			
		2	2	22			
		2	3	18			
		2	4	4			
		1	5	1			
		2	5	1			
		1	6	2	2	.3	.022
		1	6	2	12	.3	.044
		1	6	1	9	.5	.044
		2	6	1	7.5	.33	.018
-6	0	2	1	105			
		2	2	106			
		2	2	34			
		2	4	1			
		2	5	3			
		3	3	1			
		3	3	1			
		4	6	3	5	.5	.077
		4	6	6	2.5	.375	.022
		1	4	5			
		1	5	5			
		1	1	1			
5	0	2	6	1	96	10.3	162
2	0	4		11			
		4		5			
		4					
		4	6			.5	.011
		1					
		1	3				

15-PSI RAW TREE-DEBRIS DATA, TABULATED ACCORDING TO 15-PSI GRID SQUARES

15-PSI GRID SQUARE X	Y	TREE NO	GROUP NO	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			.161
		[illegible]	[illegible]	[illegible]	58	[illegible]	1.378
		[illegible]	6	[illegible]	12	.312	.044
0	0	3	6	[illegible]	3.	.5	.033
		[illegible]	[illegible]	[illegible]	2	.625	.033
		[illegible]	[illegible]	[illegible]			.52
		[illegible]	[illegible]	[illegible]			.022
1	0	[illegible]	[illegible]	25			.298
2	0	[illegible]	[illegible]	[illegible]			.154
		[illegible]	6	[illegible]	16.	.437	.044
		[illegible]	[illegible]	[illegible]	70	.75	1.047
3	0	4	7	[illegible]	85	.5	.882
		[illegible]	[illegible]	[illegible]			.033
		[illegible]	[illegible]	[illegible]			.011
4	0	5	[illegible]	1	3	.25	.007
		5	[illegible]	[illegible]			.22
		[illegible]	5	[illegible]	48.	9.4	32
5	0	[illegible]	[illegible]	[illegible]			.022
		[illegible]	[illegible]	[illegible]			.154
		[illegible]	[illegible]	[illegible]			.029
6	0	6	[illegible]	[illegible]			.033
		[illegible]	[illegible]	[illegible]			.011
[illegible]	0	[illegible]	[illegible]	[illegible]			.033
8	0	6	[illegible]	[illegible]			.033
9	0	6	[illegible]	1			.022
10	0	[illegible]	[illegible]	[illegible]			
-9	1	[illegible]	[illegible]	[illegible]			.011
		[illegible]	[illegible]	[illegible]	20	1.	2.535
		[illegible]	[illegible]	[illegible]	10	.687	1.124
		[illegible]	[illegible]	[illegible]			.143
		[illegible]	[illegible]	[illegible]	3	.187	.044
		[illegible]	[illegible]	[illegible]	[illegible]	.5	.044
		[illegible]	[illegible]	[illegible]	5	1	.044
		[illegible]	[illegible]	[illegible]	[illegible]	.25	.055
		[illegible]	[illegible]	[illegible]	[illegible]	.5	.165
		[illegible]	[illegible]	[illegible]	[illegible]	.375	[illegible]
		[illegible]	[illegible]	[illegible]	4	.187	[illegible]
-8	1	[illegible]	[illegible]	[illegible]			.178
		[illegible]	[illegible]	40	2.5	.5	.044
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.5	.066
[illegible]	1	[illegible]	[illegible]	[illegible]	20	1	.044
		[illegible]	[illegible]	[illegible]	60	[illegible]	2.518
		[illegible]	[illegible]	[illegible]	[illegible]	.375	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]

15-PSI GRID SQUARE X	Y	TREE NO	GROUP NO	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
5	1	2	4	8			
		2	6	3	24	.75	.562
		2	6	4	8	.75	.181
		2	6	5	7	.25	.066
		3	3	1			
		1	2	1			
		2	7	1	50	1.	.864
		2	5	1			
		2	7	1	45	.75	.353
		2	5	4			
		2	6	1	28	.5	.176
		2	6	1	18	.75	.176
		2	6	1	8	.25	.022
		2	6	1	16	.25	.055
		2	6	1	4	.4	.022
		2	6	1	15	.4	.055
		2	6	1	444	4.65	516.
-4	1	3	1				.044
		3	2	23			
		3	3	5			
		3	4	1			
		2	5	1			
		2	3	3			
		2	2	2			
		2	3	4			
-3	1	3	4	1			
		3	3	1			
		3	2	1			
		3	1	16			.011
		3	6	1	13	.75	.143
		3	6	1	8	.5	.044
-2	1	4	7	1	43	.5	.386
		4	4	1			.276
		4	3	6			
		4	2	5			
		4	1	26			
		3	5	1			
		3	1	6			
		3	2	5			
		3	3	1			
		2	6	1	3.	.25	.011
-1	1	4	3	6			
		4	2	21			
		4	1	37			.066
		3	2	3			
0	1	4	1				.289
		4	2	8			
		4	3	7			
		4	4	1			
		3	4	1			
		3	6	2	5.	.25	.033
1	1	4	1				.165
		4	2	14			
		4	3	6			
		4	4	1			
		4	6	1	20	.75	.276
		4	[illegible]	2	45.	.625	.882
		[illegible]	5	1	6	.312	.055
		2	4	1			
		2	6	2	14	.312	.165
		2	6	1	6.	.312	.022
2	1	4	7	1	60.	1	1.431
		4	4	1			
		4	4	1			
		4	3	5			
		4	2	10			
		4	6	1	252	6.9	378
3	1	5	1				.165
		5	2	8			.143
		4	1	13			
		4	2	9			
		4	3	1			
		4	6	1	1.5	.25	.022
4	1	5	1				.176
		5	2	8			
		5	3				
		5	6	3	10	.25	.055
		5	6	1	12.	.25	.077
		5	6	1	30.	.5	.243
		4	1	1			
		4	2	3			
		3	1	2			
5	1	5	1				.209
		5	2	11			
		5	3	1			
		5	6	1	6	.5	.011
		6	2	4			.033
			1	1			
		4	2	4			
		4	6	1	[illegible]	.5	.044
6	1	5	3				
		6	2				
		5	1	25			
		6	[illegible]	80			
7	1	6	[illegible]	[illegible]			
8	1	6	[illegible]	53			
9	2	6	[illegible]	45			
-11	2	[illegible]	[illegible]	20			.013
		[illegible]	[illegible]	[illegible]	2.5	.25	.009
		[illegible]	[illegible]	[illegible]	10	.4	[illegible]
-10	2	[illegible]	[illegible]	[illegible]			[illegible]
		[illegible]	[illegible]	[illegible]	9	[illegible]	[illegible]
-9	2	[illegible]	[illegible]	100	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

15-PSI RAW TREE-DEBRIS DATA, TABULATED ACCORDING TO 15-PSI GRID SQUARES

15-PSI GRID SQUARE X	Y	TREE NO.	GROUP NO.	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
9	2	[illegible]	6	1	18	4	049
		[illegible]	6	1	4 5	.45	026
		[illegible]	6	1	1 25	5	004
		[illegible]	6	1	5	.25	011
		[illegible]	[illegible]	1	45	4	231
8	2	[illegible]	[illegible]				198
		[illegible]	[illegible]	64			176
		[illegible]	3	28			
		[illegible]	6	5	6	.25	088
		[illegible]	5	5			
		[illegible]	[illegible]	4			
		[illegible]	6	1	6	.5	044
7	2	[illegible]	[illegible]	1	95.	1.125	4.519
							.055
							011
		[illegible]	[illegible]	5			
		[illegible]	6	11	3	.187	044
		[illegible]	6	2	15	.562	165
		[illegible]	6	4	15	.25	077
		[illegible]	[illegible]	10			
		[illegible]	3	6			
		[illegible]	4	2			
		[illegible]	5	1			
		[illegible]	6	8	3	187	044
		[illegible]	6	3	6	.25	044
		[illegible]	6	4	10	.375	077
		[illegible]	6	2	3	.187	011
6	2	[illegible]	[illegible]	1	48	.75	606
		[illegible]	[illegible]	1	52	.5	384
		[illegible]	[illegible]	1	76	1.25	1 764
							088
		[illegible]	[illegible]	56			
		[illegible]	3	47			
		[illegible]	6	1	10	75	.121
		[illegible]	6	3	11	.25	077
		[illegible]	6	3	7	4	077
		[illegible]	6	1	12	6	11
		[illegible]	4	9			
		[illegible]	5	8			
		[illegible]	3	2			
		[illegible]	4	4			
5	2	[illegible]	[illegible]	1	60	5	838
		[illegible]	6	1	40.	6	.65
		[illegible]	6	1	22.	75	243
		[illegible]	[illegible]	7			
							265
		[illegible]	3	32			
		[illegible]	[illegible]	62			
		[illegible]	1	3			
		[illegible]	3	1			
		[illegible]	5	3			
		[illegible]	4	14			
		[illegible]	3	2			
		[illegible]	[illegible]	2			
		[illegible]	6	4	6	4	11
		[illegible]	6	5	3	33	044
		[illegible]	6	2	28	6	.408
		[illegible]	6	1	8	25	033
		[illegible]	6	2	4.	2	.031
		[illegible]	6	5	2	2	.02
		[illegible]	6	4	2 5.	4	044
4	2	[illegible]	[illegible]				002
		[illegible]	[illegible]	25			
		[illegible]	[illegible]	4			
		[illegible]	[illegible]	1	20	75	143
		[illegible]	[illegible]	1	14	5	044
		[illegible]	[illegible]	4			
		[illegible]	[illegible]	3			
		[illegible]	[illegible]	2			
		[illegible]	6	[illegible]	12	25	066
		[illegible]	6	[illegible]	20	.25	066
		[illegible]	6	[illegible]	4	.25	004
		[illegible]	6	[illegible]	3	4	011
3	2	[illegible]	[illegible]	[illegible]	95	1 5	6 449
							011
		[illegible]	[illegible]	12			
		[illegible]	[illegible]	12			
		[illegible]	[illegible]	0			
		[illegible]	[illegible]	1	8	375	.026
		[illegible]	6	2	3	25	011
		[illegible]	6	1	19	4	705
-2	2	[illegible]	[illegible]	[illegible]	40	.75	65
		[illegible]	[illegible]	3			
		[illegible]	[illegible]	5			
[illegible]	2	[illegible]	[illegible]	[illegible]	57	375	761
		[illegible]	[illegible]	[illegible]	44	75	1 631
		[illegible]	[illegible]	6			
		[illegible]	[illegible]	[illegible]	20	75	165
0	2	[illegible]	[illegible]	[illegible]			
		[illegible]	[illegible]	5			
		[illegible]	[illegible]	3			
		[illegible]	[illegible]	1	6	.25	044
		[illegible]	[illegible]	[illegible]	4	1 5	044
							099
		[illegible]	[illegible]	[illegible]	5	25	044
[illegible]	2	[illegible]	[illegible]	[illegible]	52	5	[illegible]
		[illegible]	[illegible]	[illegible]	58	5	[illegible]
		[illegible]	[illegible]	[illegible]	64	625	1 [illegible]
							88[illegible]
		[illegible]	[illegible]	[illegible]	3	625	165
		[illegible]	[illegible]	[illegible]	3	[illegible]	11
		[illegible]	[illegible]	[illegible]	3	375	[illegible]

15-PSI GRID SQUARE X	Y	TREE NO.	GROUP NO.	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
2	2	4	2	6			
		4	3	1			
		4	1				.176
		5	1	5			
3	2	5	1	75			
		5	2	4			
		5	3	1			
		4	1	33			
		4	2	9			
		4	3	3			
		4	7	1	60.	.6	.507
		4	7	1	44	.5	.386
		4	7	1	44.	.375	.276
4	2	5	1				.309
		5	2	23			
		5	3	6			
		5	4	1			
5	2	5	4	1			
		4	4	8			
		5	1				.265
		6	1	9			.011
		4	4	1			
		4	7	1	64	.75	.948
6	2	6	5	[illegible]			
		6	3	1			
		6	2	6			
		6	1				.165
		5	1				.077
		4	1	1			
		5	2	1			
7	2	6	1				.088
		6	2	5			
		6	3	2			
		6	6	1	48.	10.3	90.
		6	1	6			
8	2	6	1				.154
		6	2	5			
9	2	6	1	37			
-11	3	1	3	1			
		1	2	6			
		1	6	2	4.5	.33	.022
-10	3	1	1				.066
		1	2	13			
		1	3	6			
		1	4	1			
		1	6	3	4.	.25	.044
		1	6	1	10.	.25	.044
		1	6	1	24	.75	.154
-9	3	1	1				.276
		1	2	97			.209
		1	3	35			.231
		1	4	1			.055
		1	7	2	48.	.375	.408
		1	6	8	5	.25	.088
		1	6	5	11.	.312	.154
		1	6	6	4	.187	.033
		1	5	7	2.5	.125	.022
		1	6	6	2.5	.187	.011
		1	6	4	3	.25	.033
		1	6	1	4.	.5	.022
		2	[illegible]	2			
		2	3	1			
		2	6	1	5.	.25	.022
		2	6	1	18.	.437	.188
-8	3	1	1				.187
		1	2	94			
		1	3	15			
		1	4	2			
		1	5	1			
		1	6	5	2	.2	.033
		2	2	5			
		2	3	6			
		2	6	1	5	.25	.033
		2	6	1	15	.35	.055
		2	6	1	16	.75	.121
-7	3	2	1				.055
		2	2	21			
		2	3	13			
		2	4	1			
		2	6	1			.029
		2	6	1			.049
		2	6	1			.007
		3	6	1			.013
		1	2	12			
		1	3	6			
		1	4	5			
		1	6	7	4.5	25	044
		1	1				011
-6	3	2	1				694
		2	2	182			485
		2	3	62			.507
		2	4	14			419
		2	5	1			121
		2	6	1	26	687	[illegible]
		2	6	3	19	375	265
		2	6	7	8	25	099
		2	6	4	2 5	187	015
		3	[illegible]	[illegible]			
		3	3	[illegible]			
		3	6	[illegible]	3	312	029
							[illegible]
-5	3	[illegible]	1				
		[illegible]	2	30			
		[illegible]	3	55			
		[illegible]	4	3			
		[illegible]	6	[illegible]			011
		[illegible]	6	[illegible]	7 5	5	088
		3	[illegible]	[illegible]			
		3	[illegible]	[illegible]			
		3	6	[illegible]	2	25	011
-4	3	[illegible]	1	[illegible]			
		[illegible]	2	16			
		[illegible]	3	6			
		[illegible]	4	5			
		[illegible]	[illegible]	[illegible]	4	25	0[illegible]
		[illegible]	[illegible]	[illegible]	[illegible]	375	038
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	018
		[illegible]	[illegible]	[illegible]	16	[illegible]	[illegible]
		[illegible]	[illegible]	[illegible]	4	45	[illegible]
3	3	[illegible]	[illegible]	[illegible]			

15-PSI RAW TREE-DEBRIS DATA, TABULATED ACCORDING TO 15-PSI GRID SQUARES

15 PSI GRID SQUARE X	Y	TREE NO	GROUP NO	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
3	3	4 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	2 1 3 4 4 2 5 6 6 7 6 6 6	2 52 32 16 [illegible] 2 3 3 3 2 1 1 1	1.5 15 40 20. 12	.33 .4 .6 .5 .3	.022 .22 .134 .187 .044 .009 .055
-2	3	3 4 6 3 4 3 4 4 3 4 3 3	1 2 2 6 3 3 4 4 3 5 7 7 6	12 1 1 11 1 12 1 1 1 1 2 1	3 50 45 134	1.25 .5 .5 9.7	.033 .507 .694 262.
-1	3	4 4 4 3 3 3 4 4 3 3	5 [illegible] 3 2 1 3 7 7 6 6	2 5 5 5 3 5 1 2 1 2	40. 36. 4. 7.	.35 .4 .25 .3	.287 .772 .013 .044
0	3	4 4 4 4 4 4 3 3	5 5 1 2 3 7 1 2	1 7 20 6 3 2 1 1	38	.6	1.268
1	3	4 4 4 4 4 4 4 3 3	4 4 7 1 2 6 1 6 2	11 2 2 17 52 2 1 1	41. 10	.5 .75	2.612 .331 .992 .066
2	3	4 4 4 4 5 5	1 2 3 5 1 2	23 7 4 2 2			.386 .452 .794
3	3	4 4 4 5 5	1 2 3 1 2	8 4 3 93 7			
4	3	5 5 5 4 4 4	4 1 2 1 2 7	1 275 11 2 1 1			
5	3	5 5 3 6 5 5 5	7 4 2 1 3 1 [illegible]	1 [illegible] 1 6 1	42 48	.4 .625	.309 .827 .397
6	3	5 5 5 5 6 6	6 1 1 [illegible]	19 3 2 1 5 5	6	.5	.187 .132
[illegible]	3	[illegible]	[illegible]	1 1 42			
8	3	[illegible]	[illegible]	[illegible]			
9	3	[illegible]	[illegible]	[illegible]			
10	3	5	[illegible]	[illegible]			
-11	4	[illegible]	[illegible]	[illegible]			
-10	4	[illegible]	2 3	1 3 38 30	7. 45 16 [illegible] 16	.375 .5 .35 .25 .25 .4 .33 .6	.035 .518 .055 .033 .033 .011 [illegible]
-9	4	[illegible]	4 4 3 6 6	3 1 12 15 11 1 10			[illegible]
8	4	[illegible]	6 [illegible]	28 9 12 12	48	.4	.044 .11 [illegible] .399 [illegible] .368
-8	4	2 2 3 2	4 4 5 6 6 6 6 5	3 8 5 4 1 1 1 1	3. 8 5 5	.2 .33 .25 .33	.02 .055 .026 .022
-7	4	2 1 2 2 1 2 2	5 1 1 2 2 3 3 6	1 8 81 24 1 20 3	12	.625	.066 .287
-6	4	2 2 2 2 1 3 3	1 2 3 4 5 6 6 6 6 6 6 6	220 93 7 1 5 5 12 2 1 1 1	9. 6 2.5 3. 3. 9 2.	.312 .25 .187 .25 .312 .687 .312	.75 .639 .739 .231 .165 .11 .055 .044 .011 .044 .077 .011 .066
-5	4	2 2 2 2 2 3 3 3	1 2 3 4 6 2 1 3	124 33 4 1 5 1 2	4	.625	.044
-4	4	2 3 2 3 3 3 3 2	4 3 2 1 1 2 3 6 6 6 6 6	3 5 6 5 6 20 11 1 4 2 1 1	20 5 12 7.5 7.5	.5 .3 .4 .25 .375	.088 .033 .066 .015 .02 .132
-3	4	3 3 3 2 3 3 3 3 3	1 2 3 3 4 4 4 5 6 6 7 7	30 25 4 14 15 1 3 4 1 1 1	6 2.5 56. 72.	.375 .375 .65 .875	.077 .011 .816 1.036
-2	4	3 3 3 3 3 3 3 3 3 3 3 3 4 3	1 2 3 4 5 6 6 6 6 6 6 6 5 6	7 14 11 5 1 1 1 9 5 5 1 1 1	30. 24 12 7 3 4.5 2 372.	1 .625 .375 .312 .187 .437 .25 4.1	.364 .276 .375 .066 .015 .022 .011 350.
-1	4	4 3 4 3 3	5 2 3 6 6	2 2 1 3 1	3. 15.	.33 .3	.018 .035
0	4	4 3 3 4 4 4	5 2 3 7 4 2	8 2 3 1 2 5	48	.625	.794
1	4	4 4 4 4 3 3	5 1 2 3 6 6	15 28 16 13 2	[illegible]	.375 [illegible]	.033 .397 .018 .009 .231
2	4	4 5 4 4 4 5	5 [illegible]	6 6 22 3 3 1	60	.375 .5	.033 [illegible]
3	4	[illegible]	[illegible]	[illegible]			.165
4	4	[illegible]	[illegible]	[illegible] 1			.705
5	4	[illegible]	[illegible]	[illegible]	28 60 12 [illegible]	.75 .625 [illegible] .437	.683 [illegible]
6	4	[illegible]	[illegible]	[illegible]			

15-PSI RAW TREE-DEBRIS DATA, TABULATED ACCORDING TO 15-PSI GRID SQUARES

15-PSI GRID SQUARE X	Y	TREE NO	GROUP NO	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
6	4	6	2	11			.055
		5	4	4			
		4	3	1			
		6	7	1	66	.75	1.676
7	4	5	4	1			
		6	3	1			
		4	3	1			
		6	2	33			
		5	2	1			
		6	1				.419
		5	1	6			.011
8	4	4	1				.419
		6	6	1	1	.25	.055
		5	2	1			
		6	2	27			
		6	3	3			
9	4	4	1				.077
		6	6	1	6	.25	.022
		4	2	4			.011
10	4	6	1				.011
		6	2	4			
-11	5	1	1				.009
		1	4	5			
		1	3				
		1	6	1	15.	.75	.165
		1	4	5	3.5	4	.066
-10	5	2	5	1			
		1	5	1			
		1	4	17			
		1	3	19			
		1	2	40			.088
		1	1				.055
-9	5	1	1				.231
		1	2	120			
		1	3	61			
		1	4	18			
		2	1	1	84	1.25	4.663
		1	6	1			.165
		1	6	6	3	3	.044
		1	6	3	6	4	.055
		2	4	1			
		1	6	1	23	3	.066
		2	6	1	27	.75	.22
-8	5	2	1	1	110	1.125	5.787
							.099
		1	2	60			.099
		1	3	39			.22
		1	4	7			.066
		1	6	1	8	.437	.033
		1	6	4	10	.312	.088
		1	6	7	6	.25	.066
		1	6	8	2.5	.25	.033
		1	6	2	2	.5	.033
		2	2	5			
		2	3	4			
		2	4	1			
		2	5	2			
		2	6	1	5	.187	.018
		2	6	1	1	1.	.022
		2	6	5	8	.25	.132
-7	5	2	7	1	45	.5	.386
		2	1				.154
		2	2	29			.198
		2	3	36			.331
		2	4	2			
		2	5	4			
		2	6	3	6	4	.044
		2	6	4	13.	.25	.066
		1	6	4	8	3	.055
		1	1				.011
		1	6	2	1.5	.25	.007
		[illegible]	2	5			
		1	3	2			
-6	5	1	[illegible]	1	104.	1.125	3.858
		[illegible]	[illegible]	[illegible]	45	.5	.141
		[illegible]	[illegible]	[illegible]	54	.75	.728
		3	6	[illegible]	32.	.6	[illegible]
		[illegible]	[illegible]	23			
		[illegible]	5	2			.187
		[illegible]	6	6	2.5	.5	.055
		[illegible]	6	1	14	.75	.132
		[illegible]	5	5	[illegible]	.375	.088
		[illegible]	6	[illegible]	4	.625	.055
		[illegible]	[illegible]	[illegible]			.683
		[illegible]	[illegible]	103			.661
5	5	[illegible]	[illegible]	[illegible]			.683
		[illegible]	[illegible]	13			.143
		[illegible]	1	43			[illegible]
		[illegible]	[illegible]	[illegible]			.397
		[illegible]	[illegible]	[illegible]			.154
		[illegible]	[illegible]	[illegible]			.165
		[illegible]	[illegible]	[illegible]	12	.25	.099
		[illegible]	6	[illegible]	5	.25	.015
		[illegible]	[illegible]	3	3	.187	.011
		[illegible]	[illegible]	[illegible]	3	.312	.015
		[illegible]	[illegible]	[illegible]	8	.562	.044
		3	[illegible]	[illegible]			
		[illegible]	[illegible]	[illegible]	37	.625	.044
		[illegible]	[illegible]	[illegible]			.86
		[illegible]	[illegible]	[illegible]			.033
		[illegible]	[illegible]	[illegible]	2.5	.5	[illegible]
		[illegible]	[illegible]	[illegible]	22	.5	[illegible]
		[illegible]	[illegible]	[illegible]	6	.5	.055
		[illegible]	[illegible]	[illegible]	6	4	.088
		[illegible]	[illegible]	[illegible]	1	.25	[illegible]
		[illegible]	3	5			

15-PSI GRID SQUARE X	Y	TREE NO	GROUP NO.	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
-4	5	2	4	1			
		2	6	1	25	[illegible]	.11
-3	5	3	2	66			
		3	3	21			
		3	1				.198
		3	4	3			
		3	6	5	14	.45	.375
		3	6	1	4.5	.5	.018
		2	3	1			
		2	1	1			
		2	6	4	3.5	.2	.022
-2	5	3	5	1			
		3	4	4			
		3	1				.077
		3	2	23			
		3	3	10			
		3	6	2	4	.3	[illegible]
		3	6	2	12.	.375	.066
		3	6	1	14	.45	.088
		3	6	1	[illegible]	.7	.088
		4	5				
-1	5	4	5	5			
		4	3	1			
		3	1	1			
		3	2	1			
		3	6	2	14	.3	.044
		3	6	1	4.5	.45	.022
		3	6	1	7.	.45	.026
		3	3	1			
		3	6	1	8	.3	.018
0	5	4	5	15			
		4	1	2			
		4	3	1			
		3	2	1			
1	5	4	5	10			
		4	1	2			
		4	3	1			
		5	1	5			
		4	7	1	40.	.45	.661
2	5	4	5	8			
		5	1	6			
		5	2	1			
		5	3	1			
		4	1	1			
3	5	4	5	1			
		4	1	5			
		5	2	9			
		4	3	1			
		5	3	1			
		4	2	1			
		4	7	1	36.	.45	.518
		3	1	1			
		3	4	1			
		5	1				.154
		5	6	1			.007
		3	6	1	4	.35	.011
4	5	5	4	6			
		5	3	6			
		5	2	33			
		4	5	2			
		5	5	1			
		5	1				.728
		4	3	3			
		4	1	11			
		4	2	1			
		4	4	1			
5	5	5	2	1	56	.5	1.014
		5	4	6			
		5	6	1	42	1.125	.97
		5	7	1	42	4	.573
		5	3	13			
		5	1				1.499
		5	2	34			.882
		5	5	2			
		6	1	13			
		6	2	2			
		4	1	1			
		5	6	1	12.	.375	.044
6	5	4	5	1			
		6	5	1			
		5	2	3			
		6	2	17			
		5	1				.066
		6	3	3			
		6	1				.309
		6	4	2			
7	5	6	4	1			
		6	3	1			
		6	2	14			.154
		6	1				.485
		6	5				
8	5	6	1	1			
		6	3	4			
		6	2	7			
		6					.309
		6	6	2	9	.33	.044
		6	6	2	5.5	.375	.033
		6	4	1			
		6	7	1	70	.6	.419
9	5	6	1				.066
-11	6	1	1	18			
		1	2	8			
		1	3	8			
		1	4	1			
		1	6	2	1	.33	.009
		1	6	1	[illegible]	4	.022
		1	6	1	12	.33	.044
-10	6	1	3	2			
		1	4	4			
		1	3	27			
		[illegible]	[illegible]	[illegible]			.163
		[illegible]	[illegible]	[illegible]			.088
		[illegible]	6	5	1.5	.25	[illegible]
		[illegible]	6	[illegible]	4	3	[illegible]
		[illegible]	6	[illegible]	[illegible]	.33	.066
		[illegible]	6	1	[illegible]	[illegible]	[illegible]
9	6	[illegible]	[illegible]	[illegible]			[illegible]
		[illegible]	[illegible]	3			
		[illegible]	[illegible]	102			
		[illegible]	1	66			
		[illegible]	[illegible]	17			
		[illegible]	4	1			
		1	5	2			

15-PSI RAW TREE-DEBRIS DATA, TABULATED ACCORDING TO 15-PSI GRID SQUARES

15-PSI GRID SQUARE X	Y	TREE NO.	GROUP NO.	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
-9	6	1	6	1	40.	.437	.176
		1	7	2	8.5	.5	.154
-8	6	1	5	3			
		1	4	10			
		2	1	8			
		2	2	6			
		2	3	2			
		1	3	27			
		1	2	52			
		1	1	88			
		1	6	5	4	.2	.022
		1	6	5	2	.25	.022
		1	6	5	7	.3	.066
		2	6	1	9	.4	.031
		2	6	1	5	.55	.026
		2	6	2	2.	.3	.009
-7	6	2	5	2			
		2	1				.121
		1	1				.055
		3	1	1			
		1	2	1			
		2	2	13			
		3	2	2			
		1	3	8			
		2	3	33			
		3	3	1			
		2	4	3			
		3	4	1			
		2	6	3	4.5	.5	.088
		1	6	1	8.5	.5	.044
-6	6	1	6	1	34.	.55	.243
		1	7	1	40.	.45	.265
		2	7	1	56	.55	.529
		3	7	1	104	1.1	3.505
		2	5	1			
		2	7	2	40	.45	.529
		2	7	1	38	.4	.32
		1	3	1			
		1	1	1			
		3	3	2			
		3	6	2	6.	.33	.044
		2	5	2			
		2	4	50			
		2	2				.628
		2	1				.309
		2	6	6	5	.33	.066
		2	6	4	2.5	.3	.033
		2	6	1	8.	.45	.026
		2	3				1.135
-5	6	2	6	3	55	.5	1.268
		1	1	4			
		1	1				.32
		3	1				.033
		2	2	92			.276
		3	[illegible]	6			
		2	3	37			
		3	3	3			
		2	4	19			
		2	5	1			
		2	6	4	6	.375	.088
-4	6	4	5	1			
		2	1				.055
		[illegible]	1				.033
		[illegible]	2	4			
		[illegible]	2	11			
		[illegible]	3	4			
		[illegible]	3	17			
		[illegible]	4	4			
		[illegible]	4	2			
[illegible]	6	[illegible]	5	1			
		[illegible]	1				.243
		[illegible]	2	1			
		3	3	7			
		3	3	2			
		3	3	48			
		3	4	5			
		3	6	[illegible]	17	.37	.066
		3	6	[illegible]	6	.437	.077
-2	6	[illegible]	5	[illegible]			
		3	4	[illegible]			
		2	3	19			
		2	3	1			
		3	2	16			
		3	1				.11
		3	7	[illegible]	08	1.25	5.236
-1	6	3	6	4			.644
		3	[illegible]	3			
		3	5	4			
0	6	4	5	3			
		5	1	1			
1	6	4	5	[illegible]			
2	6	1	5	4			
		5	3	1			
		5	1	6			
3	6	4	5	3			
		4	4	2			
		5	3	1			
		5	2	6			
		5	1				.11
4	6	[illegible]	7	1	42	.5	.143
		[illegible]	1				.309
		[illegible]	[illegible]	[illegible]			
		5	4	[illegible]			
		4	4				
		5	4				
		5	3	6			
		5	2	17			
		5	1				[illegible]
		5	6	1	238	5.9	411
5	6	5	[illegible]	[illegible]	61.	3.5	11
		5	7	1	35	2.375	22
		5	[illegible]	2	39	.437	.235
		5	7	1	42	.75	.529
		[illegible]	[illegible]	[illegible]	60	.75	1.32
		[illegible]	7	[illegible]	44	[illegible]	.331
		[illegible]	4	5			
		[illegible]	3	2			
		4	3	4			
		[illegible]	3	[illegible]			
		6	[illegible]	4			
		[illegible]	[illegible]				.055
		4	[illegible]	4			
		[illegible]	5	[illegible]			

15-PSI GRID SQUARE X	Y	TREE NO.	GROUP NO.	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
5	6	5	6	2	7.	.5	.055
		5	6	3			.044
		5	6	6	4.	.25	.033
		5	1				1.521
6	6	5	5	1			
			2	8			
		5	2	6			
		4	1	3			
		4	3	1			
		6	3	2			
		5	1				.121
		6	1				.176
		6	6	1	5	.3	.018
		5	4	1	5	.3	.018
		5	6	1	16	.7	.165
7	6	4	3	1			
		4	5	1			
		5	2	1			
		5	6	1	7.	.437	.033
		6	1				.518
		6	2	20			
		6	3	6			
		6	6	1	11.	.5	.055
		6	6	6	7.	.25	.044
8	6	6	7	1	60.	.8	.871
		6	6	1	30.	.75	.375
		6	6	1	18	.625	.22
		6	6	1	24.	.5	.11
		6	3	3			
		6	2	17			
		6	1				.254
9	6	6	2	8			
		6	3	2			
		6	1				.1[illegible]
10	6	6	1				.011
		6	2	2			
-11	7	1	4	2			
		1	3	8			
		1	2	6			
		1	1	14			
-10	7	1	7	1	54.	.45	.463
		1	7	1	50.	.5	.331
		2	1	2			
		1	4	22			
		1	2				.187
		1	1				.088
		1	3	46			.331
		1	6	7	3.	.3	.035
		1	6	6	11.	.375	.154
-9	7	1	7	1	52.	.6	.331
		1	1				.11
		1	6	13	3.	.2	.088
		2	6	2	1.	.25	.011
		2	2	3			
		1	2	63			.121
		1	3	59			.452
		1	4	18			
		1	6	3	18.	.4	.143
-8	7	1	1	37			
		1	2	21			
		1	4	14			
		1	3	20			
		2	1	2			
		2	3	3			
		2	6	1			.009
		2	6	1	4	.25	.009
		2	6	1	9	.25	.018
		1	6	4	5	.2	.026
		1	6	3	9	.25	.037
		1	6	4	5	.33	.04
		1	6	2	3	.25	.011
-7	7	2	1				.165
		2	2	82			.243
			3	33			.298
		2	4	9			.287
		2	6	4	21	.375	.287
		2	6	1	5.	.5	.033
		2	6	2	11.	.25	.044
		2	6	4	4	.187	.018
		2	6	6	2.	.187	.011
		2	6	2	5.	.25	.018
		1	1				.011
		1	3	3			
		1	4	3			
		3	4	1			
		3	6	[illegible]	2.5	.5	.011
-6	7	2	7	2	38.	[illegible]	.452
		2	7	1	38	.625	.551
		2	7	1	43	.437	.187
		3	7	1	38	.562	.243
		2	1				.507
		1	1	1			
		3	1	1			
		1	2	3			
		2	2	155			
		1	3	1			
		2	3	105			
		1	4	1			
		2	4	20			
		2	5	4			
		2	6	3	19	.625	.386
		2	6	3	3.5	.375	.033
-5	[illegible]	3	[illegible]	1	42	.75	.496
		2	1				.121
		2	2	32			
		2	3	51			.364
		2	6	4	9	.4	.11
		3	6	3	4	[illegible]	.022
		2	4	15			
		3	2	4			
		2	6	7	[illegible]	.25	.055
		2	6	2		.5	.055
-4	7	3	1				.088
		1	2	27			.033
		1	3	21			
		1	4	6			
		1	6	10	4	.25	.066
		3	[illegible]	1	[illegible]	.5	.033
		[illegible]	5	1			
		[illegible]	3	5			
		[illegible]	[illegible]	0			
		[illegible]		14			[illegible]
		[illegible]	6	[illegible]			[illegible]
-3	7	3		1	[illegible]	[illegible]	[illegible]

15-PSI RAW TREE-DEBRIS DATA, TABULATED ACCORDING TO 15-PSI GRID SQUARES

15-PSI GRID SQUARE X	Y	TREE NO.	GROUP NO.	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
-3	7	3	7	1	51	.75	.639
		2	7	1	56	1.	.959
		2	7	1	116.	1.125	7.
		4	5	4			
		3	1				.474
		3	2	169			.474
		3	3	54			.43
		5	4	6			.198
		3	6	2	10.	.25	.033
		3	6	2	8.	.312	.033
		3	6	5	4	.25	.022
		5	6	4	2.5	.187	.011
		5	5	1			
		5	2	3			
		5	4	1			
		5	6	2	7	.312	.026
		5	6	1	7.	1.	.055
-2	7	3	5	1			
		4	5	2			
		3	4	4			
		3	3	16			
		3	2	19			
		3	1	25			
		3	6	1			.009
		3	6	1			.007
-1	7	4	5	3			
		3	3	1			
		3	1	1			
		3	2	4			
		3	5	1			
0	7	4	5	7			
	7	4	5	11			
		3	3	1			
		3	6	1	8.	.4	.018
2	7	4	5	4			
		5	1	5			
		4	1	2			
		4	2	4			
		4	7	1	34.	.5	.209
		5	2	1			
3	7	4	5	1			
		5	3	4			
		5	[illegible]	6			
		5					.11
4	7	5	1				.044
		5	6	4	2.	.25	.033
		5	[illegible]				
		5	[illegible]	1	46.	.8	.639
		4	5	1			
		5		1			.529
		5	[illegible]	32			.22
		5	3	7			
		5	6	8	5.	.25	.055
		5	6	1	9.	.5	.088
		6	6	2	2.	.3	.011
		4	3	2			
		4	5	3			
5	7	5	1				.243
		5	2	20			
		5	3	2			
		5	6	3	4.	.25	.044
		6	2	2			
		6	6	4	2.5	.25	.022
		6	1				.044
		4	4	1			
6	7	5	3	2			
		6	3	1			
		6	2	9			
		5	2	1			
		5	1	20			
		4	1	2			
		6	1				.143
		6	7	1	42.	.5	.287
		4	7	1	64.	.5	.452
7	7	6	1				.937
		6	2	57			.342
		6	3	6			.143
		6	4	1			.165
		6	6	2	7	.25	.033
		6	6	2	4.	.25	.013
		6	6	6	3	.187	.022
		6	5	1			
		5	6	1	5.	.25	.011
		4	5	2			
8		6	7	1	63	5.[illegible]	47.5
		6	7	1	52.	.5	1.168
		6	7	1	62	.6	.772
		6	7	1	52	.5	.661
		6	4	6			
		6	3	12			
		6	[illegible]	46			
		6	5	1			
		6	6	1	12.	.75	.176
		6	[illegible]				3.616
9	7	6	1				.22
		6	2	20			
		6	3	3			
		6	4	1			
		6	6	1	6.	.5	.044
		6	6	1	246	7.6	438.
10	7	6	[illegible]	1	72	.75	1.025
		6					.077
		6	[illegible]	2			
		6	[illegible]	3			
		6	6	2	8	.5	.088
-12	8	1	[illegible]	4			
		[illegible]	[illegible]	4			
		[illegible]	[illegible]	[illegible]			
		3	1	[illegible]			
		3	4	[illegible]			
		[illegible]	6	1	34	6	132
-11	8	[illegible]	4	3			
		[illegible]	[illegible]	8			
		[illegible]	[illegible]	10			
		[illegible]	[illegible]	[illegible]			
		[illegible]	6	[illegible]	4	.375	.009
		[illegible]	6	1	12	.45	.033
10	8	[illegible]	[illegible]				.044
		[illegible]	[illegible]	33			.088
		[illegible]	1	37			[illegible]
		[illegible]	4	[illegible]			[illegible]
		[illegible]	6	1	12	.375	.044
		[illegible]	6	4	9	.25	.044
			6	4	3	.25	[illegible]

15-PSI GRID SQUARE X	Y	TREE NO.	GROUP NO.	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
-10	8	1	6	2	6.	.187	.011
-9	8	1	7	1	48.	.5	.353
		1	7	1	37.	.3	.099
		1	1				.11
		1	2	22			.132
		1	6	1	11.	.5	.088
		1	6	4	6.	.25	.055
		1	3	12			
		1	1	2			
		2	2	2			
		2	5	1			
		6	6	2	9.	.25	.066
		2	6	1	12.	.5	.11
-8	8	1	7		50.	.55	.617
		1	5	3			
		1	2	22			
		1	4	6			
		1	3	13			
		1	1				
		1	6	7	3.	.25	.066
		2	1	4			.044
		2	2	5			
		2	3	4			
		1	4	6			
		2	6	1	11.	.5	.044
		2	6	1	5.5	.375	.022
		2	6		7.5	.33	.026
-7	8	5	7		95.	.75	.265
		5	2				.132
		5	2	49			.121
		5	3	41			.32
		5	4	16			.441
		5	5	4			.661
		5	7	1	42.	.75	.399
		5	6	4	10.	.312	.099
		5	6	2	6.	.312	.026
		5	6	7	4.	.75	.044
		5	6	2	2.5	.5	.022
		5	6	3	3.	.187	.011
		1	3	7			
		1	4	4			
		1	4	1			
-6	8	5	7	1	37.	.4	.22
		5	1				.441
		5	3	142			.386
		5	2	109			1.025
		5	6	6	9.	.25	.099
		5	6	5	4.	.2	.033
		5	6	1	23.	.5	.088
		2	6	1	14.	.3	.077
		2	6	1	8.	.4	.066
		2	6	1	5.	.3	.033
		3	4	2			
		1	4	1			
		1	3	1			
		1	2	2			
		3	2	2			
		1	1	1			
		3	1	1			
		3	6	1	15.	.312	.088
		2	5	15			
		2	6	1	30.	.4	.143
-5	8	2	7	1	96.	.8	1.918
		2	7	1	44.	.375	.243
		2	7	1	52.	.4	.298
		2	7	1	52.	.4	.397
		2	7	2	40	.4	.375
		2	3	43			
		2	5	7			
		2	2				.176
		2	4	19			
		2	1				.11
		3	4	2			
		3	3	7			
		3	1	4			
		2	6	8	3.	.25	.022
		2	6	2	24	.7	.419
		3	5	1			
		2	6	4			.055
		2	6	1			.11
		2	6	1			.009
		2	6	1	12	.3	.033
-4	8	3	1				[illegible]
		3	2	69			.176
		3	3	31			.187
		3	4	6			.11
		3	5				.562
		3	6	4	7	.25	.033
		3	6	1	3.	.187	.013
		[illegible]	[illegible]	1	2	.5	.011
		5	5	2			.287
		5	[illegible]	3			
		2	2	4			
		2	3	6			
		4	5	1			
-3	8	3	1				.606
		3	2	106			.353
		3	2	106			.331
		3	3	55			.452
		3	3	55			.452
		3	4	13			.364
		3	5	1			.176
		3	6	5	11.	.312	.198
		[illegible]	6	6	7	.55	.121
		[illegible]	6	[illegible]	7	.375	.088
		[illegible]	6	[illegible]	4	.187	.099
		[illegible]	3				
		[illegible]	5	1			
		[illegible]	5	4			
-2	8	4	5	5			
		3	4	3			
		3	5	1[illegible]			
		3	[illegible]				.176
		3					.243
		3	6	[illegible]	4.5	.33	.011
		[illegible]	6	[illegible]	[illegible]	.55	.02
			[illegible]	1			
-1	8	[illegible]	[illegible]	11			
		[illegible]	[illegible]	[illegible]			
		[illegible]	[illegible]	4			
		3	1	[illegible]			
		3	4	[illegible]			
		[illegible]	6	1	8	.375	0[illegible]

15-PSI RAW TREE-DEBRIS DATA, TABULATED ACCORDING TO 15-PSI GRID SQUARES

15-PSI GRID SQUARE X	Y	TREE NO.	GROUP NO.	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
[illegible]	8	5	6	1	2.5	.55	.022
0	8	4	5	7			
		4	1	1			
		4	6	[illegible]	[illegible] .5	[illegible]	.018
1	8	4	5	7			
		5	6	1	12	.33	.033
2	8	4	5	5			
		4	6	[illegible]	12.5	[illegible]	.04
3	8	4	5				
		5	[illegible]	8			
		5	3	[illegible]			
		5	[illegible]	36			
4	8	5	[illegible]				.209
		5	[illegible]	15			
		5	[illegible]	6			
		5	6	[illegible]	5	.187*	.033
5	8	5	[illegible]	[illegible]			
		6	[illegible]				.121
6	8	6	[illegible]	[illegible]			
		6	[illegible]	14			
		[illegible]	[illegible]	57			
		[illegible]	1				.176
7	8	5	[illegible]	[illegible]	44	.55	.485
		6	[illegible]	[illegible]	48	.6	.43
		6	[illegible]		28	.5	.265
		6	5	4			.871
		6	[illegible]	31			
		6	[illegible]	11			
		6	[illegible]	1	23	.4	.11
		6	[illegible]	2	6	.4	.055
		6	[illegible]	7	7	.25	.055
8	8	6	[illegible]	2	40	.5	1.058
		6	4	3			
		6	5	22			
		4	5	1			
		6	2	60			
		6					2.877
		6	3	7			
		6	4	5			
		6	6	3	11.	.7	.298
		6	6	2	17.	.85	.529
		6	6	5	7.	.6	.154
		6	6	1			.018
9	8	6	1	6			
		6	[illegible]	16			
		6	[illegible]				.298
		[illegible]	[illegible]	[illegible]	10.	.312	.132
		6	[illegible]	4	6	.25	.055
		6	[illegible]	[illegible]	3	.25	.033
10	8	6	[illegible]	5			
		6	5	1			
11	8	6	1	1			
-11	9	[illegible]	4	5			
		1	1	10			
		[illegible]		10			
		1					.011
		[illegible]	6	4	3	.25	.044
		1	6	3	14	.3	.099
		1	6	[illegible]	10	.4	.088
		1	6		5	.25	.033
-10	9	[illegible]	4	[illegible]			
		[illegible]	3	2?			
		1	[illegible]	1?			
		1					.066
		1	6	4	2	.25	.077
		2	[illegible]	[illegible]	6.5	.5	.077
-9	9	1					.011
		1		20			.044
		1	1	15			.088
		[illegible]	4	[illegible]			
		[illegible]	6	1	18	.75	.22
-8	9	[illegible]	5	[illegible]			
		[illegible]	[illegible]	[illegible]			
		[illegible]	4	[illegible]			
		[illegible]	[illegible]	4			
		[illegible]	[illegible]	[illegible]			
		2	3	4			
		[illegible]	2	11			
		[illegible]	[illegible]	6			
		[illegible]	[illegible]	11			
		[illegible]	[illegible]	11			
		[illegible]	1	1			
		[illegible]	6	2	5	.312	.033
		[illegible]	[illegible]	[illegible]	[illegible]	.312	[illegible]
-7	9	[illegible]	6	1	24	.9	.562
		[illegible]	6	1	60	.55	.551
		[illegible]	6	1	78	.75	.959
		[illegible]	6	[illegible]	56	.5	.419
		[illegible]	6	[illegible]	44	.5	.309
		[illegible]	[illegible]	8			
		1	[illegible]	[illegible]			
		1	6	[illegible]	3	.33	.018
		1	6	1	7	.5	.018
		[illegible]	4	8			
		[illegible]	[illegible]	4			
		[illegible]					.132
		[illegible]					.055
		[illegible]	[illegible]	[illegible]	2	.55	.307
-6	9	[illegible]	[illegible]	[illegible]	43	.375	.298
		[illegible]	[illegible]	[illegible]	85	.75	.849
		[illegible]					.088
		[illegible]	[illegible]	11			[illegible]
		[illegible]	3	12			[illegible]
		[illegible]	3	31			[illegible]
		[illegible]	[illegible]	11			.336
		[illegible]	[illegible]				[illegible]
		[illegible]	[illegible]				[illegible]
		[illegible]	6	3	6	.25	[illegible]
		[illegible]	6	1?	[illegible]	.187	[illegible]
		[illegible]	6	3	1?	.437	[illegible]

15 PSI GRID SQUARE X	Y	TREE NO.	GROUP NO.	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
-6	9	2	6	1	21	.5	.11
		1	6	4	3.5	.187	.022
		3	6	4	4.	.187	.033
		3	4	1			
-5	9	2	7	1	65	.625	.573
		2	5	2			
		3	5	1			
		2	4	11			
		3	4	1			
		2	3	29			
		3	3	2			
		2	2	29			
		2	2	4			
		2	1				.055
		2	1	10			
		2	6	2	7.5	.25	.044
		3	6	3	3.5	.33	.044
		3	6	1	3.	.125*	.022
		3	6	1	9.	.25	.033
		3	6	3	6.	.312	.066
		4	5	1			
-4	9	3	1				.033
		3	2	40			.055
		3	3	60			
		3	6	5	7	.25	.066
		2	3	1			
		3	4	15			
-3	9	3	2	212			.739
		3	1				.672
		3	5	130			1.488
		3	6	15	5.5	[illegible]	.187
		3	6	1	5.	.5	.044
		3	6	1	12.	.4	.066
		3	4	38			
		3	5	4			
		4	5	1			
		2	5	1			
		2	4	1			
		2	2	1			
		2	6	1	18.	.4	.099
-2	9	3	5	2			
		3	4	6			
		3	3	26			
		3	2	47			
		3	1				.11
		3	6	2	5.	.25	.011
		3	6	1	3	.25*	.011
		3	6	3	[illegible] .5	.312	.055
		2	6	1	1[illegible]	.312	.033
		4	5	2			
-1	9	3	4	1			
		3	3	4			
		3	2	8			
		3	1	13			
		3	6	1	9.	.375	.044
		4	5	12			
0	9	4	5	5			
		3	6	3	2.5	.2	.022
1	9	4	5	1			
		3	6	1	3.	.4	.022
2	9	5	1	4			
		4	5	4			
3	9	4	5	5			
4	9	5	1				.044
		5	2	5			
		5	3	5			
		6	3	1			
		4	5	2			
5	9	4	7	1	54	.562	.32
		5	3	1			
		5	2	3			
		5	1				.044
		6	1	6			
6	9	6	5	1			
		5	4	1			
		5	1	5			
		6	2	16			.198
		6	1				.088
		6	6	1	7.	.45	.022
		6	6	1	10.	.375	.031
7	9	6	4	1			
		6	3	13			
		6	2	43			
		6	1				1.323
		6	6	1	6	.5	.187
8	9	6	7	1	70.	.687	.86
		6	7	1	18	.5	.331
		6	2	31			.43
		6	2	10			.606
		6	5	14			.033
		6	2	10			.331
		6	3	13			.529
		6	4	9			1.[illegible]77
		6	6	2	20.	.562	.336
		6	6	4	8	.562	.309
		6	6	3	5.	.5	.121
		6	1				2.866
9	9	6	7	1	42	.4	.265
		6	5	1			
		6	2	16			
		6	3	3			
		6	6	1	14	.6	.11
		6	1				.22
10	9	5	1	1			
		6	1	4			
		6	6	1	4.5	.5	.018
-10	10	1	4	7			
		1	5	1			
		1	3	8			
		1	2	10			
		1	1	5			
		1	6	1	5	.375	.018
		1	6	1	9	.25	.018
-9	10	1	5	1			
		1	4	5			
		1	3	2			
		1	2	1			
		1	1	14			
		1	6	1	3.5	.5	.022
		1	6	1	6	.312	.022
-8	10	1	5	1			
		1	4	4			
		1	4	1			
		1	1	2			

15-PSI RAW TREE-DEBRIS DATA, TABULATED ACCORDING TO 15-PSI GRID SQUARES

15-PSI GRID SQUARE X Y	TREE NO	GROUP NO	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
-8 10	[illegible]	[illegible]	1 1 3 1 14 1	5.	.312	.022
-7 10	[illegible]	[illegible]	24 29 9 5 1 1 1 1 1 4	24. 5 6	.5 .6 .3	.033 .132 .066 .044
-6 10	[illegible]	[illegible]	1 1 18 2 23 40 2	72. 7.	.7 .375	1.455 .209 .099 .066 .049
-5 10	[illegible]	[illegible]	1 2 6 2 11 2 5 7 10 1 2 5 2	60. 13. 4.5 3.5	.562 .312 .375 .312	.496 .088 .077 .055 .066
-4 10	[illegible]	[illegible]	1 2 1 20 2 8 1 74 1 3 1	54.	.812	.276 .022 .794
-3 10	[illegible]	[illegible]	1 1 101 76 11 92 65 9 3 3 7 4 13 2	60. 33. 13 10 5	.625 .625 .5 .312 .25 .187	.54 .276 .309 .639 .32 .32 .617 .276 .331 .231 .132 .044 .077 .397
-2 10	[illegible]	[illegible]	2 3 73 9 6 3 1 1	24. 3 8. 13 13 16.	.6 .3 .33 .55 .33 .4	.353 .187 .648 .375 .22 .046 .04 .099 .04 .049
-1 10	[illegible]	[illegible]	6 1 3 7 17 1	3	.4	.022
0 10	[illegible]	[illegible]	1			
1 10	[illegible]	[illegible]	6			
2 10	[illegible]	[illegible]	10			
4 10	[illegible]	[illegible]	4 2			
5 10	[illegible]	[illegible]	2 1 1 3 1 1			
6 10	[illegible]	[illegible]	1 1 2 1			055
7 10	[illegible]	[illegible]	2 14 46 5 1 1 2 1	4 7	6 4	066 022 099 1 202
8 10	[illegible]	[illegible]	2 5 44 1 1	5 5 3 174	125 062 1 85	009 1 025 004 70
9 10	[illegible]	[illegible]	2 2 2 6	15	25 437	529 353 044
[illegible] 11						

15-PSI GRID SQUARE X Y	TREE NO	GROUP NO	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
-12 11	1 1 1	2 3 4	1 1 1			
-11 11	1 1 1 1 2	4 3 2 7 7	1 3 1 1 1	64. 46.	.55 .6	.65 .485
-10 11	1 1	1 4	5 1			
-9 11	1 1 1 1 1	3 1 6 6 7	3 3 1 1 1	6. 11 46	.25 .45 .625	.011 .044 .485
-8 11	[illegible]	[illegible]	1 1 1 3 3 4 2	2.	.4	.022
-7 11	[illegible]	[illegible]	2 2 2 3 1 1 2 1 2 1	5 10.	.3 .312	.033 .044
-6 11	[illegible]	[illegible]	5 9 1 11 2 12 1 1 1 1 1	30 5.25 6. 4. 5.	.362 .312 .375 .375 .312	.066 .198 .033 .033 .033 .033
-5 11	[illegible]	[illegible]	3 4 8 5 2 3 1 1 1 1	13. 8. 4.	.25 .3 .25	.055 .044 .022 .099 .132 .507
-4 11	[illegible]	[illegible]	51 58 21 3 1 2 8 2 4	20. 9. 3. 3.5	.5 .25 .2 .2	.143 .055 .055 .044
-3 11	[illegible]	[illegible]	1 1 3 32 1 1 7 4 1 6	70. 50. 7. 10. 4. 5.5	.75 .7 .3 .33 .33 .33	2.8 .672 .254 .397 1.257 .093 .121 .013 .079
-2 11	[illegible]	[illegible]	1 1 18 70 101 2 1	32. 4.	.75 .375	.309 .309 .044
-1 11	[illegible]	[illegible]	2 10 8 3 2 1 3 2	6. 3.5 3. 2.	.25 .4 .25 .2	.022 .018 .022 .011
0 11	[illegible]	[illegible]	5 2 1			
1 11	4 2	5 2	4 1			
2 11	4	5	5			
3 11	4	5	7			
4 11	5	1	1			
5 11	5 6	1 1	1 2			
6 11	6 6 6 6 6	3 2 1 6 5	1 20 2 2	8	.375	.143 .077
7 11	6 6 6 6	4 3 2 1	1 9 22			.452
8 11	[illegible]	[illegible]	4 1 2 34	42 12 23	.4 25 4	.683 .551 .309 .066 .132
9 11	6 6 6 6	3 3 4 1	9 8 25			.408

15-PSI RAW TREE-DEBRIS DATA, TABULATED ACCORDING TO 15-PSI GRID SQUARES

15-PSI GRID SQUARE X Y	TREE NO.	GROUP NO.	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
[illegible]	[illegible]	[illegible]	[illegible]	8.5	.375	.077
[illegible]	[illegible]	[illegible]	[illegible]	5	.33	.035
[illegible]	[illegible]	[illegible]	[illegible]	12	.25	.031
[illegible]	[illegible]	[illegible]	[illegible]	8	.25	.055
[illegible]	[illegible]	[illegible]	[illegible]	35	.4	.198
[illegible]	[illegible]	[illegible]	[illegible]	3	.33	.011
[illegible]	[illegible]	[illegible]	[illegible]	3	.25	.018
[illegible]	[illegible]	[illegible]	[illegible]	3	.2	.011
[illegible]	[illegible]	[illegible]	[illegible]	47	.437	.22
[illegible]	[illegible]	[illegible]	23			
[illegible]	[illegible]	[illegible]	64			
[illegible]	[illegible]	[illegible]	[illegible]			.121
[illegible]	[illegible]	[illegible]	[illegible]	14	.5	.11
[illegible]	[illegible]	[illegible]	[illegible]	10	.437	.077
[illegible]	[illegible]	[illegible]	[illegible]	8	.437	.055
[illegible]	[illegible]	[illegible]	[illegible]	5	.5	.055
[illegible]	[illegible]	[illegible]	19			
[illegible]	[illegible]	[illegible]	64			
[illegible]	[illegible]	[illegible]	34			
[illegible]	[illegible]	[illegible]	[illegible]			.154
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.625	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.437	.055
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.25	.033
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.375	.033
[illegible]	[illegible]	[illegible]	[illegible]	2.5	.375	.033
[illegible]	[illegible]	[illegible]	[illegible]	39	.25	.132
[illegible]	[illegible]	[illegible]	[illegible]	38	.4	.154
[illegible]	[illegible]	[illegible]	21			.088
[illegible]	[illegible]	[illegible]	39			.077
[illegible]	[illegible]	[illegible]	23			.309
[illegible]	[illegible]	[illegible]	[illegible]	3.5	.2	.022
[illegible]	[illegible]	[illegible]	[illegible]	10	.25	.077
[illegible]	[illegible]	[illegible]	60			.132
[illegible]	[illegible]	[illegible]	84			.209
[illegible]	[illegible]	[illegible]	17			.25
[illegible]	[illegible]	[illegible]	[illegible]			.386
[illegible]	[illegible]	[illegible]	[illegible]			.387
[illegible]	[illegible]	[illegible]	[illegible]	5	.3	.033
[illegible]	[illegible]	[illegible]	[illegible]	12	.33	.033
[illegible]	[illegible]	[illegible]	[illegible]	9	.3	.033
[illegible]	[illegible]	[illegible]	[illegible]	2	.3	.007
[illegible]	[illegible]	[illegible]	[illegible]	4	.3	.011
[illegible]	[illegible]	[illegible]	[illegible]	6	.2	.011
[illegible]	[illegible]	[illegible]	[illegible]	9.5	.4	.044
[illegible]	[illegible]	[illegible]	[illegible]	7	.55	.044
[illegible]	[illegible]	[illegible]	[illegible]	5	.55	.049
[illegible]	[illegible]	[illegible]	[illegible]			.187
[illegible]	[illegible]	[illegible]	[illegible]			.11
[illegible]	[illegible]	[illegible]	[illegible]			.099
[illegible]	[illegible]	[illegible]	[illegible]			.11
[illegible]	[illegible]	[illegible]	[illegible]	8	.25	.022
[illegible]	[illegible]	[illegible]	[illegible]			[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	6	.25	.022
[illegible]	[illegible]	[illegible]	[illegible]	12	.25	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	45	.55	.154

15-PSI GRID SQUARE X Y	TREE NO.	GROUP NO.	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
9 12	6	5	4			
	6	6	2	8	.5	.055
13	1	1	1			
-10 13	1	3	2			
-8 13	2	1	2			
-7 13	[illegible]	4	2			
-6 13	3	1	1			
-5 13	3	1	3			
	3	6	5	3.	.33	.022
	3	0	1	5.	.5	.018
-4 13	3	5	2			
	3	[illegible]	20			
	3	[illegible]	12			
	3	[illegible]	19			
	3	6	1	25.	.625	.198
	3	6	2	17.	.5	.154
	3	6	[illegible]	6.	.437	.077
	3	6	[illegible]	6.	.25	.055
	3	6	[illegible]	3	.312	.055
-3 13	3	1	[illegible]			.033
	3	[illegible]	34			.088
	3	3	37			.397
	3	4	12			.353
	3	5	1			.044
	3	6	1	9.	.375	.022
	3	6	2	4.	.375	.018
	3	6	2	5.	.25	[illegible]
	3	6	6	3.	.187	[illegible]
-2 13	3	7	1	44.	.5	[illegible]
	3	7	1	44	.55	.298
	[illegible]	[illegible]	22			[illegible]
	[illegible]	[illegible]	43			[illegible]
	3	6	3	5	.25	[illegible]
	3	6	3	[illegible]	.33	[illegible]
	3	6	2	8	.45	[illegible]
	3	6	1	18	.6	.121
-1 13	3	[illegible]	3			.011
	3	[illegible]	[illegible]			.044
	3	[illegible]	[illegible]			.088
	3	5	1			.143
	3	6	2	18	.312	.099
	3	6	1	12	.5	.077
0 13	4	5	3			
1 13	4	5	2			
2 13	4	5	2			
3 13	4	5	3			
4 13	4	5	4			
5 13	6	5	4			
6 13	6	[illegible]	5			
	6	6	1	9	.375	.033
	6	5	5			.022
7 13	6	1	11			.055
	6	[illegible]	1			.022
8 13	6	3	4			
	6	[illegible]	[illegible]			.022
9 13	6	7	1	39	.5	.198
	6	1	[illegible]			.044
10 13	4	5	1			
-6 14	[illegible]	[illegible]	[illegible]			
-5 14	[illegible]	3	1			
-4 14	3	6	1	10	.5	.044
	3	7	1	46.	.5	.408
	3	4	9			
	3	3	9			
	3	6	1	8.5	.312	.033
	3	6	1	8.5	.312	.033
	3	6	[illegible]	5	.25	.022
-3 14	3	[illegible]	[illegible]			
	3	[illegible]	6			
	3	[illegible]	11			
-2 14	3	6	[illegible]	7	.5	.022
	3	1	4			.011
	3	[illegible]	11			.055
	3	[illegible]	20			[illegible]
	3	6	[illegible]	18	.375	.066
	3	[illegible]	1	[illegible]	.25	.033
	3	[illegible]	[illegible]	[illegible]	.187	.011
[illegible] 14	[illegible]	[illegible]	[illegible]			

15-PSI RAW TREE-DEBRIS DATA, TABULATED ACCORDING TO 15-PSI GRID SQUARES

15-PSI GRID SQUARE X	15-PSI GRID SQUARE Y	TREE NO	GROUP NO	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			.033
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	13.5	.312	.044
[illegible]	[illegible]	[illegible]	[illegible]	3	5.5	.24	.044
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			.011
[illegible]	[illegible]	6	[illegible]	[illegible]	12	.625	.088
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	8	.25	.044
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3	.25	.022
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	20	.5	.044
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5.5	.312	.022

15-PSI GRID SQUARE X	15-PSI GRID SQUARE Y	TREE NO	GROUP NO	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
8	18	6	5	6			
9	18	6	5	[illegible]			
[illegible]	18	6	5	3			
[illegible]	18	6	5	9			
12	18	6	5	4			
14	18	6	5	1			
15	18	6	[illegible]	1			
[illegible]	18	6	5	1			
[illegible]	19	1	1	1			
5	19	6	5	2			
[illegible]	19	6	[illegible]	3			
8	19	6	5	3			
9	19	6	5	1			
10	19	6	5	1			
[illegible]	19	6	5	4			
8	20	6	5	1			
9	20	6	5	2			
11	20	6	5	1			
12	20	6	5	1			
[illegible]	20	6	5	3			
[illegible]	[illegible]	6	[illegible]	1			
11	[illegible]	6	[illegible]	2			
4	[illegible]	6	5	1			
5	[illegible]	6	5	1			
6	[illegible]	6	5	1			
7	[illegible]	6	5	1			
8	[illegible]	6	5	1			
9	[illegible]	6	5	1			
10	[illegible]	6	5	1			
[illegible]	[illegible]	6	5	1			
5	[illegible]	6	5	1			
15	25	6	5	1			

*Indicates bark; a value listed under average diameter column denotes average width of bark fragment(s)

50-PSI RAW TREE-DEBRIS DATA TABULATED ACCORDING TO 50-PSI GRID SQUARES

50-PSI GRID SQUARE X	Y	TREE NO.	GROUP NO.	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
-2	-4	7	6	1	6.	1.	
		7	6	1	4.	.75	
-1	-4	10	6	1	3.	1.5	
		9	6	1	3.	2.	
		8	6	1	2.	1.5	
		8	6	1	8.	.33	
		8	6	1	3.	.75	
		8	6	1	4.5	.5	
		8	6	1	3.	.5	
		7	6	1	8.	10.	
		7	6	1	3.	1.25	
		7	6	3	6.	.5	
		7	6	3	7.	.5	
		7	6	1	16.	.625	
0	-4	10	6	1			
		11	3	3			
		12	3	1			
		9	6	2	2.	.5	
		9	3	1			
		8	6	1	8.5	.3	
		8	6	1	8.	2.	
		8	6	1	6.	.1	
		8	6	1	2.	2.5	
		8	6	2	2.	.75	
		8	6	1	3.	.625	
		7	6	1	5.	2.	
		7	6	1	4.	.75	
		7	6	1	6.	.75	
		7	6	1	3.	.5	
		7	6	2	4.	.33	
1	-4	7	6	1	22.	1.5	
		7	6	1	8.	.5	
		11	3	3			
		11	3	1			
		12	2	4			
		7	6	5	4.	.5	
		7	6	2	7.	.375	
		7	6	1	4.	.5	
		7	6	1	1.5	3.	
-2	-3	7	6	4	10.	.3	
		7	6	3	6.	.5	
		7	6	2	2.	.5	
		7	6	1	4.	.5	
		7	6	1	4.	2.5	
		7	6	1	9.	.45	
		7	3	1			
-1	-3	10	6	1	48.	.75	
		10	6	1	36.	.875	
		10	6	2	4.	.5	
		9	6	1	3.5	.375	
		8	6	1	3.	.625	
		8	6	2	4.	1.5	
		8	6	1	1.2	8.	
		8	6	1	2.	1.5	
		8	6	1	8.	.5	
		8	6	1	3.	1.	
		7	3	1			
		7	6	2	5.5	.375	
		7	6	1	18.	.55	
		7	6	1	7.	1.	
		7	6	1	4.	.875	
		7	6	1	4.	.4	
		7	6	2	1.5	3.	
		7	6	4	4.	.6	
		7	6	3	5.	.5	
		7	6	4	4.	.3	
		7	6	5	8.	.33	
		7	6	1	6.	.625	
		7	6	1	9.	.375	
		7	6	1	8.	1.5	
		7	6	2	6.	.3	
0	-3	11	2	4			
		10	6	3			
		10	6	2	1.	1.	
		10	6	1	6.5	.875	
		10	6	1	10.	.75	
		8	3	1			
		8	6	3	12.	3.	
		8	6	1	4.	1.	
		8	6	1	2.	1.	
		8	6	1	1.	1.	
		8	6	3	3.	.5	
		8	6	5	2.	.5	
		9	6	3	2.	.5	
		9	6	1	11.	2.5	
		7	6	1	12.	1.	
		7	6	1	12.	.75	
		7	6	1	2.5	.45	
		7	3	1			
		7	6	2	2.	1.5	
		7	6	1	4.	.3	
1	-3	12	2	3			
		11	2	2			
		12	2	15			
		11	2	7			
		12	6	2	10.	.33	
		11	6	1	6.	.5	
		8	6	1	3.	.375	
		12	2	1			
2	-3	12	2	1			
-2	-2	7	3	1			
		7	3	7			
		7	6	2	16.	.33	
		7	6	4	4.	1.5	
		7	6	2	2.5	1.	
		7	6	2	4.	.28	
		7	6	4	2.	.3	
		7	6	1	8.	.3	
		7	6	3	7.	.375	
		7	6	2	4.	.33	
		7	6	1	8.	.25	
-1	-2	10	2	1			
		9	6	1	3.	.75	
		8	3	1			
		8	6	1	8.	1.	
		8	6	6	3.	.5	
		8	6	1	1.	5.	
		8	6	1	1.	9.	
		8	6	1	2.5	.33	
		7	6	1	20.	2.	
		7	6	1	16.	1.75	
		7	6	3	7.	.75	
-1	-2	7	6	4	5.	.75	
		7	6	4	3.	1.	
		7	6	1	3.	.5	
		7	6	2	6.5	.3	
		7	6	8	4.	.3	
		7	6	1	15.	2.25	
		7	3	4			
		7	6	1	8.	.33	
		7	6	1	10.	.75	
		7	6	2	4.	.375	
		7	6	3	3.	.33	
		7	6	1	1.	1.	
0	-2	11	2	6			
		10	6	2	4.	.5	
		9	6	1	6.	.5	
		9	6	1	1.5	1.5	
		8	6	1	9.	3.	
		8	6	1	15.	1.5	
		8	6	4	5.	1.	
		8	6	2	3.	.5	
		8	6	1	2.	3.	
		8	6	1	10.	1.	
		8	6	1	8.	.625	
		8	6	1	7.	.5	
		8	6	1	3.	.75	
		7	6	1	17.	.625	
		7	6	1	11.	.5	
		7	6	3	5.	.375	
		7	3	1			
		7	6	1	14.	.3	
		7	6	1	16.	.5	
1	-2	12	5	1			
		8	2	1			
		11	2	3			
		8	6	3	2.5	.3	
		8	6	1	7.	.75	
		12	2	13			
		11	2	12			
		12	3	1			
		11	3	1			
		11	6	1	4.	.375	
		11	6	1	1.	9.	
		11	6	1	6.	.75	
		8	6	1	8.	1.5	
		8	6	2	12.	.375	
2	-2	12	2	3			
-2	-1	8	6	1	4.	1.	
		7	6	5	4.	1.	
		7	6	1	12.	2.	
		8	3	6			
		8	6	2	10.	.5	
		7	3	7			
		7	6	2	8.	.375	
		7	6	2	12.	.5	
		7	6	3	8.	1.	
		7	6	2	42.	1.	
		7	6	2	36.	1.5	
		7	6	1	48.	10.9	90.
-1	-1	8	6	16	7.	.312	
		8	6	3	10.	.437	
		9	6	1	8.	2.	
		9	6	7	4.	1.	
		8	6	1	36.	3.875	
		7	6	3	10.	.5	
		9	6	3	8.	.375	
		7	6	3	18.	1.25	
		8	6	1	36.	1.	
		8	6	1	80.	1.38	
		8	6	1	108.	2.5	
0	-1	10	6	2	16.	.625	
		10	6	3	10.	.5	
		10	6	1	6.	.375	
		10	6	4	4.	.5	
		9	6	2	4.	1.	
		8	6	8	4.	1.	
		8	3	3			
		8	6	2	18.	.75	
		8	6	4	8.	.5	
		7	6	1	4.	1.	
		7	6	2	16.	1.	
		7	6	5	9.	.5	
		11	2	2			
		10	6	1	48.	9.2	77.
1	-1	12	2	17			
		11	3	4			
		12	3	2			
		8	4	1			
		10	6	4	4.	1.	
		8	6	1	14.	1.5	
2	-1	12	2	3			
		11	2	3			
		12	2	14			
-3	0	8	6	1	6.	.625	
		7	6	1	63.	3.25	
		7	6	1	10.5	4.	
		7	6	1	11.	1.187	
		7	6	1	22.	1.875	
		7	6	1	26.	1.125	
		7	6	1	24.	1.	
		7	6	7	12.	.375	
		7	6	7	7.	.375	
		7	6	5	6.	.437	
-2	0	8	3	14			
		7	4	21			
		7	6	19	4.	.187	
		7	6	12	7.	.437	
		7	6	11	10.	.312	
		7	6	5	14.	.75	
		7	6	10	25.	.625	
		7	6	4	14.	1.25	
		7	6	2	35.	1.	
		7	6	2	35.	1.5	
		7	6	6	6.	1.	
		8	3	17			
		8	6	2	8.	.187	
		8	6	5	4.	.5	
		8	6	1	48.	10.5	88.
-1	0	8	6	1	221.	8.2	334.
		8	6	19	7.	.375	
		7	6	11	8.	.375	
		9	6	2	9.	.375	
		8	6	4	5.	.5	
		9	6	3	5.	.5	
		8	6	1	3.	1.	

50-PSI RAW TREE-DEBRIS DATA TABULATED ACCORDING TO 50-PSI GRID SQUARES

50-PSI GRID SQUARE X	Y	TREE NO	GROUP NO	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
[illegible]	0	8	6	2	30	.5	
		9	3	3			
		10	[illegible]	6			
		9	6	12	4	[illegible]	
		8	6	20	5	[illegible]	
		8	3	1			
		7	6	10	6	2	
		[illegible]	6	6	24	[illegible]	
		8	6	3	22	1	
		8	6	2	36	1.5	
		8	6	1	54	2	
		9	6	1	45	9.6	72
0	0	10	6	1	36	2.5	
		11	6	1	24	[illegible]	
		10	6	2	6	.437	
		11	6	1	9	.375	
		10	6	1	25	.625	
		10	6	2	10	.5	
		10	6	2	5	.5	
		12	3	1			
		11	5	10			
		[illegible]	5	5			
		[illegible]	6	1	4	.25	
		10	6	1	60	.75	
		10	6	1	36	.75	
		10	6	1	9.5	.75	
		8	6	1	5	.5	
1	0	11	6	1	12.	.875	
		[illegible]	[illegible]	6			
		[illegible]	[illegible]	2			
		8	6	1	5.75	1.	
		12	6	1	15	.625	
		[illegible]	6	2	10	.5	
		[illegible]	6	1	13	1.	
		12	6	1	16	.5	
		8	6	1	10	1.125	
		12	6	1	45	9.5	86.
		11	6	1	48	9.7	38.
2	0	10	3	5			
		12	3	5			
		11	2	11			
		12	2	11			
		[illegible]	3	2			
		11	6	1	6	.5	
		11	6	1	5	1.25	
		12	5	5			
-4	1	8	3	1			
-3	1	8	6	1	46	.875	
		8	6	1	12	.25	
		8	3	1			
		7	6	1	22	.625	
		7	6	4	11.	1.125	
		8	6	1	12	.25	
		7	6	32	8	.312	
		7	3	5			
-2	1	9	6	2	17.	.625	
		9	6	5	5	.75	
		8	1	30			
		8	6	15	14	.75	
		7	6	1	52	1.375	
		7	6	2	25	1.875	
		7	6	4	18	.75	
		7	6	1	36	.75	
		7	6	27	13	.5	
		7	3	22			
		7	6	13	4	.5	
		7	6	2	14	1.25	
-1	1	9	6	1	58	1.625	
		9	6	1	120.	1.625	
		9	6	1	54	2.125	
		9	6	1	85	1.375	
		9	6	1	80.	1.25	
		9	6	1	54	2	
		9	6	1	57	1.25	
		9	6	1	47	1.125	
		9	6	2	32	1.125	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0	1	1	6	2	5	.5	
		11	6	2	10	.375	
		10	6	2	12	.5	
		8	6	2	9.5	.375	
		7	6	1	7	.25	
		11	2	6			
		10	3	3			
		11	2	29			
		10	2	46			
1	1	12	6	1		.625	
		11	6	1	48	1.	
		11	[illegible]	2	30	.875	
		11	[illegible]	2	24	.5	
		12	6	2	10	1.	
		10	6	2	10	1.25	
		11	6	1	6	.5	
		11	6	3	6	.5	
		11	6	1	3	.562	
		10	2	1			
		12	2	14			
		11	2	27			
		12	6	1	9.5	.375	
		11	6	5	5.5	.25	
		11	6	1	12	.625	
		11	6	1	9	.25	
		12	6	1	12.5	.375	
		11	6	1	13.	1.25	
2	1	12	3	1			
		11	6	1	7	.875	
		12	6	2	5	.625	
		12	5	5			
		12	2	60			
		12	6	3	7	.5	
		12	6	2	3	.5	
		12	6	10	5	.375	
		12	6	2	12	.625	
-4	2	7	6	1	48	1.375	
		7	6	1	12	.5	
		7	6	10	8.	.25	
		8	3	1			
		7	3	2			
		7	6	1	8.	.5	
-3	2	9	6	3	9	.437	
		7	6	1	60	1.25	
		[illegible]	6	2	27	.875	
		7	6	5	6	1.5	
		7	6	3	18	.5	
		8	3	2			
		8	6	5	7.5	.437	
		7	6	7	10.	.437	
		7	6	13	9.5	.437	
		8	6	1	7	.437	
		7	3	15	5.5	.437	
		7	3	10			
		7	[illegible]	80	5	.187	
		7	6	6	12	.25	
		7	6	6	12.5	.875	
-2	2	7	6	1	105	2.5	
		7	6	2	57	2.25	
		7	6	1	57	2.25	
		9	6	1	15.	.5	
		9	6	4	8.5	.375	
		9	6	1	3.	.25	
		8	6	2	23	1.125	
		8	6	1	48	.562	
		8	6	1	16	1.125	
		8	6	2	23	.562	
		8	6	8	15.5	.5	
		8	6	1	10.5	.75	
		8	6	13	7.5	.375	
		8	6	11	4.5	.187	
		8	6	3	5	.625	
		8	3	165			
		7	6	2	30.	.5	
		7	6	3	20	.625	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
-1	2	[illegible]	[illegible]	[illegible]	24	2.25	54
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

50-PSI RAW TREE-DEBRIS DATA TABULATED ACCORDING TO 50-PSI GRID SQUARES

50-PSI GRID SQUARE X	50-PSI GRID SQUARE Y	TREE NO	GROUP NO	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
0	2	[illegible]	6	1	6	.45	
		10	[illegible]	2			
		10	6	1	30	[illegible]	
		9	3	7			
		9	6	1	20	.5	
		[illegible]	6	1	[illegible]	.375	
		8	6	[illegible]	[illegible]	.55	
		[illegible]	6	[illegible]	[illegible]	.45	
		[illegible]	6	2	3	1	
		7	6	[illegible]	6	.4	
		[illegible]	6	1	[illegible]	.2	
		[illegible]	6	[illegible]	[illegible]	1.25	
		[illegible]	6	3	[illegible]	.5	
		[illegible]	6	[illegible]	[illegible]	.75	
		[illegible]	6	2	[illegible]	.5	
		10	6	4	[illegible]	.5	
		[illegible]	6	[illegible]	[illegible]	[illegible]	
		[illegible]	6	3	[illegible]	1	
[illegible]	2	[illegible]	6	1	[illegible]	.85	.65
		[illegible]	6	1	[illegible]	.55	.408
		[illegible]	6	[illegible]	[illegible]	.75	[illegible]
		11	3	3			
		11	[illegible]	[illegible]			
		10	[illegible]	5			
		10	6	1	3	.4	.004
		3	3	3			
		[illegible]	[illegible]	24			
		[illegible]	[illegible]	6			
			3	1			
		3	6	1	6	.3	.013
		[illegible]	6	1	21	.5	.154
		[illegible]	6	1	6	.375	.026
		[illegible]	6	1	11	.33	.031
		[illegible]	6	1	11	.55	.077
		11	6	1	10	.4	.035
		11	6	1	6	.375	.026
		11	6	1	5	.3	.011
		[illegible]	6	1	9	2.5	.22
		3	6	1	[illegible]	.5	.009

50-PSI RAW TREE-DEBRIS DATA TABULATED ACCORDING TO 50-PSI GRID SQUARES

50-PSI GRID SQUARE X	Y	TREE NO.	GROUP NO.	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
[illegible]	3	[illegible]	3	4			
		7	6	4	5	.25	
		7	[illegible]	2			
		7	6	1	27	.75	
		7	6	1	18	1.	
		7	6	3	12	.75	
0	3	9	5	1	25.	1.5	
		9	6	1	38.	1.	
		9	6	3	16.	.625	
		9	6	7	8.	.437	
		9	6	4	3.75	.5	
		9	3	9			
		9	6	1	4	.5 *	
		8	6	1	25	.625	
		8	6	[illegible]	5	.375	
		8	6	[illegible]	10	.625	
		11	6	3	9	.562*	
		11	6	3	6	.875*	
		11	6	2	4.	.5 *	
		11	6	10	8.	.25	
		11	3	4			
		11	2	66			
		11	6	[illegible]	18	.5	
		11	6	[illegible]	54	1.	
		12	6	2	27	.625	
		10	6	1	24	.5	
		10	6	2	15.	.625	
		10	6	6	16	.25	
		10	6	7	9	.375	
		10	6	24	7.	.437	
		10	6	13	4.5	.25	
		10	6	1	12	1.5 *	
		10	6	8	11.	1.25 *	
		10	6	16	3.5	.75 *	
		10	6	13	6.5	.437*	
1	3	11	6	1	219.	7.[illegible]	349.
		11	6	1	64	.625	
		11	6	1	[illegible]	1.25	
		11	6	2	[illegible]	1.25	
		11	6	4	[illegible]	.875	
		11	6	2	[illegible]	.5	
		11	4	1			
		11	6	6	20	.375	
		11	3	2			
		11	6	4	10	3.5 *	
		11	6	33	[illegible]	.75 *	
		11	2	122			
		11	6	2	5	.437	
		8	3	35			
		8	[illegible]	[illegible]			
		7	6	3	6.	.25	
		8	6	2	8.	.312	
		8	6	[illegible]	5	.25	
		8	6	[illegible]	3	.187	
		10	6	1	15.5	1.	
		10	6	3	13	.25	
		10	6	3	8.5	.375	
		10	6	2	13	.375	
		10	6	3	[illegible]	.25	
		7	6	2	3	.625	
		10	6	1	5.5	.5	
		10	[illegible]	19			
		11	2	10			
		11	6	16	5.25	.187	
		12	6	[illegible]	52	.75	
		12	6	2	[illegible]	.625	
		12	6	1	12	.625	
		12	[illegible]	10			
		[illegible]	6	1	15	.312	
		[illegible]	6	1	6.5	.312	
		[illegible]	6	1	7.5	.375	
2	3	12	5	2			
		[illegible]	[illegible]	4			
		11	[illegible]	[illegible]			
		12	6	1	13.5	.75	
		[illegible]	5	24			
		11	5	[illegible]			
		12	6	1	40	1.125	
		[illegible]	6	1	14	1.[illegible]	
		[illegible]	6	3	68	.875	
		[illegible]	6	3	52	.875	
		[illegible]	7	1	38	.5	
		[illegible]	6	1	56	.75	
		[illegible]	6	1	30	.8	
		12	6	4			
		12	6	1	24	.4	
		12	6	1	30	.75	
		12	6	1	18	.625	
		12	6	1	16	.55	
		12	6	1	[illegible]	1.	
		12	6	1	[illegible]	.625	
		[illegible]	6	3	8	.33	
		[illegible]	6	2	6	.5	
		[illegible]	6	3	4	.375	
		[illegible]	6	2	6	.5	
		[illegible]	6	1	16	1.5 *	
		[illegible]	6	3	6	.5 *	
		[illegible]	6	[illegible]	[illegible]	5.[illegible] *	
		[illegible]	6	1	2	.5 *	
		[illegible]	[illegible]	11			
		[illegible]	[illegible]	214			
		[illegible]	[illegible]	13			
		[illegible]	[illegible]	68			
		[illegible]	[illegible]	6			
		[illegible]	6	[illegible]	[illegible]	.75	
		[illegible]	6	[illegible]	[illegible]	[illegible]	
		[illegible]	6	[illegible]	[illegible]	.5	
		[illegible]	[illegible]	[illegible]	6	.5	
		[illegible]	[illegible]	3	5.5	[illegible]	
		[illegible]	[illegible]	3	[illegible]	[illegible]	
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible] *	
		[illegible]	[illegible]	1	[illegible]	.5 *	
		[illegible]	[illegible]	1	[illegible]	[illegible] *	
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible] *	
		[illegible]	[illegible]	[illegible]	6	[illegible] *	
		[illegible]	[illegible]	[illegible]			
		[illegible]	[illegible]	[illegible]	5	1	
		[illegible]	6	[illegible]	8	.25	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	
		[illegible]	[illegible]	[illegible]			

50-PSI GRID SQUARE X	Y	TREE NO.	GROUP NO.	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
3	3	11	2	1			
		10	2	1			
		9	3	1			
		11	6	1	10.	.375	
		11	6	2	3.5	1. *	
		11	6	2	3	.5 *	
		12	6	3	2.5	.25 *	
-6	4	9	6	1	4.75	1.	
		9	6	1	12.5	.375	
-5	4	9	6	1	6.27	.375	
		9	6	1	13.	.375	
-4	4	[illegible]	6	1			
		[illegible]	[illegible]	3			
		3	6	1	14	.625	
		7	[illegible]	[illegible]	20	.75	
		7	[illegible]	[illegible]	27	.875	
		7	[illegible]	2	11	.5	
		7	[illegible]	3	6	.25	
		7	[illegible]	[illegible]	[illegible]	.5	
-2	4	8	6	[illegible]	32	1.75	
		8	6	2	[illegible]	.625	
		8	6	1	[illegible]	1.5	
		8	6	6	15.5	.5	
		8	6	5	6.	.75	
		8	6	31			
		8	6	51	10	.437	
		8	6	34	5.5	.25	
		8	6	85	4	.25	
		8	3	325			
		10	6	5	16.	.5	
		10	6	2	9	.812	
		10	6	1	36.	.625	
		9	6	2	[illegible]	1.	
		9	6	1	[illegible]	.5	
		9	3	112			
		9	6	17			
		9	6	14	7.5	.375	
		9	6	3	5	.875	
		7	6	1	43	1.25	
		7	6	[illegible]	[illegible]	1.625	
		7	6	3	[illegible]	.562	
		7	6	5	[illegible]	1.	
		7	6	5	[illegible]	.75	
		7	6	[illegible]	20	.625	
		7	6	30	14	.375	
		9	6	33	6.5	.375	
		9	6	29	7	.187	
		9	3	10			
		9	6	10			
		9	6	[illegible]	[illegible]	1.437	
-1	4	8	6	1	45	1.5	
		8	6	1	27	.75	
		8	6	1	26.	1.25	
		8	6	1	18		
		8	6	1	10	.75	
		8	6	[illegible]	16.5	.5	
		8	6	10	15	.625	
		8	5	4	5.5	.375	
		8	6	38			
		8	6	49			
		[illegible]	6	1	59	.75	
		[illegible]	6	1	43	.75	
		[illegible]	6	1	18	.625	
		[illegible]	6	8	6.5		
		10	6	1	1.25		
		10	[illegible]	7			
		10	[illegible]	4	7.25	.375	
		10	[illegible]	3	[illegible]	.375	
		10	[illegible]	[illegible]	9	.312	
		10	[illegible]	4	[illegible]	.187	
		10	[illegible]	4	16.5	.687	
		10	[illegible]	2			
		9	[illegible]	2[illegible]			
		9	3	139			
		9	[illegible]	61	[illegible]	.375	
		9	[illegible]	33	[illegible]	.25	
		9	[illegible]	[illegible]	[illegible]	.625	
		9	[illegible]	[illegible]	[illegible]	.562	
		9	[illegible]	[illegible]	11.5	.375	
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
0	4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	315.
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

50-PSI RAW TREE-DEBRIS DATA TABULATED ACCORDING TO 50-PSI GRID SQUARES

50-PSI GRID SQUARE X	Y	TREE NO.	GROUP NO.	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
0	4	10	6	12	13	.375	
		10	6	9	7.5	.375	
		10	6	36	8	.312	
		10	6	18	4.5	.25	
		10	6	1	17	2.5 •	
		10	6	3	6.5	1.5 •	
		10	6	15	5	.75 •	
		11	6	1	16	2.5	
		10	6	8	6	[illegible]	
		10	6	1	10.	.5	
		11	2	4			
		11	6	3	[illegible]	.375	
		11	6	3	8.5	.25	
		11	6	23	6	.25	
		11	6	[illegible]	4	.375	
		9	6	3	4	.187	
		[illegible]	6	4	4	.25	
1	4	10	6	1	40.	8.6	150.
		12	5	3			
		11	5	5			
		11	2	89			
		11	6	1	65	.875	
		11	6	1	50	.85	
		11	6	1	22	.95	
		11	6	1	44	.55	
		11	6	1	25	.5	
		11	6	1	14	.625	
		11	6	5	14	.375	
		11	6		10.	.3	
		11	4	[illegible]			
		11	3	15			
		11	6	4	10	.375	
		11	6	5	7	.375	
		11	6	1	[illegible]	.4	
		11	6	7	6	.33	
		11	6	14	6	.28	
		11	6	2	14	.45	
		11	6	2	3	.45	
		12	6	1	60.	.75	
		12	5	1	37	[illegible]	
		12		1			
		12		1			
		12	[illegible]	[illegible]			
		12	6	1	10.	.5	
		12	6	1	7.5	.75	
		12	6	1	6	.4	
		10	2	36			
		10	3	3			
		10	4	1			
		10	6	1	10.	.5	
		10	6	6	10.	.375	
		10	6	1	8.	.625	
		10	6	4	6.5	.25	
		10	6	1	21.	.5	
		10	6	5	5.	.25	
		8	3	12			
		8	6	1	2.5	.375	
		8	6	4	4.	.375	
		8	6	8	4.5	.25	
		8	6	1	4.	.5	
		9	3	2			
		9	6	1	9.	.375	
		10	5	1	9.	1.125	
		10	6	6	3.	.375	
		10	6	3	2.5	.875	
		11	6	1	15	.625 •	
		11	6	2	9.	1 •	
		11	6	3	7.	1.5 •	
		11	6	1	11.	3 •	
		11	6	1	30.	3.25 •	
2	4	12	5	22			
		12	[illegible]	111			
		12	[illegible]	13			
		12	6	1	39	.875	
		12	6	1	21	.625	
		12	6	1	63	.75	
		12	6	1	22	.375	
		12	6	2	16	.625	
		12	6	1	21	.625	
		12	6	3	29	.5	
		12	6	1	48	.5	
		12	6	2	20	.5	
		12	6	1	16	.875	
		12	6	1	3	1.	
		12	6	1	9	.75	
		12	6	11	13	.375	
		12	6	11	10	.375	
		12	6	3	7	.5	
		12	6	4	4.5	.375	
		12	6	1	[illegible]	.75 •	
		12	6	1	5	1.5 •	
		12	6	3	[illegible]	.5	
		12	6	1	[illegible]	.5	
		12	6	1	4.5	1	
		[illegible]	6	[illegible]			
		[illegible]	5	30			
		[illegible]	[illegible]	6			
		11	6	[illegible]	12	.75	
		11	6	[illegible]	10	1	
		11	6	3	5	.375	
		11	6	3	9	.5	
		11	6	3	3.5	.55	
		11	6	[illegible]	6	.5	
		11	6	[illegible]	24	.625 •	
		11	6	[illegible]	3	.375	
		11	6	6	[illegible]	[illegible]	
		[illegible]	[illegible]	[illegible]	11.5	4 •	
		[illegible]	[illegible]	[illegible]	3.5	.375	
		[illegible]	[illegible]	[illegible]	24	.375	
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
		8	[illegible]	[illegible]	3.5	.375	
		8	[illegible]	[illegible]	3	[illegible]	
		8	[illegible]	[illegible]	2.5	.25	
		8	[illegible]	[illegible]	4.5	.375	
2	4	8	6	2	6.5	.375	
		8	6	1	9	.25	
		8	6	1	4.5	.75	
		8	6	1	2	1.	
		8	6	1	3.5	.375	
		8	6	1	2.5	.25	
3	4	12	5	40			
		12	6	1	36	.75	
		11	2	5			
		12	6	1	13.	.375	
		12	6	1	7.	.25	
		12	6	1	3.	.25	
		11	6	1	2.5	.75	
		10	6	1	4	1.	
		9	3	2			
		9	6	3	3.	.25	
		10	2	1			
		10	6	1	4	.375	
		11	2	16			
		11	3	1			
		11	6	1	16.	.625	
		11	6	1	5	1. •	
		12	6	1	55.	1.	
		12	6	1	43	.875	
		12	6	1	36.	.5	
		12	2	33			
		11	2	13			
		12	3	2			
		12	4	1			
		12	6	1	21	.3	
		12	6	1	14.	.3	
		12	6	1	10.	.3	
		12	6	4	7	.33	
		12	6	2	3.5	.35	
		12	6	3	5	.25	
		11	6	1	5	6. •	
		11	6	1	5	2.5 •	
		12	2	2			
		7	3	5			
		7	6	1	10.	.3	
		8	6	1	10	.3	
		7	6	1	8	.25	
		7	6	2	4	.25	
		8	6	2	4	.25	
		12	6	1	4	.625 •	
		11	6	1	11.	.25 •	
-6	5	7	5	14			
		7	6	2	10.5	.5	
		7	6	1	13.25	.75	
		7	6	3	6.5	.625	
		7	6	16	13	.375	
		7	6	16	3.75	.25	
		7	6	9	4.	.437	
		7	6	24	[illegible]	.375	
		7	6	7	2.75	.75	
-5	5	9	6	[illegible]	[illegible]	.625	
		9	6	2	20.	.437	
		9	6	5	9.	.375	
		9	6	1	6.5	.625	
		9	3	2			
-4	5	7	6	1	41.	1.75	
		7	6	1	53	[illegible]	
		7	6	3	23.5	.437	
		7	6	2	21	.625	
		7	6	2	17	1	
		7	6	2	12	.875	
		7	6	1	5.	.75	
		7	6	4	15	.375	
		7	6	15	10.5	.437	
		7	4	1			
		7	3	13			
		8	3	2			
		9	6	1	11.5	.312	
-3	5	7	6	1	54	2.25	
		7	5	1	24	2.5	
		7	6	1	34	.625	
		7	6	1	40	1.125	
		7	6	1	42	.625	
		7	6	1	27	1.75	
		7	4	11			
		7	5	4			
		7	6	1	30	.5	
		7	6	9	15	.562	
		7	6	13	14	.375	
		7	3	28			
		7	6	24	10.5	.25	
		7	6	6	[illegible]	.25	
		7	6	31	7.5	.375	
		8	6	1	18.5	.875	
		8	6	1	24	.437	
		8	6	1	11	.437	
		8	6	[illegible]	6	1.625 •	
		8	6	1	5.5	.625	
		8	6	8	[illegible]	[illegible]	
		8	6	7	[illegible]	.375	
		8	6	21	[illegible]	.187	
		8	3	14			
		9	6	[illegible]	6.5	.625	
		9	6	[illegible]	6.5	[illegible]	
		9	6	5	4	[illegible]	
		9	[illegible]	9			
		9	4	1			
-2	5	[illegible]	[illegible]	25			
		[illegible]	4	7			
		[illegible]	5	5			
		7	6	[illegible]	20	.437	
		7	6	[illegible]	26	.812	
		7	6	[illegible]	44	.875	
		7	6	[illegible]	14	1	
		7	6	6	12	.562	
		7	6	12	[illegible]	.312	
		7	6	7	5	.5	
		7	6	10	8	.312	
		7	6	[illegible]	[illegible]	[illegible]	
		7	6	1	10	1. •	
		8	3	193			
		8	4	34			
		8	5	4			
		8	6	[illegible]	[illegible]	.812	
		8	6	4	[illegible]	[illegible]	
		8	6	7	[illegible]	.437	
		8	6	17	8	.5	
		8	6	10	[illegible]	.312	
		8	6	6	4	.5	

50-PSI RAW TREE-DEBRIS DATA TABULATED ACCORDING TO 50-PSI GRID SQUARES

50-PSI GRID SQUARE X	50-PSI GRID SQUARE Y	TREE NO.	GROUP NO.	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
2	5	8	6	1	4	.25	
		8	6	38	5	.312	
		8	6	60	3.5	.25	
		8	6	1	4	1.	
		9	3	104			
		9	4	36			
		9	5	4			
		9	6	1	32	.5	
		9	6	3	14	.625	
		9	6	7	[illegible]	.375	
		9	6	2	[illegible]	.437	
		9	6	3	8	.312	
		9	6	11	5	.312	
		9	6	33	[illegible]	.25	
		9	6	9	4	.437	
		9	6	[illegible]	5	1.25	
		[illegible]	6	[illegible]	23	.75	
		[illegible]	6	[illegible]	7	.25	
[illegible]	5	10	[illegible]	1	36.5	.75	
		10	[illegible]	3			
		10	[illegible]	2	32	.5	
		10	6	4	12	.875	
		10	6	7	7	.25	
		10	6	3	4	.25	
		10	[illegible]	1			
		8	7	1	84.	1.25	
		[illegible]	6	1	39.	1.	
		8	6	1	18	.5	
		8	6	2	40	.625	
		8	6	1	41	1.125	
		8	6	31	6	.375	
		8	6	2	4	.25	
		8	6	7	2	.25	
		11	6	1	5	.375	
		8	7	1	44	1.	
		8	6	5	3	.375	
		8	4	1			
		8	4	1	42	.9	
		8	6	5	9	.375	
		8	6	3	9	.5	

50-PSI GRID SQUARE X	50-PSI GRID SQUARE Y	TREE NO.	GROUP NO.	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
1	5	11	3	4			
		11	6	1	[illegible]	[illegible]	
		11	6	1	[illegible]	[illegible]	
		11	6	3	9	.5	
		11	6	[illegible]	10	.812	
		11	6	4	[illegible]	[illegible]	
		11	6	1	[illegible]	.187	
		11	6	6	[illegible]	[illegible]	
		11	6	1	[illegible]	[illegible]	
		11	6	2	[illegible]	[illegible]	
		11	6	13	[illegible]	[illegible]	
2	5	12	6	1	312.	6.	495.

50-PSI RAW TREE-DEBRIS DATA TABULATED ACCORDING TO 50-PSI GRID SQUARES

50-PSI GRID SQUARE X	Y	TREE NO.	GROUP NO.	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
3	5	11	2	21			
		12	4	4			
		12	6	2	52.	.625	
		12	6	1	28.5	.687	
		12	6	1	28.	.5	
		12	6	1	5.	.25	
		12	6	4	3.	.25	
		12	6	1	22.	.5	
		12	6	1	9.	.375	
		12	6	3	9.	.5	
		12	6	1	6.	.437	
		10	6	1	10.	.562	
		11	6	3	4.	.187	
		11	6	1	3.5	.25	
		11	6	2	5.5	.25	
		11	6	1	16.	.5	
		11	6	2	6.	.25	
		11	6	2	7.	.25	
		10	6	1	4.	.562	
		11	6	1	3.	.5 *	
		11	6	1	2.	1.75 *	
		11	6	2	4.	1.75 *	
		11	6	2	5.	.25 *	
		11	6	1	8.5	1. *	
		11	6	1	9.25	.75 *	
		7	3	2			
		7	4	1			
		8	6	2	7.	.187	
		8	3	1			
		8	6	1	4.5	.25	
-6	6	7	3	2			
		7	6	1	3.	.5 *	
		7	6	4	4.	.25	
		7	6	4	5.	.25	
		7	6	1	7.5	.25	
		7	6	2	11.	.375	
		7	6	1	16.	.5	
-5	6	7	3	1			
		7	4	1			
		7	6	1	24.	.375	
		7	6	1	14.	1.	
		7	6	2	12.	.375	
		7	6	6	7.	.375	
		7	6	2	5.	.375	
		7	6	2	3.	.25	
-4	6	7	3	10			
		7	4	3			
		7	5	1			
		7	6	5	20.	.375	
		7	6	1	15.	1.	
		7	6	5	13.	.375	
		7	6	3	14.	.25	
		7	6	2	9.	.25	
		7	6	11	6.	.25	
		7	6	8	4.	.25	
		7	6	7	2.	.375	
		7	6	1	1.	.5 *	
-3	6	7	3	12			
		7	4	5			
		7	5	8			
		7	6	2	2.	.5	
		7	6	1	5.	.375	
		7	6	14	6.	.25	
		7	6	9	9.	.375	
		7	6	12	14.	.375	
		7	6	2	7.	.75 *	
		7	6	2	21.	.75	
		7	6	1	24.	1.375	
		7	6	2	22.	.625	
		7	6	3	41.	.625	
		7	6	1	8.	.625 *	
		9	6	1	12.	.5	
		9	6	2	11.	.25	
		9	6	2	2.	.375	
		9	6	1	18.	.5	
		8	3	6			
		8	4	2			
		8	6	2	3.	.25	
		8	6	2	10.	.25	
		8	6	2	14.	.375	
-2	6	7	3	17			
		7	4	12			
		7	5	7			
		7	7	5	40.	.5	
		7	6	3	29.	.625	
		7	6	5	12.	.75	
		7	6	4	28.	1.75	
		7	6	7	11.	.5	
		7	6	12	8.	.375	
		7	6	14	6.	.312	
		8	3	57			
		8	4	17			
		8	5	8			
		8	7	3	42.	.625	
		8	7	1	64.	.875	
		8	6	1	22.	.5	
		8	6	3	11.	.5	
		8	6	13	10.	.25	
		8	6	4	8.	.375	
		8	6	2	4.	.5	
		8	6	3	2.	.5	
		8	6	15	6.	.25	
		8	6	26	3.	.25	
		9	3	53			
		9	4	31			
		9	5	7			
		9	6	1	36.	.75	
		9	6	12	17.	.687	
		9	6	5	12.	.375	
		9	6	16	6.	.312	
		9	6	8	6.	.375	
		9	6	6	3.	.5	
		9	6	12	2.	.312	
		9	6	3	2.	.25	
		10	6	1	7.	.312	
		10	6	1	13.	.5	
		10	6	1	45.	.375	
		10	6	1	40.	1.	
-1	6	9	4	36			
		9	3	53			
		10	[illegible]	5			
		9	6	3	3.	.5	
		9	6	8	7.	3.	
		9	6	10	3.	.375	
-1	6	9	6	38	8.	.375	
		9	6	23	18.	.5	
		9	6	7	28.	.5	
		9	6	1	63.	1.	
		9	5	7			
		8	6	15	6.	.375	
		8	6	10	4.	.25	
		8	6	1	33.	.625	
		8	6	8	4.	.375	
		8	6	1	7.	.5	
		8	6	3	15.	.5	
		8	5	2			
		8	3	8			
		7	6	1	17.	.625	
		7	6	1	13.	.375	
		7	6	1	14.	1.25	
		7	6	1	7.	.5	
		7	6	1	40.	.5	
		7	6	1	42.	1.25	
		10	6	1	41.	.625	
		10	6	1	51.	.75	
		10	4	1			
		10	6	2	8.	.375	
		10	6	2	9.	.25	
		10	6	2	9.	.625	
		11	6	1	14.	.5	
		11	6	1	3.	.375	
0	6	8	6	1	50.	1.5	
		8	6	1	10.	1.125	
		8	6	1	10.	.625	
		8	6	1	4.	.625	
		9	3	10			
		9	4	9			
		9	5	7			
		9	7	1	38.	.625	
		9	7	1	90.	1.5	
		9	6	1	67.	.875	
		9	6	14	4.	.25	
		9	6	7	11.	.312	
		9	6	2	10.	.625	
		10	2	11			
		10	3	10			
		10	4	7			
		10	7	5	40.	.5	
		10	5	3			
		10	6	1	48.	1.	
		10	6	2	40.	.75	
		10	6	2	20.	.687	
		10	6	1	4.	.625	
		10	6	5	12.	.437	
		10	6	10	8.	.312	
		10	6	10	4.	.312	
		10	6	3	4.	2. *	
		11	2	7			
		11	3	4			
		11	4	1			
		11	7	1	48.	.5	
		11	7	1	72.	.75	
		11	6	3	45.	1.	
		11	6	2	24.	.875	
		11	6	1	10.	.875	
		11	6	3	5.	.437	
		11	6	3	5.	1. *	
		12	6	1	9.	.5	
1	6	11	5	6			
		12	5	16			
		10	5	1			
		10	2	22			
		10	6	1	4.	1. *	
		10	6	5	3.12	.875	
		10	6	4	6.5	.5	
		10	6	3	13.	.625	
		10	6	8	11.	.5	
		10	6	6	17.	.875	
		10	6	4	24.	.375	
		10	6	4	30.	.5	
		10	6	2	48.	.5	
		10	6	1	47.	1.125	
		10	6	2	52.	.625	
		10	6	1	62.	.5	
		10	6	1	18.	.437	
		11	6	2	6.5	.312 *	
		11	6	14	4.	.312 *	
		11	6	6	8.	.5	
		11	6	12	6.	.25	
		11	6	6	11.	.25	
		11	6	10	6.	.25	
		11	6	5	11.	.25	
		11	6	2	17.	.25	
		11	6	2	23.	.312	
		11	6	1	14.	.687	
		11	6	3	45.	1.	
		11	6	1	25.	4.5	
		11	6	1	94.	.75	
		12	6	1	4.75	.5	
		12	6	1	3.	.25	
		12	6	5	10.	.25	
		12	6	2	10.25	.5	
		12	6	1	18.	.75	
		12	6	1	50.	.83	
		12	6	1	79.	.562	
		10	6	1	23.	.375	
		10	6	1	12.	.75	
		10	6	1	3.5	1.	
		10	6	2	3.5	.5	
		11	6	2	5.	.375	
		9	6	1	33.	.75	
		9	6	1	26.	.375	
		9	3	1			
		9	6	1	13.	.312	
		9	6	6	5.	.25	
2	6	11	6	1	96.	5.25	55.
		10	2	4			
		10	6	1	45.	.875	
		[illegible]	5	44			
		11	5	2			
		12	6	5	3.5	.25	
		12	6	5	4.	.375	
		12	6	[illegible]	6.	.25	
		12	3	[illegible]			
		12	6	[illegible]	10.	.25	
		12	6	3	[illegible]	.25	
		12	6	[illegible]	[illegible]	.25	
		12	6	3	53.	.25	

50-PSI RAW TREE DEBRIS DATA TABULATED ACCORDING TO 50-PSI GRID SQUARES

50-PSI GRID SQUARE X	Y	TREE NO.	GROUP NO.	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	43	.812	
		[illegible]	[illegible]	[illegible]			
		[illegible]	[illegible]	[illegible]			
		[illegible]	[illegible]	[illegible]	6.5	.375	
		[illegible]	[illegible]	[illegible]	16.	.25	
		[illegible]	[illegible]	[illegible]	14.	.437	
		[illegible]	[illegible]	[illegible]	14.	1	
		[illegible]	[illegible]	[illegible]	60	1	
		[illegible]	[illegible]	[illegible]	67	1.	
		[illegible]	[illegible]	[illegible]	7.	.25	
		[illegible]	[illegible]	[illegible]	4	.625*	
		[illegible]	[illegible]	[illegible]	4	.25	
		[illegible]	[illegible]	[illegible]	10	.5	
		[illegible]	[illegible]	[illegible]	4	1.5	
1	6	[illegible]	[illegible]	[illegible]			
		[illegible]	[illegible]	[illegible]			
		[illegible]	[illegible]	[illegible]			
		[illegible]	[illegible]	[illegible]			
		[illegible]	[illegible]	[illegible]			
		[illegible]	[illegible]	[illegible]	1.75	.375	
		[illegible]	[illegible]	[illegible]	2.5	.5	
		11	6	1	6	.375	
		11	6	1	[illegible]	.625	
		12	6	1	9	.437	
		12	6	2	25	.437	
		12	5	167			
-6	7	7	6	1	23.	2.5	
		7	6	1	20.	.5	
-5	7	7	6	1	6.	.312	
		7	6	1	15	.25	
		7	6	2	24	.375	
		7	6	1	3.5	.437	
-4	7	7	6	1	37	1.5	
		7	6	2	[illegible]	.625	
		7	[illegible]	1	60	1.25	
		7	6	2	10.	.437	
		7	6	1	23	.437	
		7	6	2	6	.5	
		7	6	7	8	.375	
		7	5	4	6	.312	
		7	6	2	12	.187	
		7	6	1	7.5	.5	
-3	7	7	6	1	8.	.625	
		9	6	1	31.	.625	
		9	6	1	10.	.5	
		9	6	1	22.	.437	
		9	6	1	2.5	.375	
		9	4	2			
		9	5	1			
		8	4	1	26	.625	
		8	6	1	14.	.5	
		8	6	1	15.	.437	
		8	6	1	12.	.312	
		8	5	1	16	.75	
		8	6	1	7.5	1.5 *	
		8	6	1	4	1.25 *	
		8	6	1	2.5	1. *	
		8	6	2	4.5	.25	
		8	6	2	6.5	.25	
		7	6	1	28	.437	
		7	6	1	32.	.5	
		7	6	1	23.	.625	
		7	5	1	9	1.	
		7	6	1	5.5	.5	
		7	6	1	5.25	.25	
		7	6	10	5.75	.25	
		7	6	4	10.5	.375	
		7	4	[illegible]			
		7	6	5	16	.25	
		7	6	2	18.	.25	
-2	7	11	6	[illegible]	29.	.625	
		11	6	2	7.	.312	
		11	6	1	14.	.625	
		9	3	5			
		9	4	10			
		9	5	1			
		9	6	4	2.5	.375	
		9	6	6	6.5	.375	
		9	5	5	10.	.312	
		9	6	1	8.	.562	
		9	6	1	20	.625	
		9	6	2	29	.5	
		9	6	1	[illegible]	.687	
		9	6	1	60	.562	
		9	6	1	42	1.	
		9	6	1	49	1.125	
		8	4	3			
		8	6	4	3	.437	
		8	6	7	6.5	.25	
		8	6	5	5	[illegible]	
		8	6	3	13	.375	
		8	6	1	22	.5	
		8	6	2	40	.625	
		7	4	1			
		7	6	9	6.5	.187	
		7	6	5	5.5	.375	
		7	6	3	15	.75	
		7	6	1	14	1.375	
		7	6	2	37	.5	
		7	6	3	12	.437	
		7	6	1	14	.375	
		7	6	2	25.	.375	
		7	6	1	58	1.5	
		7	6	1	75	1.375	
-1	7	9	7	1	50	1	
		9	5	7			
		9	4	7			
		9	3	23			
		9	6	1	36	.75	
		9	6	1	36	.5	
		9	6	1	19	.625	
		9	6	1	18.5	.437	
		9	6	1	11.5	.625	
		9	6	1	21.5	.625	
		9	6	1	3.5	.5	
		9	6	7	0	.312	
		9	6	4	6	.312	
		9	6	3	16	.375	
		9	6	4	3.5	.5	
		9	6	1	4.5	.5	
		9	6	1	13	.437	
		10	5	4			
		[illegible]	6	1	8	.187	
		[illegible]	6	1	10	.75	
		[illegible]	6	1	26	.5	

50-PSI GRID SQUARE X	Y	TREE NO.	GROUP NO.	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
-1	7	7	6	1	5	.25	
		8	6	2	42	.875	
		8	6	1	26	.562	
		8	6	1	11	.5	
		8	6	1	18.	.5	
		8	6	1	16	.437	
		8	6	1	9	.312	
		8	6	3	6	.625	
		8	6	1	2.75	.437	
		8	6	2			
		8	3	1			
		8	3	2			
		8	6	3	4	.25	
		10	6	1	54	.75	
		10	6	1	8	.375	
0	7	10	5	11			
		12	5	6			
		11	5	7			
		7	6	2	7.	.5	
		9	5	4			
		9	6	3	7.	.25	
		9	6	2	20.	.625	
		9	7	2	39	1.	
		9	4	1			
		9	6	1	26	.75	
		9	6	1	2.5	.75	
		9	6	3	10.	.25	
		9	6	1	13	.25	
		10	6	4	3.5	1.	
		10	[illegible]	1	[illegible]	1.	
		10	6	1	10.	2 *	
		10	6	4	6.5	.625*	
		10	6	1	10	.5 *	
		10	6	1	15	.25	
		10	6	1	13	.75	
		10	2	12			
		10	6	1	9	.5	
		10	6	10	15	.5	
		10	7	7	51	.5	
		10	6	2	52.	.75	
		10	6	11	53.	.5	
		7	6	2	5	.375	
		7	6	1	6.5	.25	
		11	6	2	61.	.75	
		8	6	1	38	.5	
		8	6	1	11.	.625	
		7	6	1	19	.5	
1	7	12	5	37			
		11	5	3			
		10	5	7			
		10	6	2	6.	1.25	
		11	6	5	5.	.437	
		10	6	3	3.	.75	
		12	6	1	6.5	.437	
		12	6	1	11.	.75	
		10	6	1	9.5	.625	
		11	2	13			
		[illegible]	6	3	8	1.5 *	
		11	6	23	6	.375*	
		11	6	4	9	.312	
		11	6	2	10	.5	
		11	6	1	6	.25	
		11	6	5	7	.875	
		10	6	2		.562	
		10	6	1	47	.75	
		10	6	2	23	.875	
		10	6	5	3.	.5 *	
		10	6	1	14.	.312	
		10	6	1	30	.437	
		10	2	9			
		9	6	1	34	.5	
		9	6	1	11.	.375	
2	7	11	6	1	36	3.94	10.
		12	6	4	60	.75	
		12	6	1	41.	.375	
		12	6	1	30.	.375	
		12	6	1	10.	.375	
		12	6	1	4	.375	
		12	6	1	5	.375	
		12	6	1	2.5	.312	
		12	5	195			
		11	5	9			
		11	6	3	3	.25	
		11	6	1	36	.625	
		11	6	2	15	.5	
		11	6	1	13	.625	
		11	6	4	11	.375	
		11	6	3	8	.375	
		11	6	2	6	.375	
		11	6	4	4	.187	
		11	6	3	5	.25	
		11	6	2	2.25	.437	
		11	6	15	4.5	.875*	
		11	6	1	5	.75	
		11	6	3	6.25	.25	
		11	6	1	11	1.	
		11	6	1	15.5	.375	
		12	6	3	4.75	.5	
		10	6	2	6.5	.375	
		11	6	1	3.75	1.187	
		11	6	1	6.5	1.125	
		10	6	1	11.5	.562	
		10	6	1	7.5	.25	
		10	6	1	5	.312	
		10	6	1	6.5	.25	
3	7	11	6	1	15.5	.75	
		11	6	3	4.5	.312	
		11	6	2	8	.375	
		12	6	1	28	.5	
		11	6	4	[illegible]	.5 *	
		10	6	1	6	1.25 *	
		11	6	1	5	1.25 *	
		9	6	1	1	[illegible] *	
		12	[illegible]	3			
		12	6	[illegible]	6	[illegible]	
-5	8	[illegible]	6	1	1.5	[illegible]	
		[illegible]	6	[illegible]	1.25	[illegible]	
		7	6	[illegible]	4.5	[illegible]	
		7	6	[illegible]	8	[illegible]	
		7	6	[illegible]	11.75	.25	
-4	8	[illegible]	6	[illegible]			
		[illegible]	6	[illegible]	27.5	.5	
		[illegible]	6	1	18	[illegible]	
		7	6	5	4	[illegible]	
		7	6	1	1.25	[illegible]	

50-PSI RAW TREE-DEBRIS DATA TABULATED ACCORDING TO 50-PSI GRID SQUARES

50-PSI GRID SQUARE X	Y	TREE NO.	GROUP NO.	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
-4	8	7	6	1	44.	1.	
-3	8	8	6	1	43.	.625	
		9	6	1	36.	.875	
		9	6	1	9.	.187	
		9	6	1	33.	1.25	
		9	6	1	87.	1.125	
		9	6	1	42.	.5	
		9	6	1	25.	.375	
		9	6	2	17.	.375	
		9	6	1	15.5	.75	
		9	6	2	6.5	.312	
		9	6	1	10.	.375	
		9	6	1	7.5	.25	
		9	5	1			
		9	4	2			
		9	6	1	6.	.875	
		9	6	1	4.25	.687	
-2	8	9	4	1			
		9	5	1			
		9	6	1	6.	.25	
		9	6	1	11.	.25	
		9	6	1	11.	.375	
		9	6	1	22.	.375	
		9	6	1	28.	.75	
		9	6	1	42.	.75	
		9	6	1	35.	.375	
		9	6	1	7.	.75 •	
		8	6	1	14.	.5	
		8	6	1	7.	.375	
		8	6	1	7.	.187	
		8	6	1	31.	.375	
		7	3	4			
		7	6	1	30.	.5	
		7	6	1	45.	1.625	
		7	6	1	55.	1.625	
		7	6	2	14.	.625	
		7	6	1	14.	.5	
		7	6	1	8.	.25	
		7	6	1	14.	.875	
		7	6	2	27.	.5	
		11	6	1	77.	.875	
-1	8	11	6	1	28.	.75	
		10	6	1	19.	.75	
		10	6	1	29.	.5	
		10	5	7			
		10	6	1	4.5	.375•	
		8	6	1	30.	.75	
		8	6	1	20.	.5	
		8	6	3	10.5	.437	
		8	3	1			
		8	4	1			
		9	7	1	45.	.5	
		9	4	3			
		9	3	2			
		9	6	1	10.	.25	
		9	6	1	17.5	.312	
		9	6	1	9.	.5	
		9	6	1	6.	.437	
		9	6	4	17.	.375	
		9	6	2	20.	.437	
		9	6	1	21.5	.687	
		9	7	1	66.	.75	
		9	6	1	50.	1.	
		7	6	1	49.	.312	
		7	6	1	33.	.437	
		7	6	1	81.	-1.125	
		7	6	2	13.	.5	
		7	6	1	10.	.437	
		7	6	1	7.	.5	
		7	6	1	13.	.312	
0	8	10	6	2	16.	.75	
		10	2	1			
		10	6	4	7.	.25	
		10	6	3	22.	.375	
		10	6	3	7.5	.25	
		10	9	9	32.	1.	
		11	5	1	78.	.75	
		9	7	1	41.	.375	
		9	6	1	23.5	.5	
		10	6	1	15.	4.5 •	
		10	6	3	8.5	1. •	
		10	6	2	5.	.5 •	
1	8	12	5	10			
		11	5	9			
		10	5	2			
		11	6	6	4.25	.375•	
		11	6	1	4.25	.25	
		12	6	1	68.	.75	
		11	6	1	19.5	1.25	
		11	6	1	9.25	.437	
		11	6	3	13.	.437	
		11	6	3	10.	.25	
		11	6	1	6.5	.437	
		11	6	2	3.5	.25	
		11	6	1	4.5	.312	
		11	6	1	3.	.312	
		11	6	4	4.	.75 •	
		12	5	30			
		10	5	5			
		10	6	1	7.	.5	
		10	6	1	22.	.375	
		10	6	1	8.	.5	
		10	6	1	14.	.25	
		10	6	1	7.	.25	
		10	6	3	4.	.437	
		7	6	1	41.	.875	
		9	6	1	23.	1.125	
2	8	12	5	166			
		10	5	4			
		11	5	11			
		11	6	2	12.	.5	
		11	6	2	5.	.5	
		11	6	1	5.	.25	
		10	6	1	37.	1.	
		10	7	1	74.	.75	
		10	6	1	22.	.375	
		10	6	1	6.	.25	
		11	6	71	4.	1. •	
		11	6	2	4.5	1.5 •	
		11	6	1	5.	.5 •	
3	8	12	5	104			
		11	5	20			
		11	6	5	7.	.25	

50-PSI GRID SQUARE X	Y	TREE NO.	GROUP NO.	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
3	8	11	2	2			
		11	6	1	37.	.5	
		11	3	1			
		11	6	4	6.	.375	
4	8	12	5	41			
-5	9	7	6	1	19.	.25	
		7	6	1	6.	.312	
-4	9	7	6	2	5.25	.25	
		7	6	2	8.5	.5	
		7	6	1	15.5	.5	
		7	6	1	28.	.75	
		7	6	1	30.	1.5	
		7	6	1	17.5	1.	
-3	9	7	4	1			
		7	6	1	24.	1.	
		7	6	1	8.	.5	
		7	6	2	13.	.5	
		7	3	1			
		7	3	1	17.	.75	
		7	6	1	32.	1.25	
		7	6	1	42.5	.75	
		7	6	1	18.	.625	
		7	6	1	8.5	1. •	
		8	6	1	21.	.5	
		8	6	1	17.5	.375	
		9	6	1	48.	1.5	
-2	9	8	4	4			
		7	6	1	12.75	.5	
		7	6	1	6.	.5	
		8	6	1	38.	1.25	
		7	6	2	50.	1.25	
		7	6	1	37.5	1.5	
		8	6	1	15.	.375	
		9	6	1	16.	.375	
		7	6	1	6.	.875	
		9	6	1	28.	.625	
		7	6	1	47.	.625	
-1	9	11	6	1	27.	1.125	
		9	6	1	44.	.562	
		9	6	1	25.	.562	
		9	5	2			
		9	4	1			
		9	6	1	7.5	.25	
		9	6	1	12.	.25	
		9	6	1	14.	.437	
		9	6	1	9.	.5	
		10	5	2			
		10	6	1	4.25	.375	
0	9	10	6	1	398.	4.41	250.
		11	6	1	85.	.812	
		11	6	1	50.	.75	
		11	6	1	3.5	.375	
		11	6	1	4.5	.437	
		10	6	1	50.	.812	
		10	6	1	49.	.562	
		10	6	1	24.	.5	
		10	6	1	18.	.437	
		10	6	2	12.5	.312	
		10	6	1	7.5	.25	
		10	6	1	17.	.812•	
		10	6	1	9.	.5 •	
		10	6	3	6.	.437	
		10	6	1	3.	1.25	
		10	5	9			
1	9	11	6	1	21.	.437	
		12	6	1	30.	.437	
		11	6	1	6.	.25	
		11	6	1	4.5	.75 •	
		10	5	11			
		11	5	13			
		12	5	17			
		10	6	1	48.	.875	
		10	6	1	20.	1.	
		11	6	1	10.	.375	
		10	6	2	24.	.5	
		10	6	1	8.	.25	
		10	6	1	9.	.25	
		10	6	1	7.	.625•	
2	9	12	5	38			
		11	5	22			
		10	5	1			
		11	6	4	8.	.25	
		10	6	1	18.	.75	
		10	6	5	8.	.375	
		10	6	1	15.	.25	
		10	5	1			
3	9	11	6	1	11.5	.25	
		11	6	1	9.	.25	
		11	6	1	46.	.75	
		11	6	1	3.5	.25	
		11	6	1	2.5	.312	
		11	5	24			
		12	5	20			
		10	5	10			
-4	10	7	6	1	6.	.25	
		7	6	1	8.	.375	
		7	6	3	11.5	.312	
		7	6	2	25.	.5	
		7	6	1	27.	.437	
		7	4	1			
-3	10	7	3	2			
-2	10	10	5	1			
		9	5	1			
-1	10	10	5	1			
		7	6	1	5.	.687	
		7	6	1	22.	.5	
		9	4	1			
		7	4	1	51.	2.	
0	10	9	6	1	15.	.375	
		10	5	3			
		11	5	7			
		10	6	1	4.	.375	
1	10	11	6	1	32.	.437	
		10	6	1	63.	.562	
		11	6	2	7.5	.562	
		11	6	1	6.	.187	
		11	6	1	5.	.25	
		11	6	1	4.5	.25	
		11	6	1	5.	.25	
		11	6	1	3.5	.312	
		10	5	3			
		11	5	15			
		12	5	5			
		12	5	37			

50-PSI RAW TREE-DEBRIS DATA TABULATED ACCORDING TO 50-PSI GRID SQUARES

50-PSI GRID SQUARE X	Y	TREE NO.	GROUP NO.	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
2	10	11	6	1	10.	.5	
		11	6	2	6.5	.187	
		11	6	1	7.	.312	
		11	6	1	7.	.187	
		11	6	1	4.	.562	
		11	6	1	5.5	.25	
		11	6	2	5.	.312	
		11	6	1	5.	.187	
		12	5	5			
		10	5	11			
		11	5	40			
3	10	12	5	3			
		11	5	17			
		11	6	1	10.	.375	
		12	6	1	9.	.562	
		12	6	1	7.5	.25	
		12	6	1	5.	.25	
		11	6	1	5.	.625	
-6	11	7	6	1	3.25	.187	
		7	6	1	13.	.375	
		7	6	1	29.	1.25	
-5	11	7	6	1	64.	.625	
-4	11	7	6	1	45.	.687	
-3	11	10	5	1			
		7	6	1	67.	1.125	
		7	6	1	80.	1.	
-2	11	10	5	2			
		7	6	1	17.	.562	
-1	11	11	6	1	60.	.875	
0	11	11	5	2			
		10	6	2	5.5	.375	
		11	6	1	8.	.312	
		10	6	1	18.	.562	
1	11	10	5	6			
		11	6	1	11.	.375	
		11	6	1	11.	.375	
		10	6	1	7.	.25	
		11	6	1	6.	.625	
		10	6	1	12.	.5	
		11	6	1	65.	1.	
2	11	10	5	40			
		11	5	16			
		10	6	3	4.	.375	
		11	6	1	9.5	.375	
		11	6	4	9.5	.375	
		10	6	1	15.	.437	
		11	6	1	20.	.375	
		11	6	1	67.	.875	
3	11	11	5	3			
		10	5	3			
		10	6	2	7.	.375	
		11	6	2	12.	.5	
		10	6	1	42.	.687	
		11	6	1	31.	1.	
		11	6	1	6.	.625	
		11	5	20			
		10	5	1			
		11	6	2	4.	.5*	
-6	12	7	6	1	44.	.875	
-5	12	7	6	1	63.	.875	
-3	12	7	6	1	78.	.812	
0	12	10	5	1			
		11	5	2			
		10	6	1	23.	.625	
		10	6	1	10.	.375	
		10	6	1	6.	.5	
		10	6	1	26.	.75	
1	12	11	6	8	6.	.5	
		11	6	1	11.	.375	
		10	6	1	11.	.375	
		10	6	1	18.	1.25	
		11	6	1	18.	.75	
		11	6	1	10.	.25	
2	12	11	5	3			
		11	6	1	13.	.5	
		10	6	2	13.	.5	
		11	6	2	10.	.375	
		10	6	1	7.	.312	
		11	6	1	4.	.5*	
3	12	11	5	3			
		11	6	1	10.	.5	
		11	6	1	5.	.75	
		11	6	1	4.5	.312	
		10	6	1	9.	.75	
		11	6	1	11.	.437	
		11	6	1	22.	.5	
-5	13	7	6	1	30.	.625	
-3	13	9	6	1	25.	.5	
-2	13	7	6	1	19.	1.	
0	13	11	5	8			
		10	6	1	8.	.375	
1	13	11	5	10			
		11	6	1	6.	.562	
		10	6	1	11.	.5	
		11	6	1	17.	.5	
		10	6	1	40.	.75	
2	13	11	5	3			
		10	6	1	3.	.375	
3	13	11	6	1	8.	.5	
		11	6	1	5.	.375	
		10	6	1	3.	.25	
		11	5	1			
-4	14	7	6	1	23.	.562	
-3	14	7	6	1	21.	.75	
0	14	10	6	1	15.	.625	
1	14	11	6	1	48.	3.15	11.
		11	6	1	6.	.562	
		10	6	1	8.5	.5	
		10	6	1	19.	.687	
2	14	10	6	1	9.5	.5	
		11	6	1	4.	.375	
2	15	10	6	1	10.	.75	
		11	6	1	12.	.5	
		10	6	1	31.	.625	
		11	6	1	23.	.812	
0	16	11	6	1	23.	.75	
3	16	11	6	1	43.	.75	
[illegible]	16	11	6	1	30.	.75	
1	17	10	6	1	20.	.375	
[illegible]	17	11	6	1	31.	1.125	
[illegible]	18	11	6	1	20.	.5	
4	18	11	6	1	30.	.5	
[illegible]	20	11	6	1	16.	.437	
6	21	11	6	1	33.	.75	

50-PSI GRID SQUARE X	Y	TREE NO.	GROUP NO.	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
6	25	9	6	1	24.	.875	
5	26	11	6	1	24.	.625	
6	26	9	6	1	12.	1.	
		9	6	2	12.	.5	
		9	4	1			
		9	5	3			
		9	6	3	6.	.5	
2	27	10	6	1	13.	2.5	
4	29	10	6	1	24.	3.	
		10	6	1	24.	3.5	

*Indicates bark; a value listed under average diameter column denotes average width of bark fragment(s)

RAW WEIGHT DATA OF 50-PSI TREE DEBRIS

TREE NO.	GROUP NO.	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
7	3				3.307
7	4	94			3.546
7	5	28			2.778
7	6	40		*	.176
7	6	4		*	.231
7	6	9		*	.298
7	6	9		*	.380
7	6	18		*	.397
7	6	5		*	.562
7	6	46		*	.573
7	6	3		*	.672
7	6	7		*	1.803
7	6	37			1.122
7	6	170	4.	.25	1.047
7	6	124	5.	.25	.75
7	6	12	7.	.25	.234
7	6	99	8.	.25	.885
7	6	168	9.	.25	2.172
7	6	52	11.	.312	1.984
7	6	152	12.	.375	3.507
7	6	63	18.	.375	2.579
7	6	77	6.	.437	1.056
7	6	68	14.	.437	3.164
7	6	22	13.	.437	1.29
7	6	15	16.	.437	.849
7	6	80	5.	.5	3.781
7	6	4	8.5	.5	.172
7	6	57	11.5	.5	.885
7	6	29	14.	.5	1.378
7	6	2	24.	.5	.154
7	6	32	30.	.5	2.954
7	7	30	40.	.5	8.311
7	6	9	4.	.562	.554
7	6	45	10.	.562	5.986
7	6	2	5.25	.625	.044
7	6	2	6.	.625	.209
7	6	33	21.	.625	4.376
7	6	2	27.	.625	.573
7	6	13	57.	.625	1.984
7	6	23	30.	.687	5.269
7	6	11	52.	.687	6.724
7	6	1	13.5	.75	.066
7	6	11	34.	.875	2.811
7	6	9	45.	.875	5.512
7	6	33	7.	1.	1.51
7	6	9	19.	1.	1.102
7	6	11	26.	1.	4.486
7	6	2	10.	1.125	.805
7	6	8	37.	1.125	4.880
7	6	9	65.	1.125	12.831
7	6	2	13.	1.25	.463
7	6	11	16.	1.25	3.164
7	6	11	24.	1.25	10.02
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TREE NO.	GROUP NO.	NUMBER OF FRAGS	AVERAGE LENGTH OF FRAGS (INCHES)	AVERAGE DIAMETER OF FRAGS (INCHES)	TOTAL WEIGHT OF FRAGS (POUNDS)
9	6	1	209.	2.23	54.
9	6	1	210.	7.	313.
9	6	1	48.	9.6	73.
10	2				1.784
10	3	93			1.731
10	4	49			2.701
10	5				.386
10	6	10		*	.077
10	6	15		*	.099
10	6	4		*	.132
10	6	16		*	.496
10	6	24		*	.496
10	6	4		*	.54
10	6	126		*	.551
10	6	7		*	1.102
10	6	3			.033
10	6	3			.463
10	6	37			4.557
10	6	91			5.168
10	6	12	3.	.187	.055
10	6	34	3.	.25	.187
10	6	17	6.	.25	.088
10	6	70	10.	.25	1.378
10	6	14	15.	.25	.198
10	6	4	15.	.312	.11
10	6	38	4.	.375	.364
10	6	37	6.	.375	.573
10	6	4	10.	.375	.132
10	6	71	13.	.375	3.803
10	6	12	4.	.5	.253
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*Indicates bark

APPENDIX B

RAW AUTOMOBILE-DEBRIS DATA

The data that was recorded on the lightweight automobile debris (less than 10 pounds in weight) is listed in this appendix. The tabulation of the lightweight automobile debris according to the 50-psi grid squares is presented, along with the weighings of this debris after it was gathered from the 50-psi grid network. The data tabulated on the heavier automobile debris is included in Table 3.1 and is not repeated here.

In the grid-network tabulation of the lightweight automobile debris, the debris is arranged depending on the originating-automobile overpressure group. The originating group of some debris found in some squares could not be positively identified, so it was listed under the most probable group. This tabulation includes all the debris found far from the postshot automobile positions but not that found in the close vicinity to these positions. After this grid-network tabulation, all the lightweight automobile debris was gathered (even that near the postshot automobile positions) according to originating-automobile overpressure groups. These aggregates, in addition to a few heavier automobile parts, are shown in the photographs of Figures 3.22 through 3.25. The lightweight automobile debris in these photographs was subsequently weighed by originating groups as presented in this appendix.

RAW LIGHTWEIGHT AUTOMOBILE-DEBRIS DATA TABULATED ACCORDING TO 50-PSI GRID SQUARES

50-Psi Grid Square X	50-Psi Grid Square Y	Automobile Debris Part (originating automobile number in parentheses if identifiable)
		Debris from 10-Psi Automobiles
2	13	Glass Fragment
3	13	Six Glass Fragments
3	14	Three Glass Fragments
2	15	Two 7- by 3-Inch Glass Fragments
3	15	Hood Hinge Spring (#9)
		Debris from 15-Psi Automobiles
-2	4	Headlight Rim (#3)
-1	4	Hubcap (#4)
-1	5	Two Chrome Strips (#10), Pushbutton Radio Panel (#10)
-3	6	Chrome Strip (#10)
-2	6	Three Chrome Strips (#3), Headlight Rim (#3), Two Headlight Rims (#4)
-1	6	Two Chrome Strips (#10)
-3	7	Two Chrome Strips (#3), Headlight Rim (#10)
-3	9	Two 4- by 5-Inch Glass Fragments, 50-Inch Chrome Strip, Headlight (#3)
-2	9	40-Inch Chrome Strip (#4), 16-Inch Chrome Strip (#6), Taillight Fragments
-1	9	43-Inch 0.8-Inch-Wide Chrome Strip, 52-Inch-Wide Chrome Strip, 15- by 2.8-Inch Chrome Chevrolet Emblem (#6), Front License Plate (#10), 15-Inch 1.75-Inch-Wide Chrome Piece from Front Hood (#6), 4.8-Inch 2-Inch-Wide Chrome Strip End Piece, Roof Rack (#6)
0	9	Taillight (#10), Chrome Strip, Two 60-Inch 0.7-Inch-Wide Chrome Strips
-4	10	Windshield Wiper Blade, Two Glass Fragments
-3	10	36-Inch Chrome Strip, Four Glass Fragments, Taillight Lens, Window Crank Knob
-2	10	Three 50-Inch Chrome Strips, Two 12-Inch Chrome Strips, Two Glass Fragments, Taillight Lens Fragment
-1	10	Two 50-Inch Chrome Strips, Three Glass Fragments
-3	11	Taillight Lens (#3), Four 3- by 5-Inch Glass Fragments
-2	11	49-Inch Chrome Strip, Four 5- by 5-Inch Glass Fragments
-1	11	Two 4- by 6-Inch Glass Fragments

RAW LIGHTWEIGHT AUTOMOBILE-DEBRIS DATA TABULATED
ACCORDING TO 50-PSI GRID SQUARES (Continued)

50-Psi Grid Square X	Y	Automobile Debris Part (originating automobile number in parentheses if identifiable)
		Debris from 15-Psi Automobiles (Cont'd)
0	11	55-Inch Chrome Strip
-3	12	4- by 4-Inch Glass Fragment
0	12	Five Glass Fragments
-2	13	3- by 3-Inch Glass Fragment
0	13	2- by 2-Inch Glass Fragment

Ground Range = 1050.0 Feet, Bearing = 244°54'18": 5-Pound Hood Latch Assembly (#4)

Ground Range = 1007.6 Feet, Bearing = 241°19'17": 8-Pound Hood Hinges and Brace (#3)

		Debris from 30-Psi Automobiles
-1	-7	Chrome Strip
-4	-5	Hubcap (#13)
-3	-5	Hubcap (#11), Hood Chrome Strip (#11), Hood Hinge Spring
-4	-4	Dashboard Cover (#2)
-3	-4	Three Chrome Strips
-2	-4	Chrome Strip
-3	-3	Chrome Strip
-5	-2	Three Chrome Strips
-3	-2	Roof Support, Knob, Hubcap (#11), Hood Latch and Brace
-2	-2	Dashboard Molding
-5	-1	Chrome Strip
-4	-1	Two Chrome Strips
-3	-1	Interior-Speaker Chrome Trim, Two Chrome Strips, Two Headlight Sockets
-2	-1	Bracket
-7	0	Window Frame
-6	0	Horn, Wiper Blade
-1	0	Chrome Strip (#11)
-9	1	Chrome Strip, Upholstery (#13), Rubber Window Weatherstrip
-7	1	Three Chrome Strips
-3	1	Dashboard, Broken Headlight

RAW LIGHTWEIGHT AUTOMOBILE-DEBRIS DATA TABULATED
ACCORDING TO 50-PSI GRID SQUARES (Continued)

50-Psi Grid Square X	Y	Automobile Debris Part (originating automobile number in parentheses if identifiable)
		Debris from 30-Psi Automobiles (Cont'd)
-10	2	Five Chrome Strips (#2)
-9	2	19-Inch 1-Inch-Wide Chrome Strip, Chrome Strip, Rubber Window Weatherstrip
-8	2	15-Inch 2-Inch-Wide Chrome Strip, 43- by 0.6-Inch Sheet-Metal Fragment, 56- by 1.5-Inch Sheet-Metal Fragment
-7	2	Two Chrome Strips (#13), Two Outside Mirrors (#13), Door Handle, Four Chrome Strips
-5	2	Rubber Window Weatherstrip, Sheet-Metal Fragment
-10	3	66-Inch 1.5-Inch-Wide Chrome Strip, 14-Inch 1-Inch-Wide Chrome Strip
-9	3	15-Inch 2-Inch-Wide Chrome Strip
-8	3	14-Inch 1-Inch-Wide Chrome Strip, 48-Inch 1.5-Inch-Wide Chrome Strip, 14- by 1-Inch Metal Side-Window Divider
-7	3	Headlight (#11), 3-Inch 2.75-Inch-Wide Chrome Piece
-4	3	Hood Hinge, Chrome Strip, Headlight Rim
-2	3	Two Chrome Strips, 8- by 4-Inch Chrome Piece, Air Cleaner (#11), Windshield Weatherstrip
-10	4	License Plate (#2)
-4	4	Two Chrome Strips
-3	4	Two Chrome Strips
-2	4	Hood Hinge Spring (#11), Bracket
-7	5	36- by 15-Inch Cardboard Panel
-5	5	Two Chrome Strips, Hood Chrome Piece, Hood Chrome Emblem
-3	5	Chrome Strip
-3	6	Hood Latch, Horn
-4	6	Chrome Strip, Window Frame, Chrome-Strip End Piece
-3	6	Chrome Strip
-4	7	Taillight Assembly
-6	8	Chrome Strip
		Debris from 50-Psi Automobiles
0	-4	Metal Molding, Outside Mirror Part
-2	-3	Chrome Strip
-1	-3	Chrome Strip, Chrome Strip (#8)

RAW LIGHTWEIGHT AUTOMOBILE-DEBRIS DATA TABULATED ACCORDING TO 50-PSI GRID SQUARES (Continued)

50-Psi Grid Square X	50-Psi Grid Square Y	Automobile Debris Part (originating automobile number in parentheses if identifiable)
		Debris from 50-Psi Automobiles (Con.'d)
0	-3	Front Grill (#7), Chrome Strip (#1)
-1	-2	Window Frame
0	-2	Chrome Strip
3	-2	Three Chrome Strips (#5)
-1	-1	Chrome Strip
1	-1	Taillight
2	-1	Chrome Strip
3	-1	Chrome Strip
0	0	Rubber Mat, Outside Mirror Part, Horn, Battery Clamp, Metal Molding (#7), Sheet-Metal Fragment, Sheet-Metal Bracket, Windshield Wiper Motor, Sun Visor, Two Light Sockets
1	0	Ashtray, Chrome Strip (#7), Headlight Rim (#7), Chrome Strip, Chrome Strip with Upholstery, Hood Hinge (#5), Two Chrome Strips (#5), Fender Guard, Two Pieces of Metal Molding, Two Hubcaps (#1), Bracket, Blower Rotor, Four Sheet-Metal Fragments
2	0	Door Hinge, Windshield Wiper Motor, Three Chrome Strips, Headlight Rim, Chrome Star Emblem (#5), Padded Dash Molding
3	0	Roof Support (#8), Chrome Strip, Windshield Washer Pump, Top Front Window Frame, Strap
0	1	Hood Latch, Water Pump, Four Chrome Strips, Front Grill (#7), Rubber Window Weatherstrip, Trunk Latch, Chrome Molding (#7), Voltage Regulator, Metal Molding, Chrome Star Emblem (#5)
1	1	Gas Cap, Bracket, Two Front Grill Parts, Two Headlight Sockets, Taillight Lens, Rocker Panel (#1), Hubcap (#1), Steering Wheel, Two Hood Hinge Springs, Two Door Sills, Sheet-Metal Fragment, Seven Chrome Strips, Metal Frame Fragments, Two Chrome Strips (#7), Chrome Strip (#8), Fender Molding, Armrest, Heater, Rear View Mirror Frame, Upholstery Panel, Battery Bolt, Battery Fragments, Water Hose, Metal Window Divider
2	1	Rubber Door Sill, Chrome Star Emblem (#5), Spare Tire Hold Down, Battery Fragment, Hood Latch Fragment
-1	2	Sheet-Metal Fragment, Two Chrome Strips
0	2	Horn, Headlight and Socket Housing, Rear View Mirror, Two Chrome Strips, Three Metal Strips, Metal Molding Fragment, Window Frame, Battery Plate
1	2	Six Chrome Strips, Rocker Molding (#1), Steering Wheel Rim (#1), Steering Wheel Fragment, Light Molding (#7), Armrest Hood Hinge Spring (#5), Headlight Rim (#5), License Plate (#1), Five Battery Case Fragments, Six Battery Plates, Ash Tray, Hood Latch with Metal Fragment, Rubber Door Sill, Chrome Piece, Chrome Molding Fragments, Window Frame Fragment

RAW LIGHTWEIGHT AUTOMOBILE-DEBRIS DATA TABULATED
ACCORDING TO 50-PSI GRID SQUARES (Continued)

50-Psi Grid-Square X	50-Psi Grid-Square Y	Automobile Debris Part (originating automobile number in parentheses if identifiable)
		Debris from 50-Psi Automobiles (Cont'd)
2	2	Door Handle (#1), Die Cast Molding Fragment
-1	3	Door Handle (#1), Die Cast Chrome Molding, Vent Window Frame
0	3	Armrest, Four Chrome Strips, Chrome Molding, Rubber Air Duct, Taillight Housing, Inside Fender Fragment with Battery Pan, Sheet-Metal Strut, Metal Fragment, Wire-Like Metal Strip
1	3	Two Chrome Strips, Door Handle (#1), Ash Tray, Battery Fragment, Windshield Center Post, Two Sheet-Metal Fragments, Metal Plate, Die Cast Molding Fragment, Window Molding
2	3	Armrest, Taillight Casing, Chrome Strip, Trunk Latch, Die Cast Molding Fragment
-1	4	Two Chrome Strips, Window Handle, Mirror, Sheet-Metal Fragment
0	4	Headlight Rim, Rear Window Frame, Two Molding Fragments, Aluminum Molding, Light Housing
1	4	Headlight Socket, Two Battery Fragments, Battery Post, Hood Fragment
2	4	Upholstery Strip, Chrome Strip, Headlight Socket, Oil Cap, Sheet-Metal Fragment
3	4	Two Chrome Strips, Two Metal Brackets, Rubber Window Weatherstrip
5	4	Trunk Handle
0	5	Metal Fragment (#7), Water Hose
1	5	Vent Window Frame, Mirror Mount, Metal Fragment
2	5	Chrome Strip
3	5	Hood Latch Support, 24-Inch Chrome Strip, 5-Pound Taillight Assembly
4	5	One-Half Hood Hinge (#8)
1	6	Chrome Strip
1	7	Taillight Assembly (#7)
5	8	60-Inch Chrome Strip
3	9	One-Half Mirror, 48-Inch Chrome Strip
1	10	Five Glass Fragments, Chrome Name Emblem
2	10	11- by 5-Inch Glass Fragment, 19- by 0.75-Inch Chrome Emblem
1	11	Headlight Rim, Eight 7- by 6-Inch Glass Fragments, 68-Inch Chrome Strip, Two Windshield Wiper Blades, Three 5-Inch Chrome Strip End Pieces, Voltage Regulator Cap
2	11	Two Glass Fragments
3	11	5- by 5-Inch Glass Fragment

RAW LIGHTWEIGHT AUTOMOBILE-DEBRIS DATA TABULATED
ACCORDING TO 50-PSI GRID SQUARES (Continued)

50-Psi Grid Square X	Y	Automobile Debris Part (originating automobile number in parentheses if identifiable)
		Debris from 50-Psi Automobiles (Cont'd)
3	12	Interior Speaker Chrome Trim
1	13	Two Taillight Lens Fragments, Two Glass Fragments
2	13	Glass Fragments
3	13	Five Glass Fragments, Metal Bracket

Ground Range = 503.0, Bearing = 255°51'23": 5.5-Pound Trunk Wheel Well

RAW WEIGHINGS OF LIGHTWEIGHT AUTOMOBILE DEBRIS
(GATHERED AND WEIGHED FOLLOWING
GRID-SQUARE TABULATION)

Automobile Debris Parts	Number of Parts	Weight of Parts (pounds)
Debris from 15-Psi Automobiles		
Light Rims, Light	8	3.5
Glass Fragments, Taillight, Window	51	25
Light Sockets	3	3.5
Taillight Assembly	1	5
Small Chrome Strips, Wiper Parts	10	0.99
Chrome Molding Fragments	12	1.72
Chrome Strips	4	0.90
48-Inch 1-Inch-Wide Chrome Strips	21	8
48-Inch 1.5-Inch-Wide Chrome Strips	14	7
Small Die Cast Parts and Fragments	13	1.7
Die Case Parts, Fragments, Mirror	10	10
Rubber Pieces	4	11.5
Hubcaps	2	2.26
Hood Hinge Springs, Jack Base, Horn	4	9.5
Roof Support	1	1.83
Roof Rack Parts (from Automobile Number 6)	3	11.5
Air Filters	2	1.7
Air Cleaner Housing	1	7
Washer Bottle	1	0.473
Flexible Exhaust Pipe	1	1.47
Miscellaneous — Ash Trays, Distributor Part, etc.	15	4.07
Upholstery Wires	3	1.43
Armrest, Visors, Metal Fragments	4	3.68
Debris from 30-Psi Automobiles		
Glass Fragments	55	29
Headlight Rims	3	0.97
Headlight, Vent Window	2	3.19
Taillight Assembly	1	5.5
Small Chrome Fragments	5	0.473
Chrome Fragments	7	2.26
36-Inch 1-Inch-Wide Chrome Strips	34	12
48-Inch 1.5-Inch-Wide Chrome Strips	15	11

RAW WEIGHINGS OF LIGHTWEIGHT AUTOMOBILE DEBRIS
(GATHERED AND WEIGHED FOLLOWING
GRID-SQUARE TABULATION) (Continued)

Automobile Debris Parts	Number of Parts	Weight of Parts (pounds)
Debris from 30-Psi Automobiles (Cont'd)		
Rocker Molding Strips	2	4
Die Cast Fragments — Handles, Air Intake Vents, etc.	19	13
Sheet-Metal Fragment — Proof Supports, Window Frames, Hubcaps	11	29
Rubber Pieces	9	32
Hubcaps	2	2.8
Hood Hinge Springs	3	2.7
Hood Hinge, Hood Latch, Dash Molding	3	11
Horns, Window Guide	3	2.09
Air Cleaner	1	7
Battery Plate	1	0.352
Rod	1	1.54
Miscellaneous — Ash Trays, Mirrors, Wiper Blades, Dash Parts	20	4
Upholstery Pieces	5	1.87
Upholstery Wires	2	1.43
Armrests, Visors	3	2.14
Debris from 50-Psi Automobiles		
Taillight Lenses	3	0.341
Lightweight Light Backing Pieces	13	4
Lights, Heavy Light Backing Pieces	8	27
Small Chrome Fragments	19	1.52
Chrome Trim Fragments	19	2.46
Miscellaneous Chrome and Aluminum Fragments — Ash Trays, Speaker Grill, etc.	11	2.84
24-Inch 1.5-Inch-Wide Chrome Strips	4	1.09
36-Inch 1-Inch-Wide Chrome Strips	22	6.0
42-Inch 1.5-Inch-Wide Chrome Strips	32	17.5
60-Inch 1-Inch-Wide Chrome Strips	5	2.83
Chrome Vent-Window Frames	2	0.935
Lightweight Chrome Die Cast Fragments — Door Handles, Grill Parts, etc.	23	17
Heavy Chrome Die Cast Fragments	2	4

RAW WEIGHINGS OF LIGHTWEIGHT AUTOMOBILE DEBRIS (GATHERED AND WEIGHED FOLLOWING GRID-SQUARE TABULATION) (Continued)

Automobile Debris Parts	Number of Parts	Weight of Parts (pounds)
Debris from 50-Psi Automobiles (Cont'd)		
Chrome Rocker Molding	2	5.5
Miscellaneous Small Fragments	10	1.43
Window Guides, etc.	7	4
Brackets, Hardware Plates	14	8.5
Large Sheet-Metal Fragments, Muffler	41	140
Rubber Pieces	43	33
Hubcaps	3	4.96
Hood Hinge Springs	4	4.46
Battery Plates	24	4.96
Battery Case Fragments	14	4.82
Battery Terminals	3	1.96
Horns, Motors, Manifold Fragments, etc.	10	28
Push Rods	5	0.814
Upholstery Pieces	46	22
Upholstery Strips	9	6
Armrests, Visors, etc.	7	5.95
Steering Wheel Fragments	4	3.48

APPENDIX C

TREE-DEBRIS GROUND WEIGHT DISTRIBUTIONS

The ground weight distributions of the debris from the twelve trees subjected to the Dial Pack blast in this project are presented in the twelve figures of this appendix. In each figure, the weight (in pounds) of the debris from a specified tree in the appropriate grid-network squares is indicated. The weight of the tree trunk of this tree remaining in the holding pipe has been estimated and added to the suitable grid square. Note that the radial line through the initial tree position is designated in every figure.

Some debris from the 50-psi trees was radially transported over 1000 feet. Such distances appear to be inexplicable since just a few discrete fragments were found at these large distances, with a large gap existing between those fragments and the closest lower-transported fragments. Some were collected fairly close to a road. They might have been tree trimmings which had blown off a truck that was carting them away as part of the preshot cleanup. But others were discovered over 150 feet from this road (the road was situated at about the 4-psi range), which tends to disprove this explanation. Besides, most of the fragments resembled fractured debris rather than trimmings. Hence it seems possible that these fragments were blast-transported to such distances, or perhaps they were even part of crater ejecta.

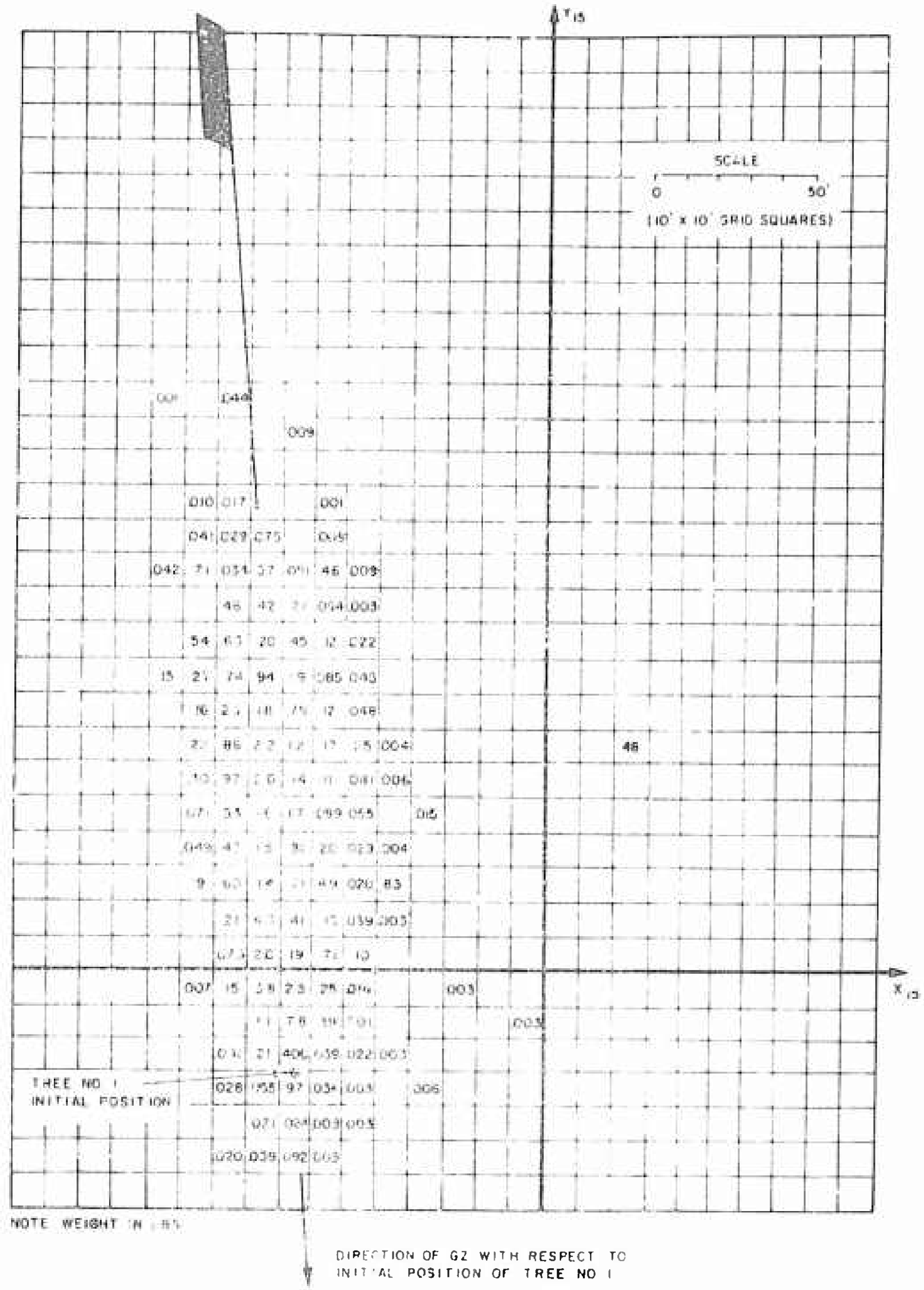


Figure C1. Ground weight distribution of debris from tree number 1, an aspen tree placed at 15 psi

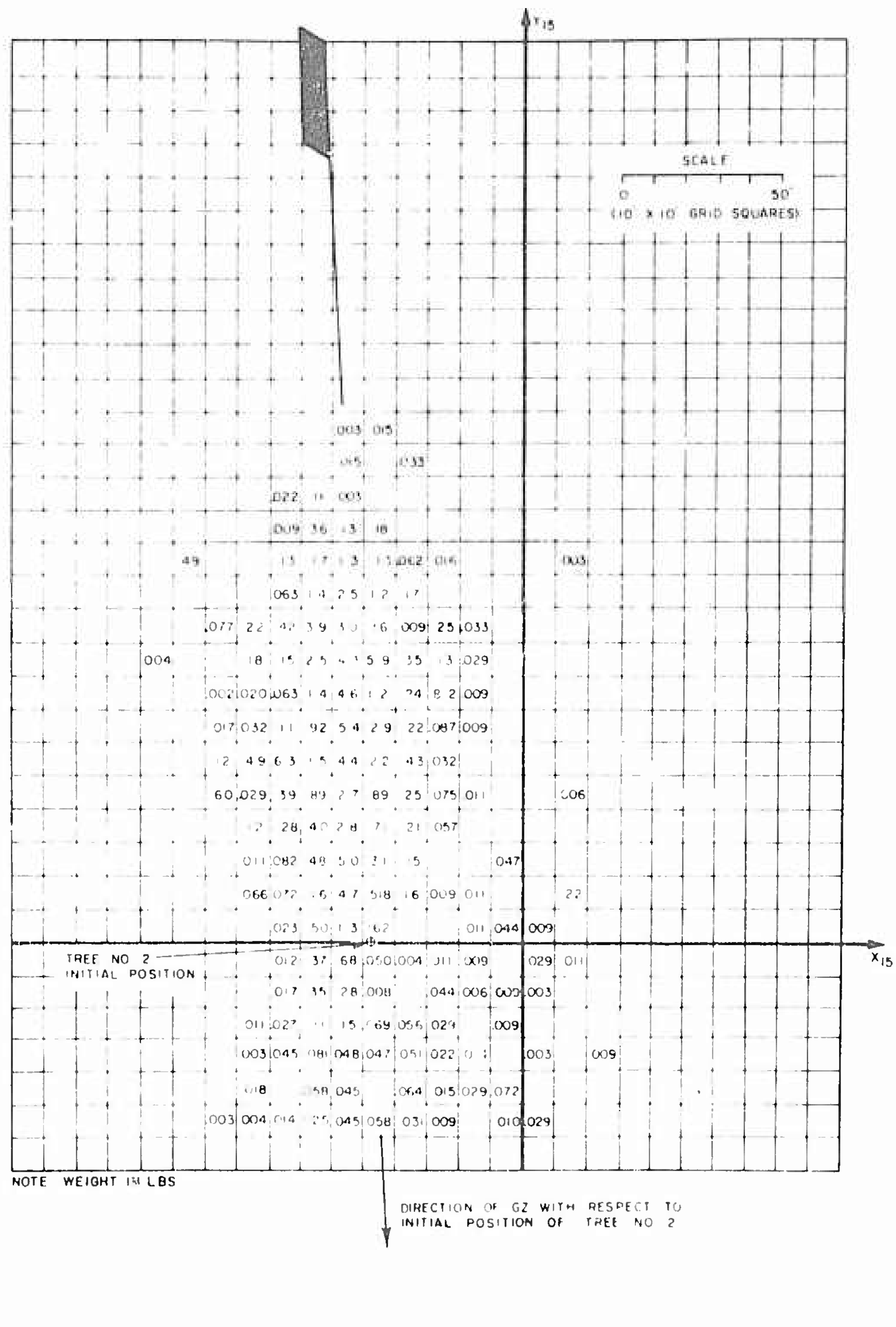


Figure C2. Ground weight distribution of debris from tree number 2, an aspen tree placed at 15 psi

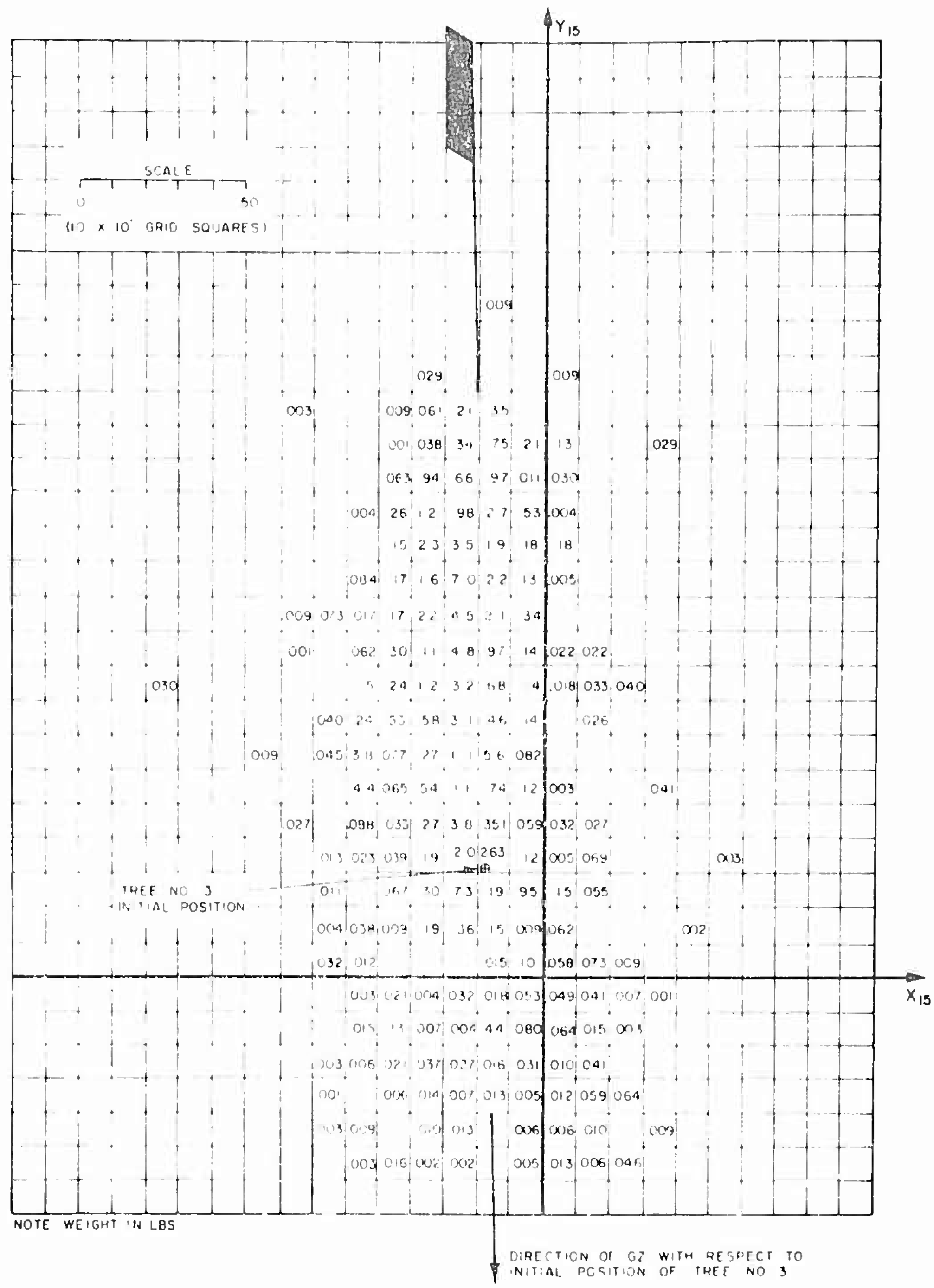


Figure C3. Ground weight distribution of debris from tree number 3, an aspen tree placed at 15 psi

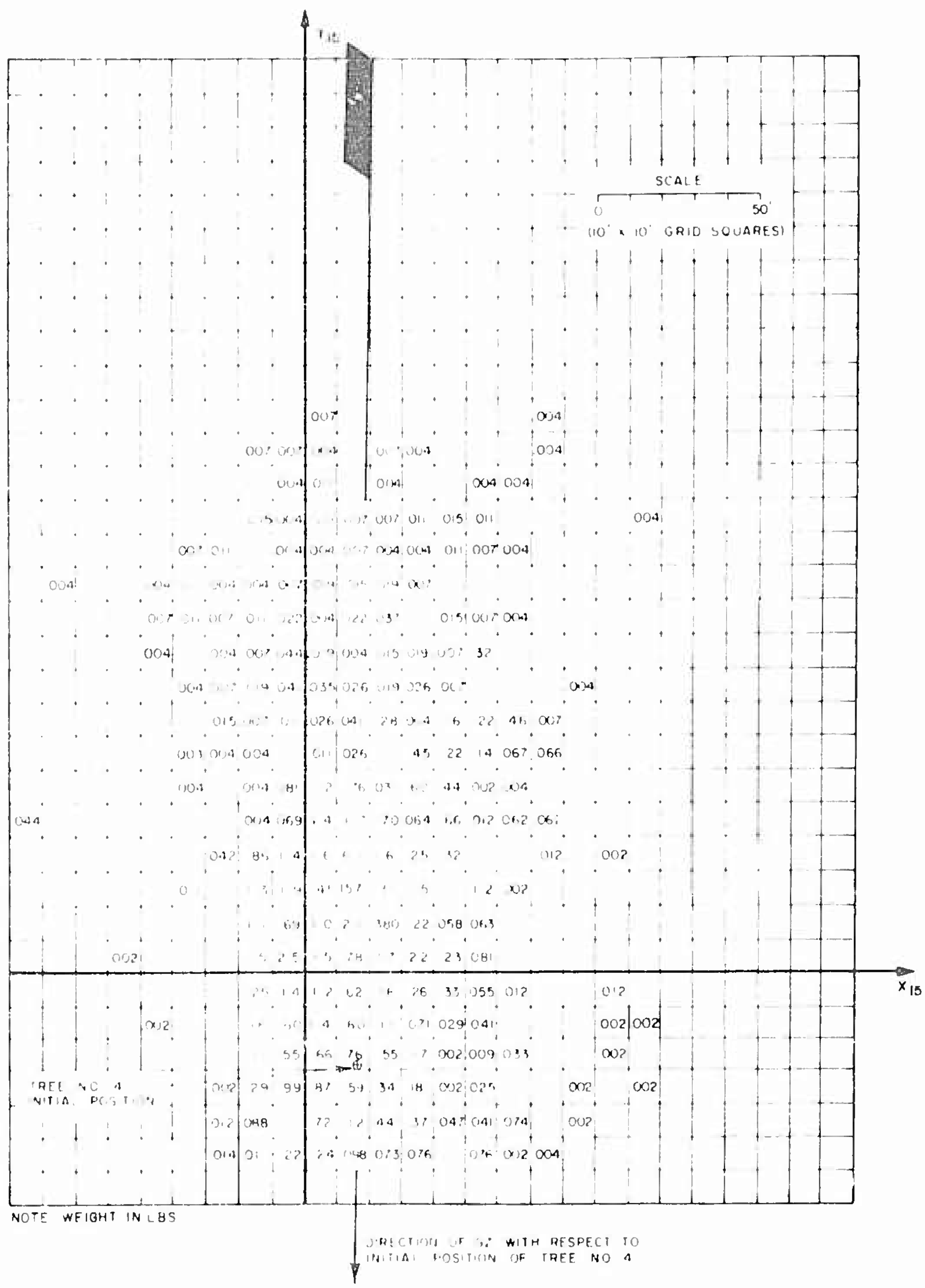


Figure C4. Ground weight distribution of debris om tree number 4, a spruce tree placed at 15 ps

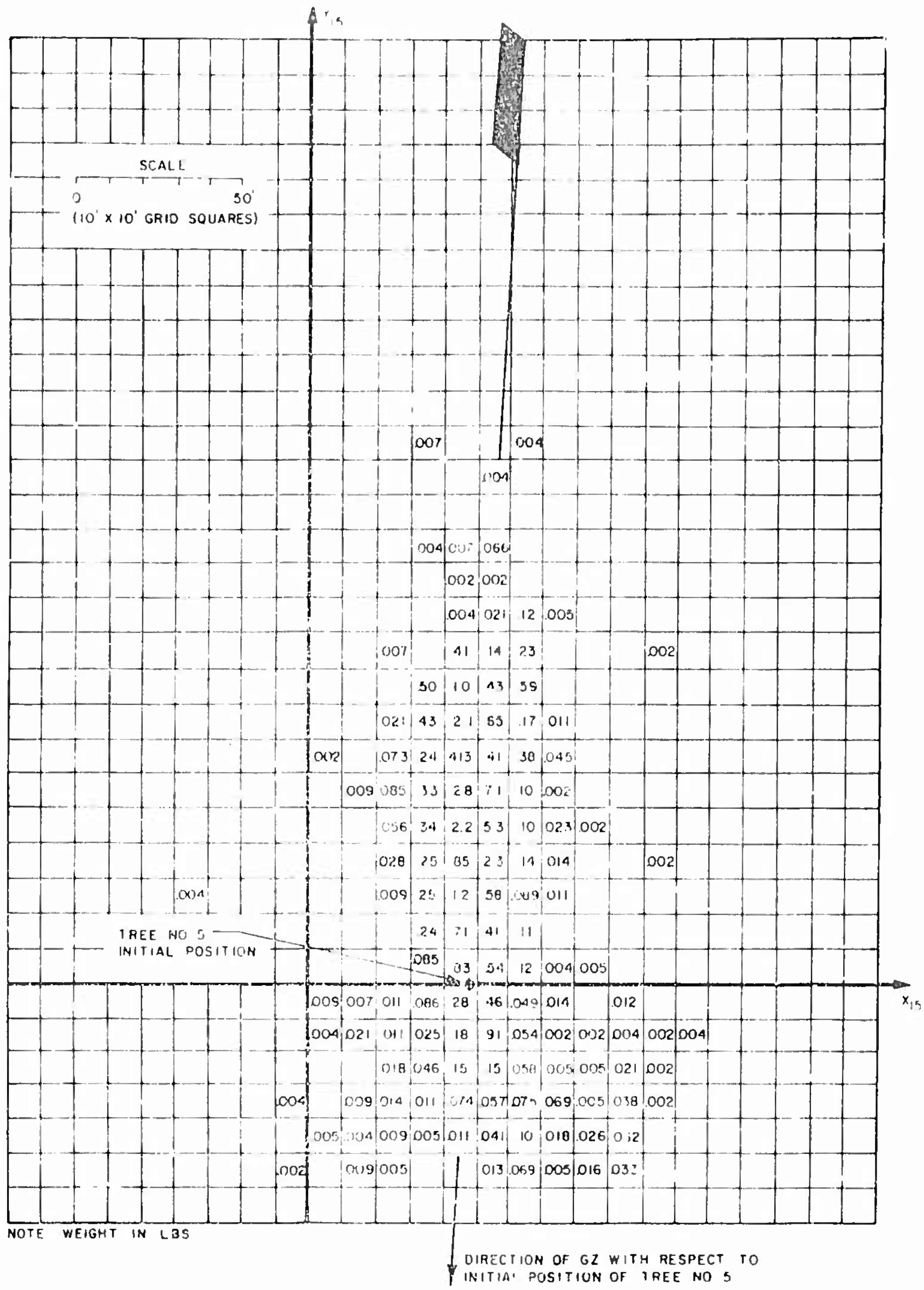


Figure C5. Ground weight distribution of debris from tree number 5, a spruce tree placed at 15 psi

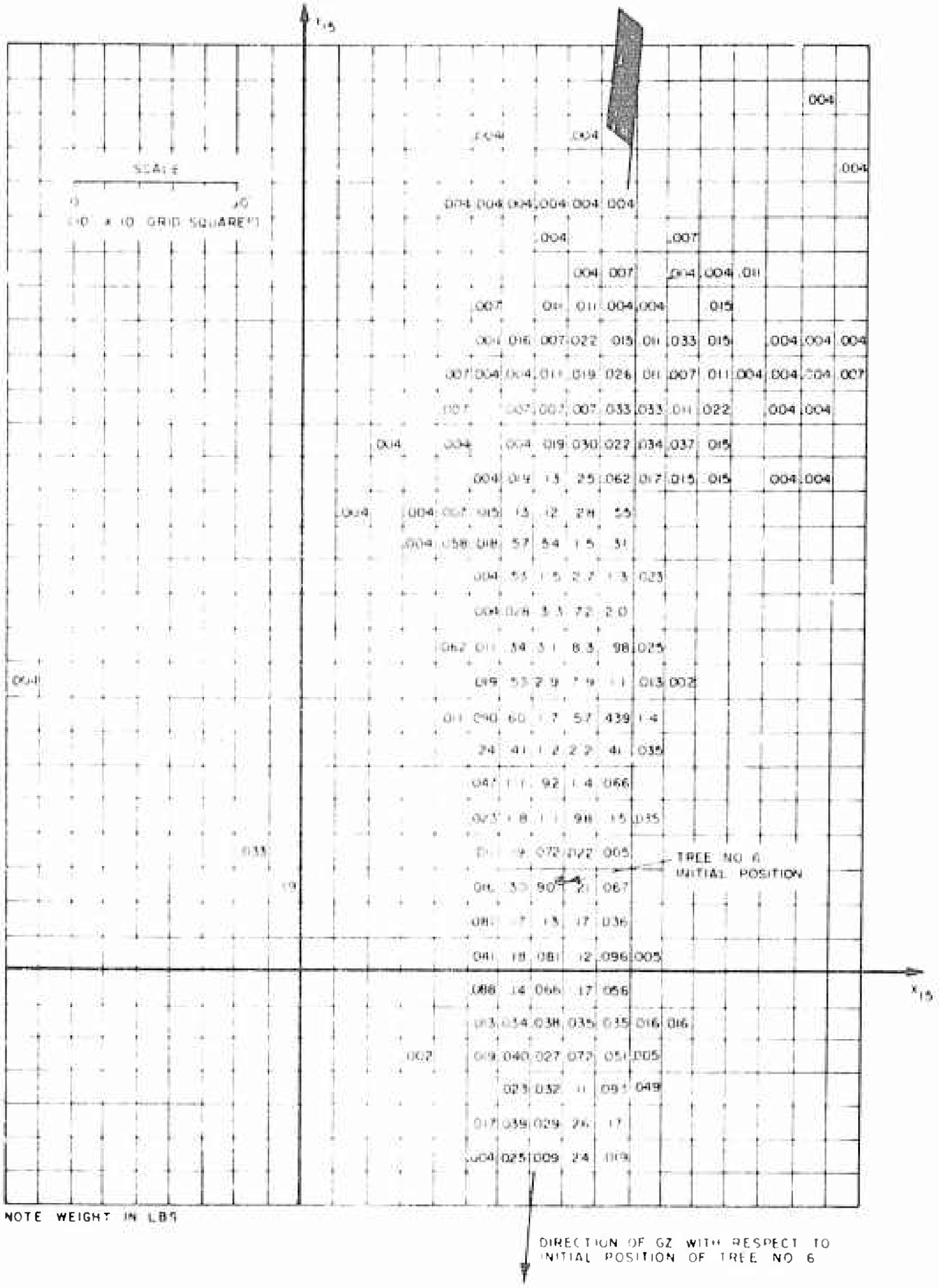


Figure C6. Ground weight distribution of debris from tree number 6, a spruce tree placed at 15 psi

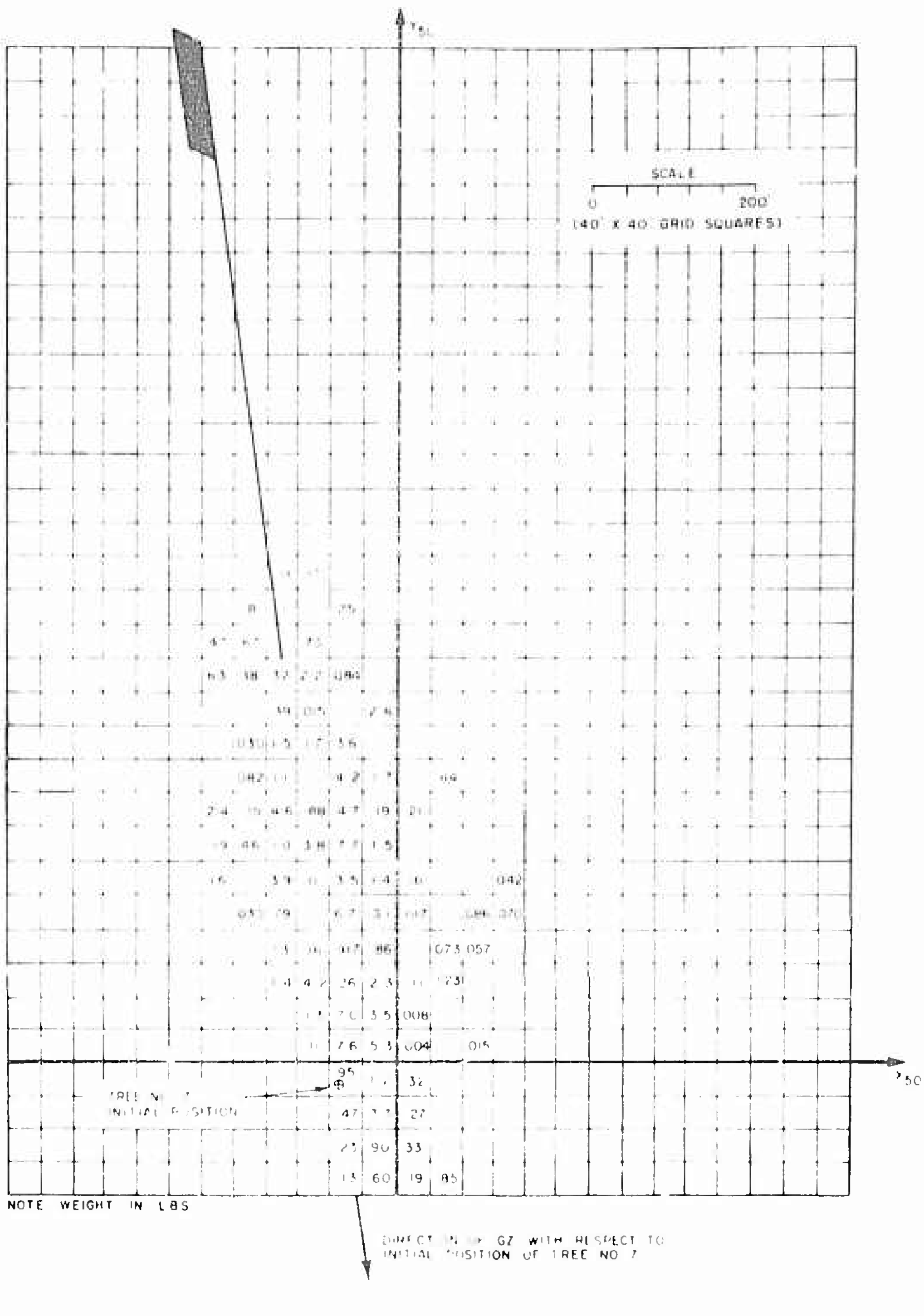


Figure C7. Ground weight distribution of debris from tree number 7, an aspen tree placed at 50 psi

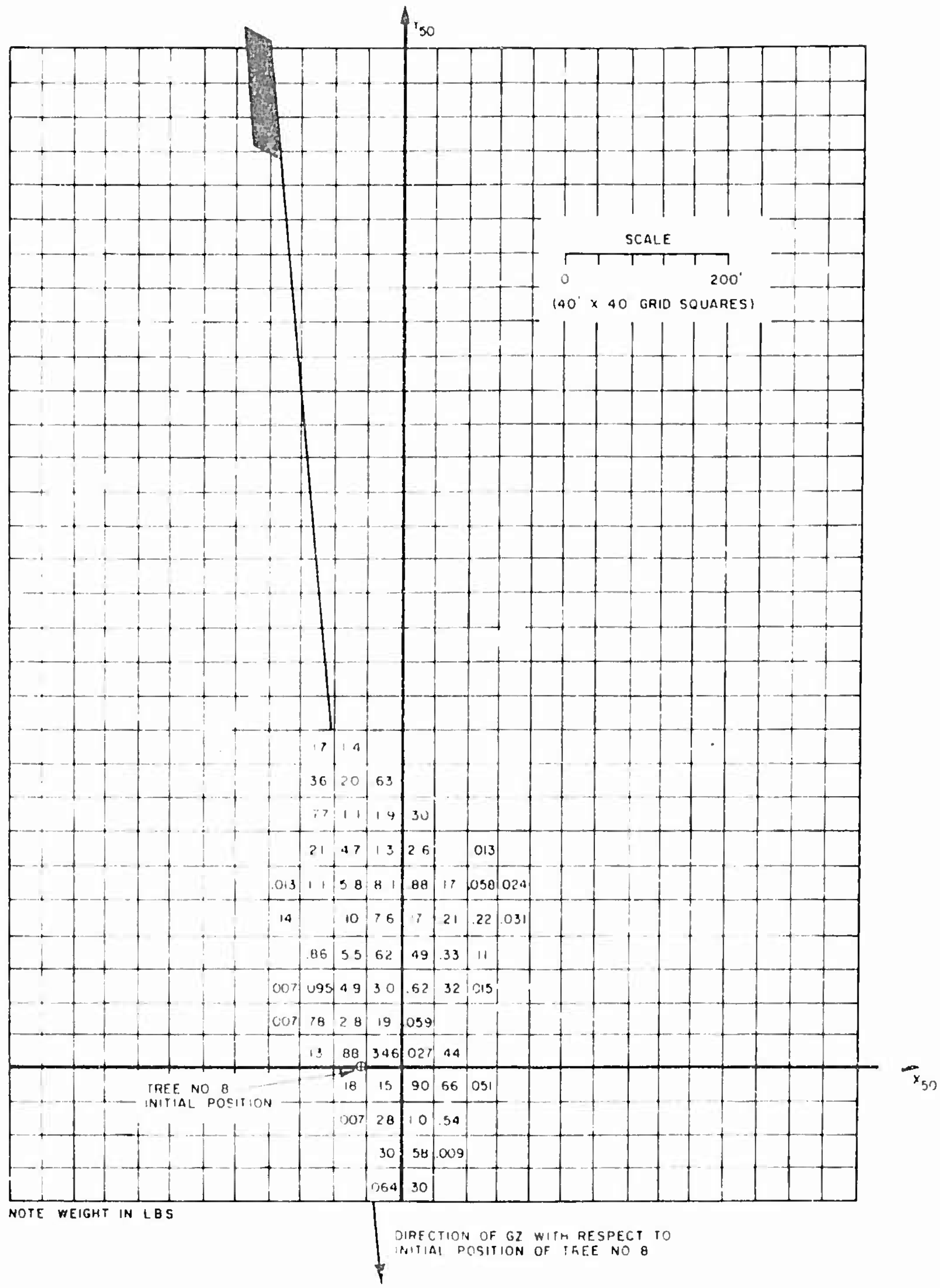


Figure C8. Ground weight distribution of debris from tree number 8, an aspen tree placed at 50 psi

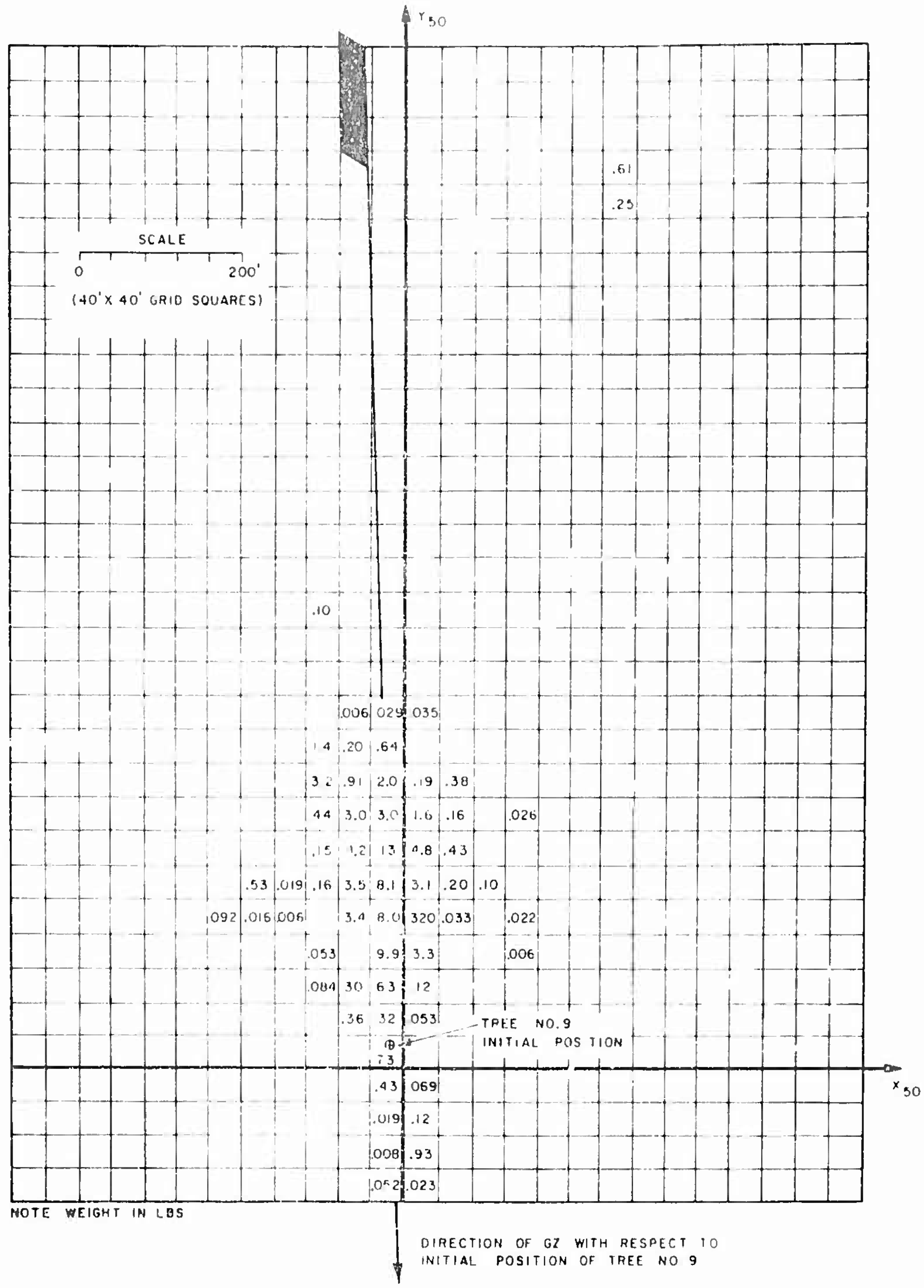


Figure C9. Ground weight distribution of debris from tree number 9, an aspen tree placed at 50 psi

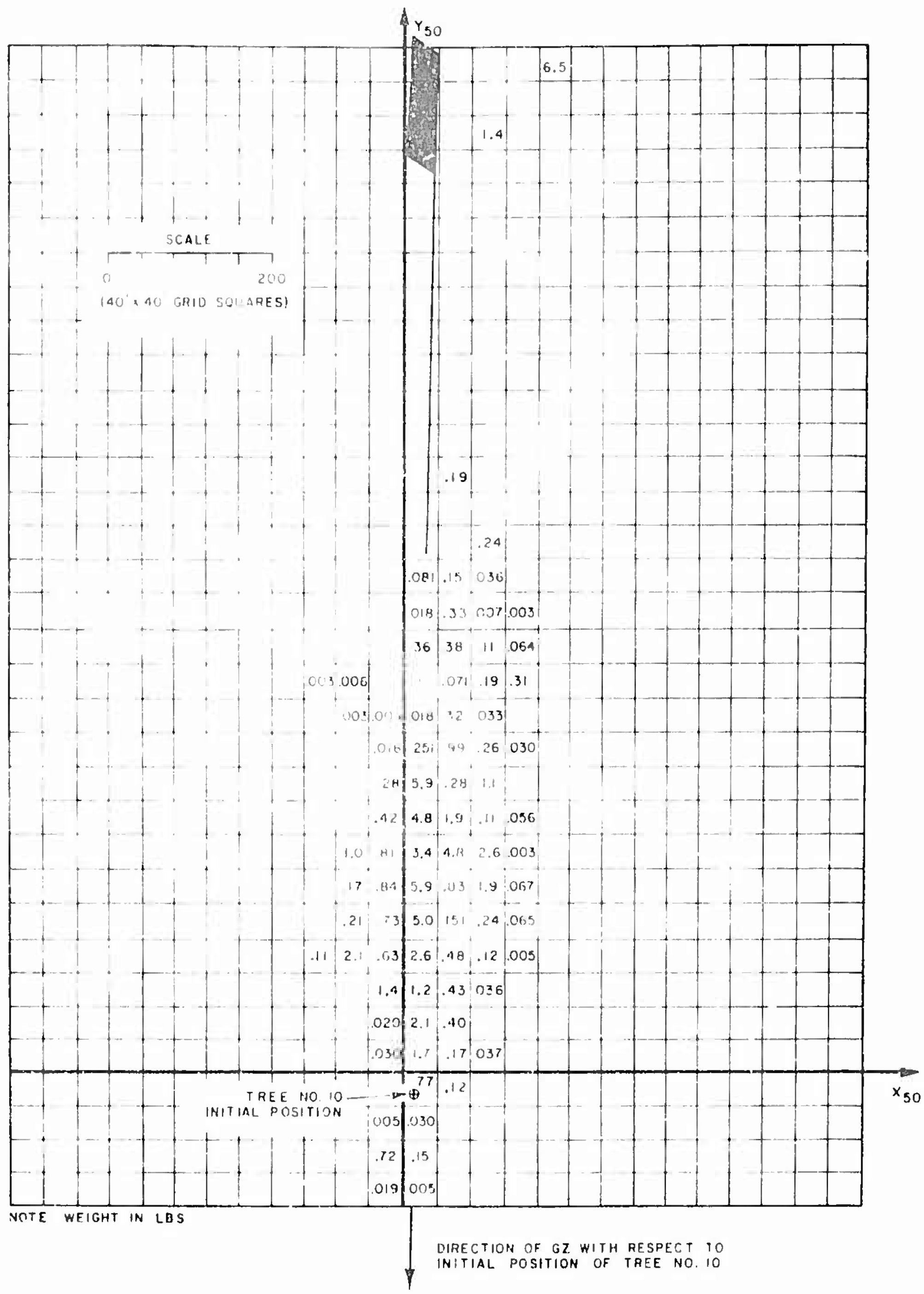


Figure C10. Ground weight distribution of debris from tree number 10, a spruce tree placed at 50 psi

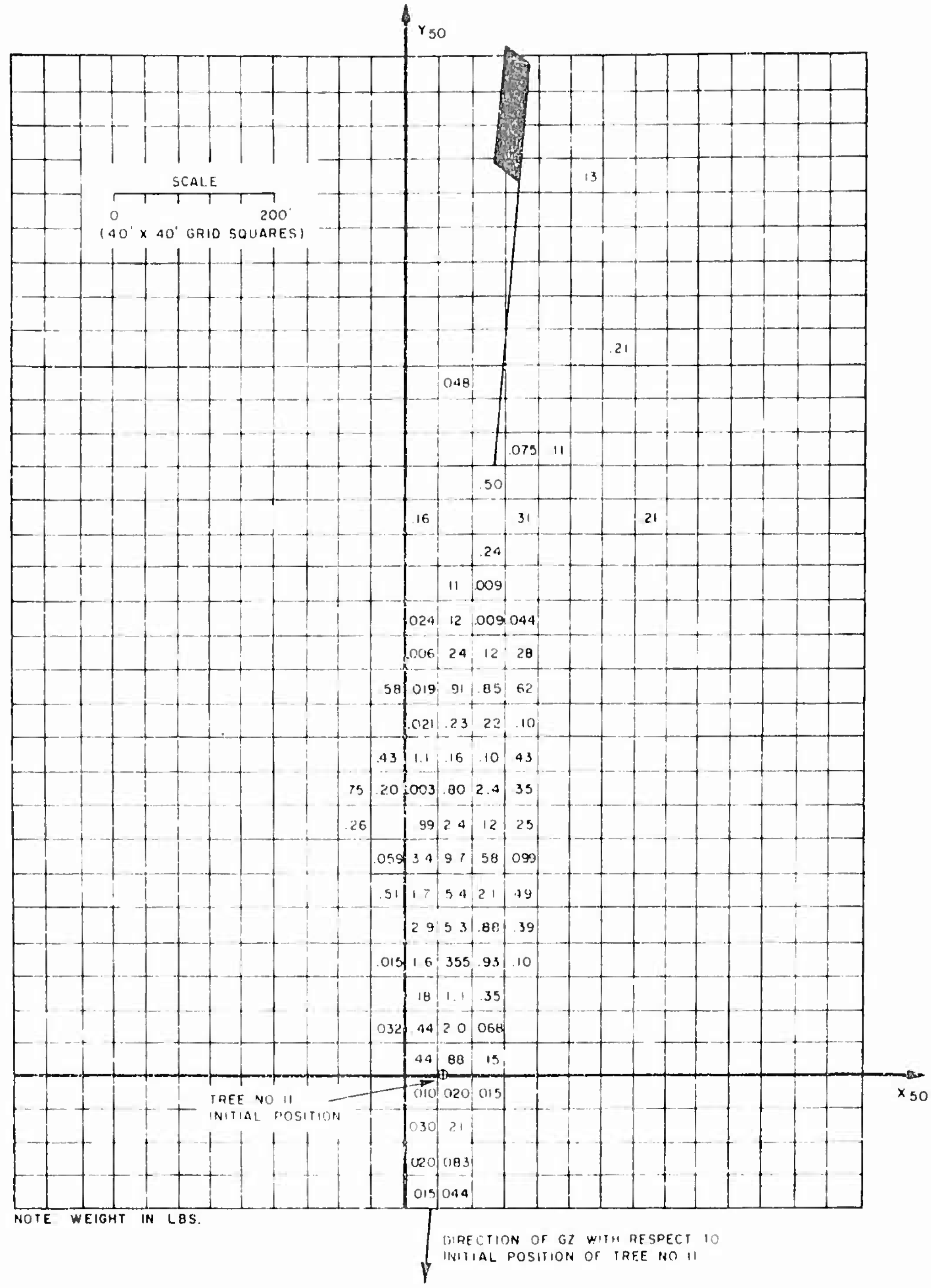


Figure C11. Ground weight distribution of debris from tree number 11, a spruce tree placed at 50 psi

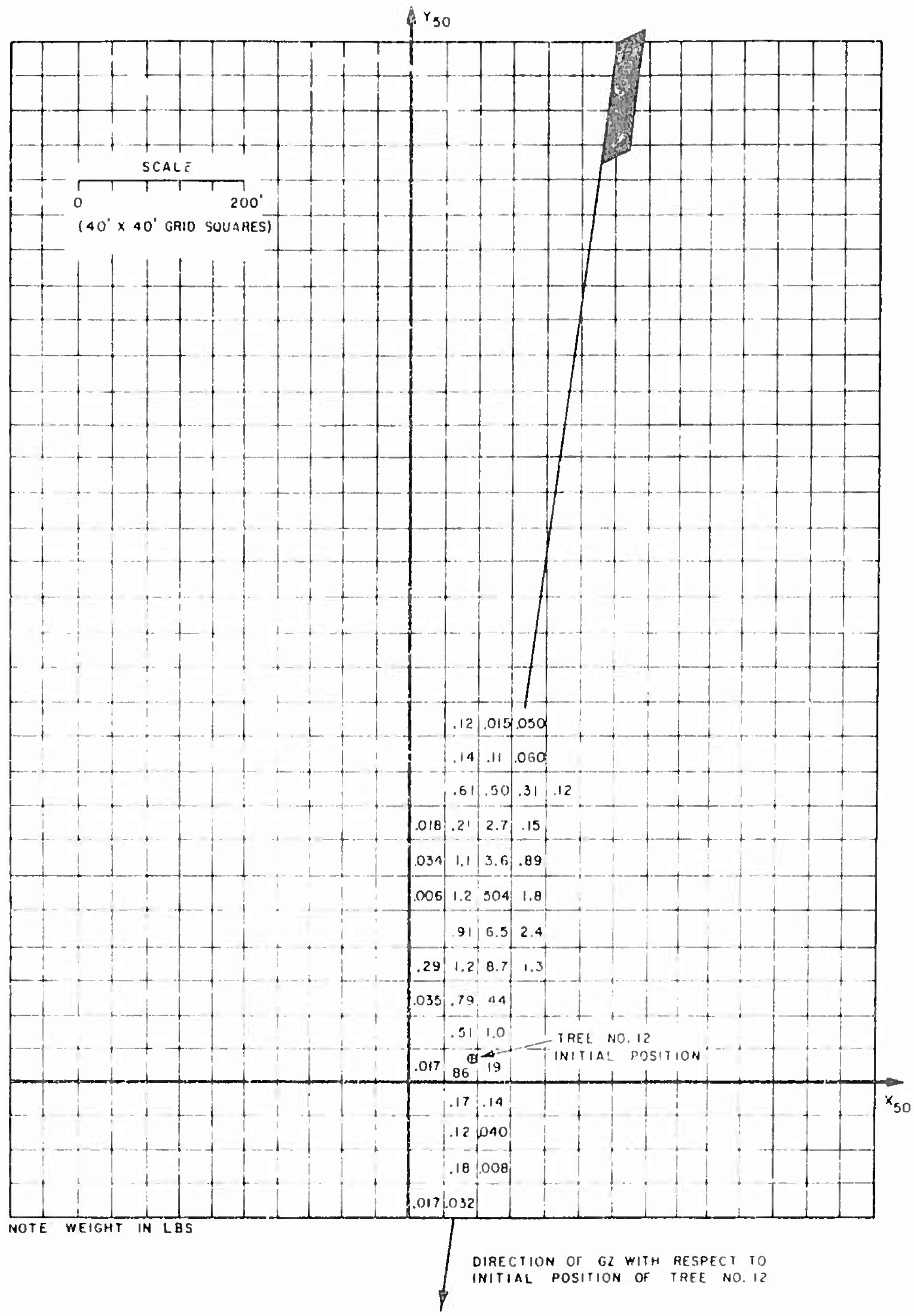


Figure C12. Ground weight distribution of debris from tree number 12, a spruce tree placed at 50 psi

APPENDIX D

PRESHOT AND POSTSHOT AUTOMOBILE CONDITIONS

The conditions of all thirteen automobiles before and after the Dial Pack blast are briefly described in this appendix. To characterize the crushing (depressed inwards) or the peaking (pressed outwards) conditions of the sheet-metal parts remaining on the automobiles after the blast, the following words are used to indicate the extent from normal:

Description	Maximum Depth or Rise from Normal
Slight	2 to 4 inches
Moderate	4 to 6 inches
Severe	6 to 8 inches
Very severe	8 to 12 inches
Drastic	greater than 12 inches

A chrome section refers to a 2- to 4-foot chrome strip, or chrome trim with the equivalent weight of such a strip. Otherwise, the wording used to depict the automobiles is self-explanatory.

PRESHOT AND POSTSHOT CONDITIONS OF AUTOMOBILES

Automobile Number 1 — 1949(?) DeSoto, Oriented Side-On (Driver's Side Facing Blast) at 50 psi

Automobile Part	Preshot Condition	Postshot Condition
Hood	Good	Blown Off
Trunk Lid	Good	Unlatched Framework Severely Twisted on Hinge; Shell Blown Off
Doors	Good (Four Doors)	Blown Off
Roof	Good	Blown Off
Fenders	Good	All Blown Off Except Passenger-Side Rear Fender Which Was Hanging
Bumpers	Good	No Change
Windows	Good	All Blown Out
Tires	Good	All Flat Except Passenger-Side Front
Hubcaps	All Four On	All Four Blown Off
Chrome Trim	Good	Eight Sections Blown Off — About 100 Percent of Chrome Trim
Lights	Good (Some Rust Around Headlights)	Headlights and Headlight Rims Blown Off; Taillights Blown Off With Parts; Front Parking Lights Good But Hanging
Outside Mirrors	Driver-Side Mirror Attached	Blown Off
Miscellaneous	Aerial and Windshield Wiper Blades Missing; Two License Plates On	Both Wipers and Both License Plates Blown Off. Chrome Sections, Small Engine Parts, and Hubcaps on Ground Nearby

PRESHOT AND POSTSHOT CONDITIONS OF AUTOMOBILES

Automobile Number 2 — 1946-1948 Dodge, Oriented Side-On
(Driver's Side Facing Blast) at 30 psi

Automobile Part	Preshot Condition	Postshot Condition
Hood	Good	Blown Off
Trunk Lid	Good	Unlatched Framework Remained, Hanging on One Hinge; Shell Blown Off
Doors	Good (Two Doors)	Both Open; Passenger-Side Door Hanging and Driver-Side Door Severely Crushed
Roof	Good	Blown Off
Fenders	Good	Passenger-Side Fenders Blown Off; Driver-Side Rear Hanging, Driver-Side Front Severely Crushed and Peaked
Bumpers	Good	No Change
Windows	Good	All Blown Out
Tires	Good	No Change
Hubcaps	All Four On	No Change
Chrome Trim	One Section Missing and One Section Loose	Seven Sections Blown Off — About 70 Percent of Chrome Trim
Lights	Good	All Broken; Driver-Side Headlight and Headlight Rim Blown Off
Outside Mirrors	Driver-Side Mirror Attached	Blown Off
Miscellaneous	Aerial Missing; Front License Plate On; Windshield Wipers Good	License Plate and Both Wiper Blades Blown Off; Seat, Chrome Sections, Hood Brace, and Hood Spring on Ground Nearby

PRESHOT AND POSTSHOT CONDITIONS OF AUTOMOBILES

Automobile Number 3 — 1960 Chrysler Saratoga, Oriented Side-On (Driver's Side Facing Blast) at 15 psi

Automobile Part	Preshot Condition	Postshot Condition
Hood	Good	Blown Off
Trunk Lid	Good	Unlatched; Severely Crushed
Doors	Good (Four Doors)	Two Rear Doors Jammed Shut And Driver-Side Front Door Open; Both on Driver's Side Severely Crushed
Roof	Good	Detached and Blown Up in Front; Attached in Rear Only
Fenders	Good	Driver-Side Fenders Severely Crushed
Bumpers	Good	No Change
Windows	Good Except Crack in Front Windshield	All Blown Out
Tires	Good	Two Rear Flat; Spare Blown Out of Trunk
Hubcaps	All Four On	Passenger-Side Rear Blown Off
Chrome Trim	Two Sections Missing	Fourteen Additional Sections Blown Off — About 75 Percent of Chrome Trim; One Section Hanging
Lights	Good (Dual Headlights)	Two Headlights Blown Off; One Headlight, Both Front Parking Lights, and Both Tail-lights Broken; Two Headlight Rims Blown Off; One Head-light Socket Hanging
Outside Mirrors	Two Attached	Both Blown Off
Miscellaneous	Aerial and License Plates Missing; Windshield Wipers Good	No Change in Windshield Wipers. Headlight Rim, Armrest, Roof Brace, Small Engine Parts, and Spare Tire on Ground Nearby

PRESHOT AND POSTSHOT CONDITIONS OF AUTOMOBILES

Automobile Number 4 — 1959 Chrysler,
Oriented Front-On at 15 psi

Automobile Part	Preshot Condition	Postshot Condition
Hood	Good	Blown Off
Trunk Lid	Good	Unlatched; Moderately Crushed
Doors	Good (Four Doors)	Rear Jammed Shut and Front Jammed Open; Both Driver-Side Doors Moderately-Severely Crushed, Both Passenger-Side Doors Lightly Crushed
Roof	Good	Very Severely Crushed in Rear and Severely Peaked in Front
Fenders	Good	Driver-Side Rear Moderately Crushed, Lightly Crushed Otherwise
Bumpers	Good	No Change
Windows	Good	All Blown Out Except Driver-Side Rear, Passenger-Side Front, and Two Side Vents
Tires	Good	No Change
Hubcaps	Passenger-Side Rear Missing	Passenger-Side Front Blown Off
Chrome Trim	Good	Seven Sections Blown Off — About 50 Percent of Chrome Trim; Five Sections Hanging
Lights	Driver-Side Taillight Broken (Dual Headlights)	One Headlight Blown Off; One Front Parking Light, Both Rear Parking Lights, and Other Taillight Broken
Outside Mirrors	Missing	No Change
Miscellaneous	Two Aerials Attached on Tailfins and License Plates Missing; Windshield Wipers Good	Both Wiper Blades Blown Off. Chrome Sections and Door Handles on Ground Nearby

PRESHOT AND POSTSHOT CONDITIONS OF AUTOMOBILES

Automobile Number 5 — 1959 Pontiac Laurentian, Oriented Front-On at 50 psi

Automobile Part	Preshot Condition	Postshot Condition
Hood	Good	Blown Off
Trunk Lid	Good	Unlatched; Drastically Crushed
Doors	Good (Four Doors)	All Jammed Open With One Hanging; Both Driver-Side Doors Severely Crushed, Both Passenger-Side Doors Moderately Crushed
Roof	Good	Blown Off
Fenders	Good	Front Fenders Blown Off; Rear Moderately-Severely Crushed
Bumpers	Good	No Change
Windows	Good Except Two Cracks in Front Windshield	All Blown Out Except Two Rear Quarter and Passenger-Side Vent
Tires	Good	No Change
Hubcaps	All Four Missing	No Change
Chrome Trim	Two Sections Missing	Sixteen Sections and Eight Emblems Blown Off — About 100 Percent of Chrome Trim
Lights	All Headlights Missing (Dual Headlights)	Both Rear Parking Lights Blown Off; One of Two Tail-lights Broken
Outside Mirrors	Missing	No Change
Miscellaneous	Aerial, License Plates, and Windshield Wiper Blades Missing	Passenger-Side Wiper Arm Blown Off. Two Grill Sections, Radiator Bracing, Wiper Blades, and Headlight Rims on Ground Nearby

PRESHOT AND POSTSHOT CONDITIONS OF AUTOMOBILES

Automobile Number 6 — 1950 Chevrolet,
Oriented Front-On at 15 psi

Automobile Part	Preshot Condition	Postshot Condition
Hood	Good	Passenger-Side Half Blown Off. Driver-Side Half Unlatched and Hanging on Hinge
Trunk Lid	Good	Unlatched; Lightly Crushed
Doors	Good (Four Doors)	All Four Open and Lightly Crushed
Roof	Good	Severely Crushed Down Center
Fenders	Good	All Lightly Crushed
Bumpers	Good	No Change
Windows	Good	All Blown Out Except Two Rear Side, Two Rear Quarter, and Driver-Side Vent
Tires	One Flat	One Additional Flat (Both on Driver's Side)
Hubcaps	All Four On	No Change
Chrome Trim	Good	No Sections Blown Off, Two Sections Hanging
Lights	Good	No Change
Outside Mirrors	Driver-Side Mirror Attached	Blown Off
Miscellaneous	Aerial Missing, Two License Plates On, Windshield Wipers Good, Roof Rack On	One Wiper Blade, Other Wiper and Roof Rack Blown Off. Rubber Window Liner, Windshield Wiper Blade on Ground Nearby

PRESHOT AND POSTSHOT CONDITIONS OF AUTOMOBILES

Automobile Number 7 — 1958 Chevrolet Biscayne,
Oriented Front-On at 50 psi

Automobile Part	Preshot Condition	Postshot Condition
Hood	Good	Blown Off
Trunk Lid	Latch Did Not Work, Wired Shut	Unlatched and One Hinge Broken; Drastically Crushed
Doors	Good (Four Doors)	Driver-Side Front Open, Others Jammed Closed; Both Driver-Side Doors Moderately Crushed, Both Passenger-Side Doors Very Severely Crushed
Roof	Good	Blown Off
Fenders	Good	Two Front Blown Off; Rear Moderately-Severely Crushed
Bumpers	Good	Front Loosened, Moderately Damaged
Windows	Good	All Blown Out
Tires	Passenger-Side Rear Flat	All Flat
Hubcaps	All Four Missing	No Change
Chrome Trim	One Section Missing	Twelve Sections Blown Off — About 60 Percent of Chrome Trim; Nine Sections Hanging
Lights	Driver-Side Taillight Broken	One Taillight Assembly (Two Lights) Blown Off, Two Taillights Broken, All Headlights and Headlight Rims Blown Off
Outside Mirrors	Two Attached	Both Blown Off
Miscellaneous	One Aerial Attached, License Plates Missing, Windshield Wipers Good	Aerial and Both Wiper Blades Blown Off. Headlight Rims, Chrome Sections, and Grill Section on Ground Nearby

PRESHOT AND POSTSHOT CONDITIONS OF AUTOMOBILES

Automobile Number 8 — 1961 Dodge Dart, Oriented Side-On (Passenger's Side Facing Blast) at 50 psi

Automobile Part	Preshot Condition	Postshot Condition
Hood	Good	Shell Blown Off, Framework Hanging
Trunk Lid	Good	Unlatched Framework Remained, on Hinges; Shell Blown Off
Doors	Good (Four Doors)	Driver-Side Front and Passenger-Side Rear Hanging, Passenger-Side Front Jammed Closed, Driver-Side Rear Jammed Open; Both Driver-Side Doors Severely Crushed, Both Passenger-Side Doors Very Severely Crushed
Roof	Good	Blown Off
Fenders	Good	Passenger-Side Front Hanging; Driver-Side Fenders Severely Crushed, Passenger-Side Fenders Very Severely Crushed
Bumpers	Good	No Change
Windows	Passenger-Side Front Missing	All Blown Out
Tires	Two Passenger-Side Tires Flat	All Flat
Hubcaps	All Four Missing	No Change
Chrome Trim	One Section Missing	Six Sections and Four Emblems Blown Off — About 90 Percent of Chrome Trim
Lights	One Headlight Missing (Dual Headlights)	Two of Four Taillights and all Parking Lights Broken; Three Headlight Rims and Three Headlights Blown Off
Outside Mirrors	Passenger-Side Mirror Attached But Loose	Blown Off
Miscellaneous	Aerial and License Plates Missing; Windshield Wipers Good	Both Wiper Blades Blown Off. Suspension Coil Spring, Taillight Assembly, Seat, Hood Hinge Spring, Chrome Section, and Manifold Pipe Exhaust on Ground Nearby.

PRESHOT AND POSTSHOT CONDITIONS OF AUTOMOBILES

Automobile Number 9 — 1960 Pontiac Laurentian, Oriented Side-On (Passenger's Side Facing Blast) at 10 psi

Automobile Part	Preshot Condition	Postshot Condition
Hood	Good	Hinges Bent (Rear) and Hood Severely Peaked Upwards in Rear
Trunk Lid	Latch Did Not Work, Wired Shut	Blown Open
Doors	Good (Four Doors)	Both Passenger-Side Doors Open and Moderately Crushed
Roof	Good	Rear Moderately Crushed
Fenders	Good	Passenger-Side Fenders Moderately Crushed
Bumpers	Good	No Change
Windows	Good Except Small Cracks in Front Windshield	All Blown Out Except Two Rear Quarter Windows
Tires	Good	No Change
Hubcaps	All Four Missing	No Change
Chrome Trim	One Section Missing	Five Small Chrome Emblems Blown Off — About 5 Percent of Chrome Trim; One Section Hanging
Lights	One Headlight Broken (Dual Headlights), Two Taillights Broken	Two Additional Headlights and Two Additional Taillights Broken; Two Headlight Rims Blown Off and Two Others Hanging
Outside Mirrors	Missing	No Change
Miscellaneous	Aerial and License Plates Missing, One Windshield Wiper Blade Missing	No Change in Windshield Wipers. Glass Fragments, Hood Spring, Small Chrome Decals on Ground Nearby

PRESHOT AND POSTSHOT CONDITIONS OF AUTOMOBILES

Automobile Number 10 — 1958 Mercury Monterey, Oriented Side-On (Driver's Side Facing Blast) at 15 psi

Automobile Part	Preshot Condition	Postshot Condition
Hood	Good	Unlatched (Rear) Open But Still Attached to Hinges (Front)
Trunk Lid	Good	Unlatched and Hanging on One Hinge; Moderately Crushed
Doors	Good (Four Doors)	All Jammed Shut; Both Driver-Side Doors Severely Crushed, Both Passenger-Side Doors Lightly Crushed
Roof	Good	Blown Off
Fenders	Good	Driver-Side Fenders Severely Crushed, Passenger-Side Fenders Lightly Crushed
Bumpers	Good	No Change
Windows	Good Except Crack in Passenger-Side Front	All Blown Out
Tires	Driver-Side Front Flat	No Change, Spare Blown Out of Trunk
Hubcaps	All Four Missing	No Change
Chrome Trim	Two Sections Missing	Nine Additional Sections Blown Off — About 50 Percent of Chrome Trim; Four Sections Hanging
Lights	Good	Two Headlights and Both Front Parking Lights Broken, One Headlight, Two Headlight Rims, One Headlight Socket, and One Complete Taillight Assembly Blown Off
Outside Mirrors	Missing	No Change
Miscellaneous	Aerial Missing, Two License Plates On, Windshield Wipers Good	Front License Plate and Both Wiper Blades Blown Off. Chrome Sections, Taillight Assembly, Headlight Rims, and Spare Tire on Ground Nearby

PRESHOT AND POSTSHOT CONDITIONS OF AUTOMOBILES

Automobile Number 11 — 1959 Plymouth Belvedere, Oriented Side-On (Driver's Side Facing Blast) at 30 psi

Automobile Part	Preshot Condition	Postshot Condition
Hood	Good	Blown Off
Trunk Lid	Good	Unlatched; Wheel Cover Off; Moderately Crushed
Doors	Good (Four Doors)	Both Driver-Side Doors Jammed Shut and Very Severely Crushed; Both Passenger-Side Doors Lightly Crushed
Roof	Good	Shell Blown Off
Fenders	Good	Driver-Side Front Blown Off; Passenger-Side Fenders Lightly Crushed, Driver-Side Rear Very Severely Crushed
Bumpers	Good	No Change
Windows	Good	All Blown Out
Tires	Good	No Change
Hubcaps	One On	Blown Off
Chrome Trim	Two Sections Loose	Nine Sections and Two Chrome Emblems Blown Off — About 75 Percent of Chrome Trim; Three Sections Hanging
Lights	Passenger-Side Taillight Broken (Dual Headlights)	Three Headlights, Three Headlight Rims, Two of Four Headlight Sockets and Taillight Assembly Blown Off; Headlight Broken
Outside Mirrors	Missing	No Change
Miscellaneous	Two Aerials Attached, License Plates Missing, Windshield Wipers Good	Both Aerials and One Wiper Blade Blown Off. Chrome Sections, Seats, Wheel Cover, Roof Brace, Dash Section, and Headlight Rim on Ground Nearby

PRESHOT AND POSTSHOT CONDITIONS OF AUTOMOBILES

Automobile Number 12 — 1950 Chevrolet,
Oriented Front-On at 30 psi

Automobile Part	Preshot Condition	Postshot Condition
Hood	Good	Blown Off
Trunk Lid	Good	Unlatched Framework Remained, on Hinges; Shell Blown Off
Doors	Good (Four Doors)	Both Driver-Side Doors Hanging; Both Driver-Side Doors Slightly Crushed, Both Passenger-Side Doors Moderately Crushed
Roof	Good	Severely Peaked Upwards Down Center
Fenders	Good	Driver-Side Fenders Slightly Crushed, Passenger-Side Fenders Moderately Crushed
Bumpers	Good	No Change
Windows	Good Except Two Large Cracks in Front Windshield	All Blown Out Except Two Side Vents
Tires	Good	No Change
Hubcaps	All Four Missing	No Change
Chrome Trim	Two Sections Loose	Six Sections Blow Off — About 60 Percent of Chrome Trim; Two Sections Hanging
Lights	One Rear Parking and One Taillight Broken	Front Parking Lights and Headlights Broken
Outside Mirrors	Missing	No Change
Miscellaneous	Aerial and License Plates Missing; Windshield Wipers Good	Both Wiper Blades Blown Off. Chrome Sections, Floor Mats on Ground Nearby

PRESHOT AND POSTSHOT CONDITIONS OF AUTOMOBILES

Automobile Number 13 — 1958 Plymouth Fury, Oriented Front-On at 30 psi

Automobile Part	Preshot Condition	Postshot Condition
Hood	Good	Shell With Latch Assembly Blown Off
Trunk Lid	Good	Unlatched and Jammed Open: Drastically Crushed
Doors	Good (Four Doors)	All Jammed Shut Except Passenger-Side Front Open; Both Driver-Side Doors Lightly Crushed, Both Passenger-Side Doors Moderately Crushed
Roof	Good	Blown Up and Attached on Passenger Side Only; Severely Crushed in Rear and Severely Peaked in Front
Fenders	Good	Front Fenders Hanging: Passenger-Side Rear Moderately Crushed, Driver-Side Rear Slightly Crushed
Bumpers	Good	No Change
Windows	Good Except Front Windshield Badly Cracked	All Blown Out Except Two Side Vents and Driver-Side Rear Quarter Window
Tires	All Flat Except Passenger-Side Front	No Change
Hubcaps	Driver-Side Rear On	Blown Off
Chrome Trim	Good	Twenty-One Sections Blown Off — About 70 Percent of Chrome Trim: Ten Sections Hanging
Lights	Two Headlights Broken (Dual Headlights)	Front Parking Lights and One Additional Headlight Broken: One Headlight and One Headlight Rim Blown Off
Outside Mirrors	Two Attached	Both Blown Off
Miscellaneous	One Aerial Attached: License Plates Missing: Windshield Wipers Good	Aerial Blown Off. Headlight Rim, Chrome Sections, and Hood Hinge Spring on Ground Nearby

REFERENCES

1. F. M. Sauer, W. L. Fons, and T. G. Storey, "Blast Damage to Coniferous Tree Stands by Atomic Explosions," Project 3.19, Operation Upshot-Knothole, WT-731, U.S. Forest Service, Division of Fire Research, January 1954.

2. W. L. Fons and T. G. Storey, "Blast Effects on Tree Stand," Project 3.3, Operation Castle, WT-921, U.S. Forest Service, Division of Fire Research, March 1955.

3. N. J. DeCapua and E. F. Witt, "Debris Studies Projects 1.05, 1.07, and 1.08," Operation Distant Plain Symposium Report (U), DASA 1947-1, Vol I, September 1967, pp 264-233.

4. E. F. Witt, "Projects LN105, LN107, and LN108 Building Fragmentation and Debris Transport Tests (U)," Operation Prairie Flat Symposium Report, DASA 2377-2, Vol II, February 1970, pp 1-42 (SECRET).

5. P. J. Morris and C. Wilton, "Debris from Trees Subjected to Blast," URS Research Company, URS 794-1, May 30, 1970.

6. E. J. Briant and J. D. Day, "Effects of Rough Terrain on Drag-Sensitive Targets (U)," Project 1.8B, Operation Plumbbob, AD344937L, Ballistics Research Laboratories, November 1959 (CONFIDENTIAL).

7. H. S. Burden and J. D. Day, "Transient Drag Loading of Actual and Idealized Shapes from High-Yield Detonations (U)," Project 1.5, Operation Redwing, AD361774L, Ballistics Research Laboratories, March 1960 (SECRET RESTRICTED DATA).

8. L. Giglio-Tos, "Fundamental Blast Studies," Event Dial Pack Preliminary Report, DASA 2606-I, Vol I, Part 1, May 1971, pp 17-36.

9. A. M. Patterson, "Blast Anomalies Studies," Event Dial Pack Preliminary Report, DASA 2606-I, Vol I, Part 1, May 1971, pp 37-60.

10. J. Zaccor, P. J. Morris, K. Kaplan, and R. Rhoda, "Prediction and Significance of Forest Damage from a 50-Ton HE Surface Burst," Project 7.01, Operation Distant Plain, Event 4, DASA-2065, URS Systems Corporation, June 1967.

11. Wood Handbook, U.S. Department of Agriculture, Forest Product Laboratory of Forest Service, Agriculture Handbook No. 72, U.S. Government Printing Office, 1955, pp 55-77.

12. E. F. Witt, "Tree and Automobile Debris," Event Dial Pack Preliminary Report, DASA 2606-I, Vol I, Part 1, May 1971, pp 153-184.

13. E. R. Fletcher and I. G. Bowen, "Blast-Induced Translational Effects," Annals of New York Academy of Sciences, Vol 152, Article 1, October 28, 1968, pp 378-402.