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16. ABSTRACT

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November 2005, Division of Research and Innovation

State of California
Department of Transportation
Division of New Technology and Research

IMPLEMENTATION PACKAGE FOR USING DISCARDED TIRES IN HIGHWAY MAINTENANCE

FINAL REPORT # CA/TL-89/10
CALTRANS STUDY #R88TL63
3rd Printing

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Chief, Division of New Technology
and Research

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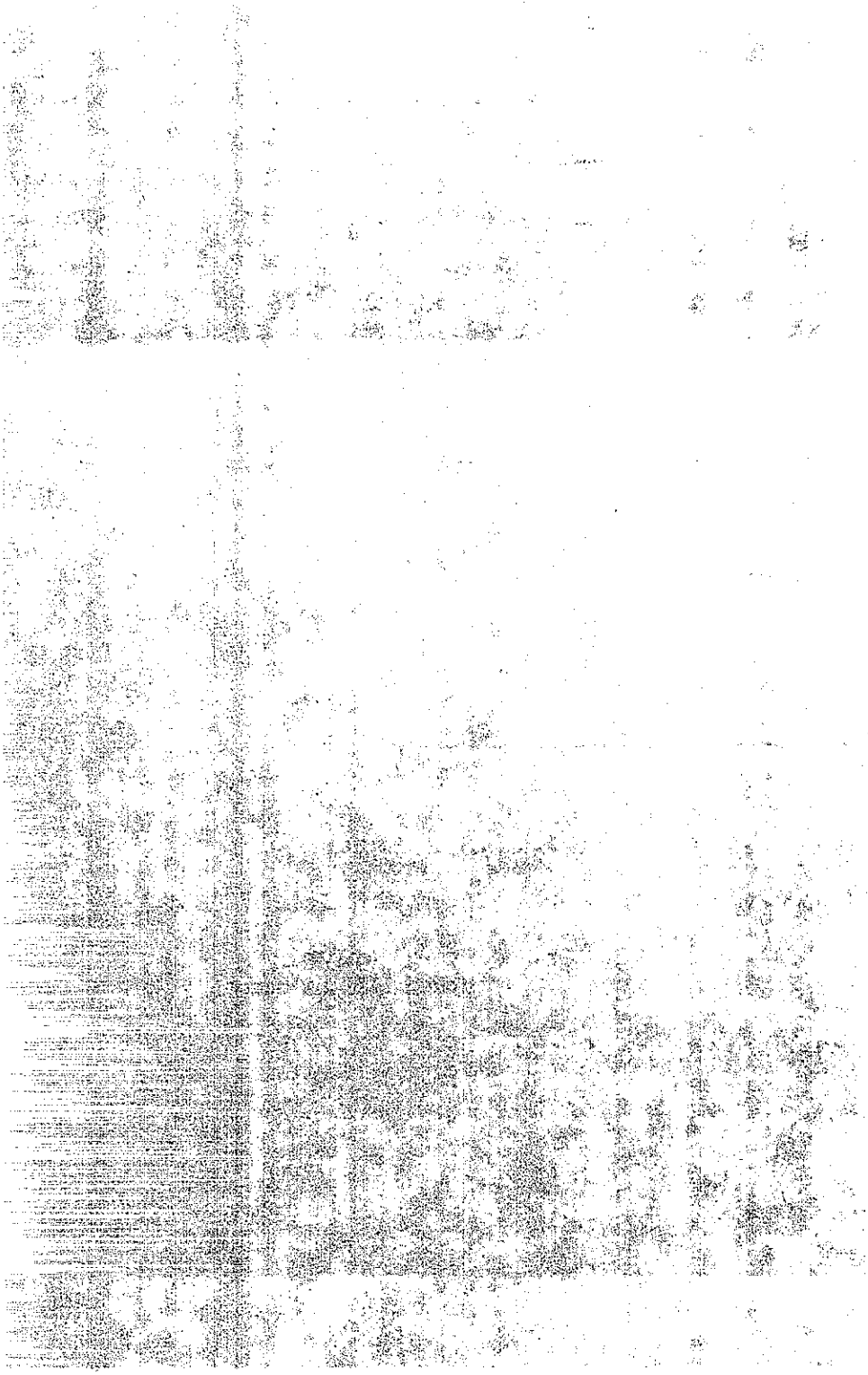

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16. ABSTRACT

This report describes the implementation package on "Guidelines For Using Tire Carcasses In Highway Maintenance" which consists of a promotional brochure, a design information bulletin and a 20 minute slide/audio-cassette presentation that outline the benefits of using discarded tires and salvaged materials in Shoulder Reinforcement and in Channel Slope Protection.

In summary, this implemantation package is designed to help maintenance personnel use discarded tires and other salvaged materials in their work.

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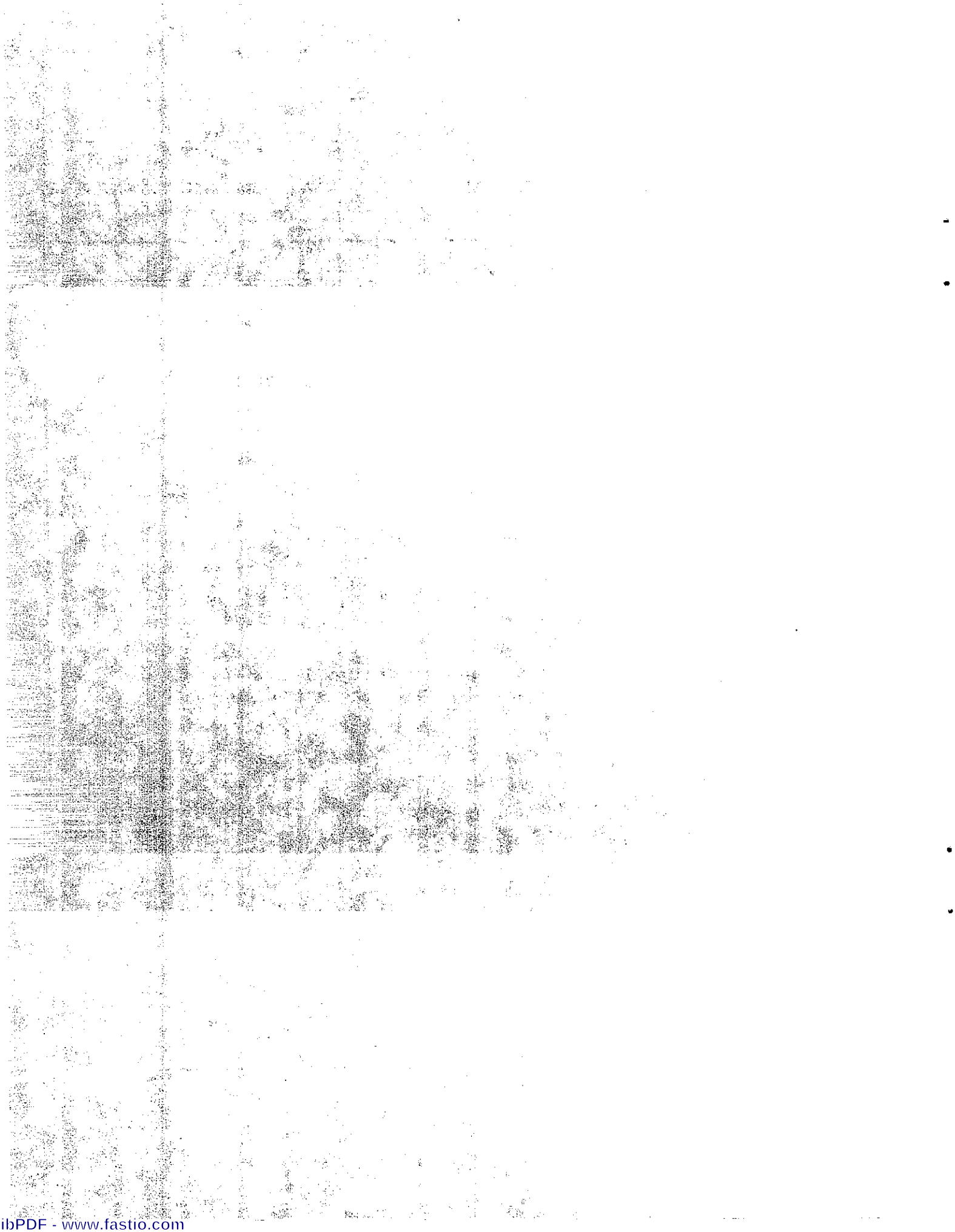

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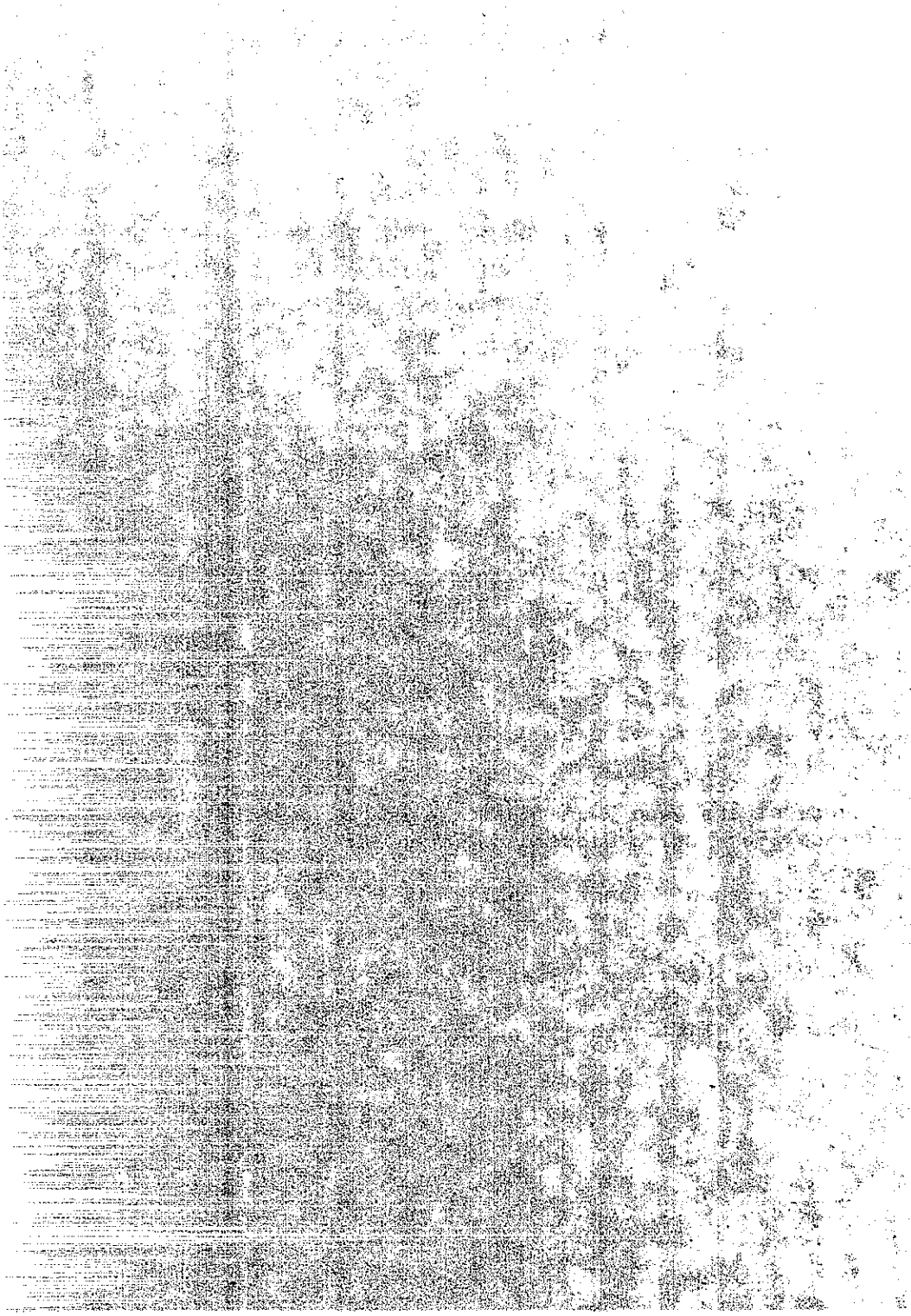

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- o Slide presentation-script
- o Flier
- o Brochure

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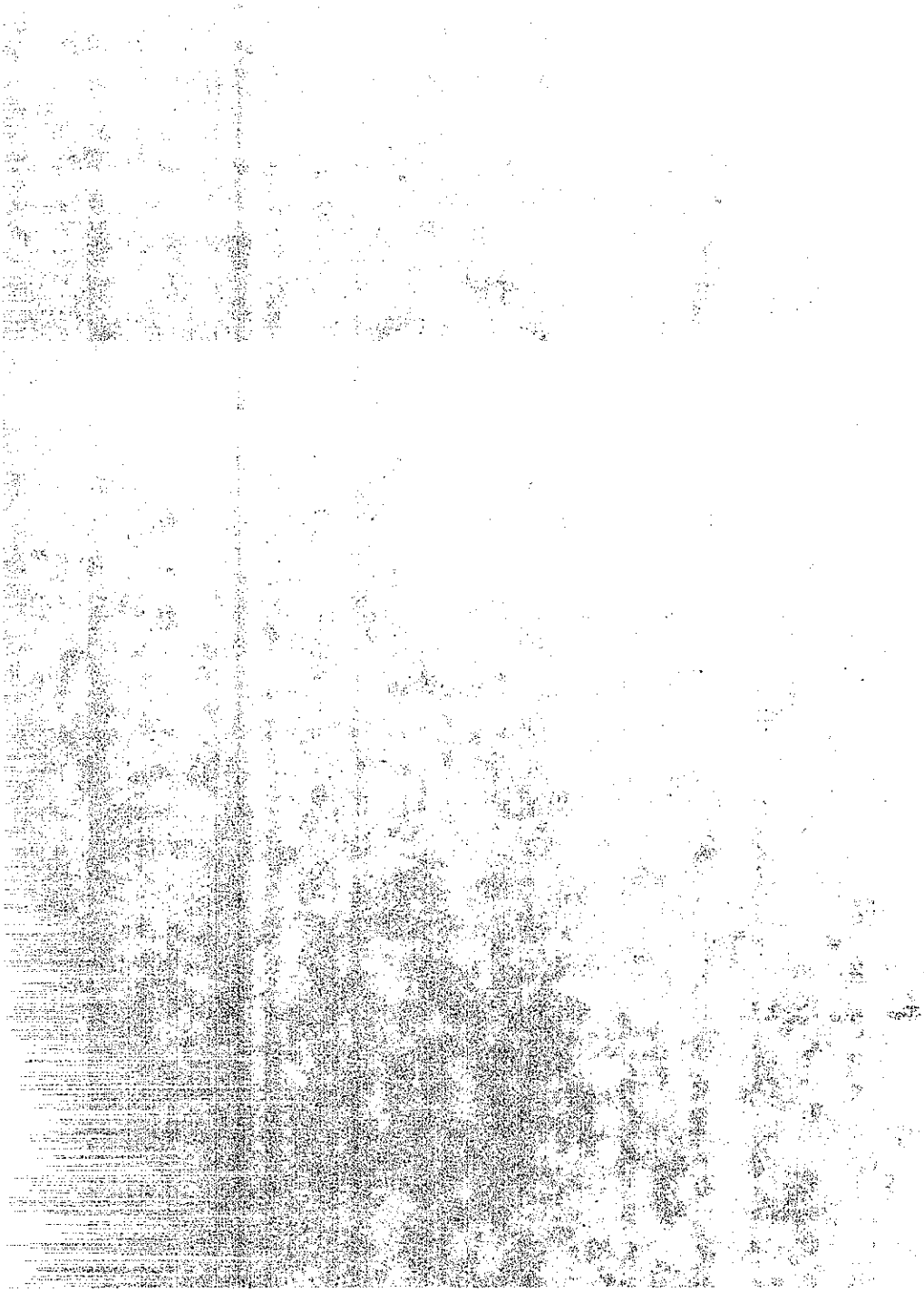

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1. INTRODUCTION

The Final Report of the research project " Guidelines For Using Tires Carcasses In Highway Maintenance" has been approved. In a Memorandum, Mr. E.O. Spartz, Chief, Value Engineering and Resouce Conservation Branch, has recommended that an implementation package be prepared to encourage wider use of used tires in highway maintenance.

The implementation package consisting of a slide presentation, and a design information package is available for interested persons.

Finally, the implementation package is designed to help maintenance personnel use discarded tires and other salvaged materials in their work.

2. OBJECTIVES

To introduce highway maintenance personnel to the beneficial uses of used tires in shoulder reinforcement and in controlling channel erosion.

3. IMPLENTATION AND BENEFITS

The use of dicarded tires in highway construction or maintenance projects such as shoulder reinforcement or channel slope protection, will provide both design and maintenance personnel with a short term solution. Using readily available, low cost, discarded tires in lieu of more expensive new materials can provide substantial cost savings.

The availability, combined with the low cost of acquiring and installing discarded tires, makes tires the ideal solution for many emergency problems which occur on California highways.

Finally, the slide program and the brochure will be available for audiences within and outside of Caltrans interested in using discarded tires. Partial list of audiences within Caltrans are:

- o The Maintenance Academy Classes
- o Design Engineers' Meetings
- o Hydraulic Engineers' Meetings
- o Specific District Presentations
- o Regional Maintenance Managers' and Superintendents' Meetings.

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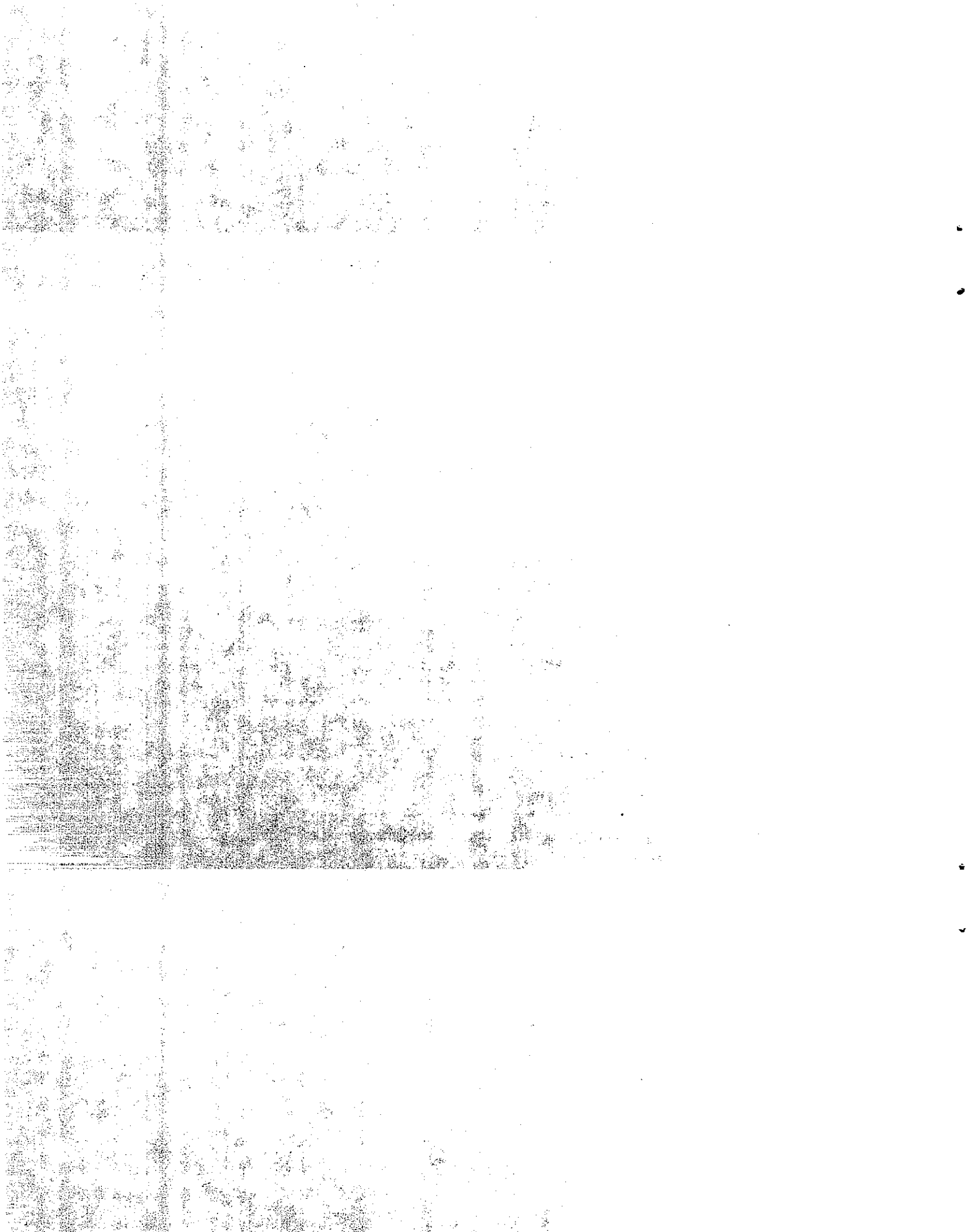

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4. DISCUSSION

4.1- AUDIOVISUAL PRESENTATION:

The audiovisual presentation consists of two parts:

The first part presents Caltrans' Transportation Laboratory research on two aspects of using discarded tires. The main purpose of these studies is not only to restore eroded slopes to normal condition, but also to minimize future erosion. The two methods "Shoulder Reinforcement" and "Channel Slope Stabilization" were effective in reducing erosion and they were found to be cost-effective for short term solutions.

The second part deals with the guidelines for using discarded tires in "Shoulder Reinforcement" and in "Channel Slope Protection".

Four aspects should be considered during design of a shoulder reinforcement project. They are:

- Site applicability
- Aesthetics
- Feasibility
- Cost comparison

And five aspects should be considered during design of a channel slope protection project. They are:

- Site applicability
- Aesthetics
- Feasibility
- Cost comparison
- Hydraulic analysis

The 20-minute presentation consists of 80 slides with an audio-cassette. Prints of the slides along with the accompanying script are in the Appendix.

4.2- PROMOTIONAL FLIER:

The Promotional Flier is a two page multicolor form (Appendix). The front page shows pictures of the highway shoulder and the channel slope before and after the construction by using discarded tires. The back page deals with the plan view, elevation view and typical section of the design of a shoulder reinforcement and a channel slope protection.

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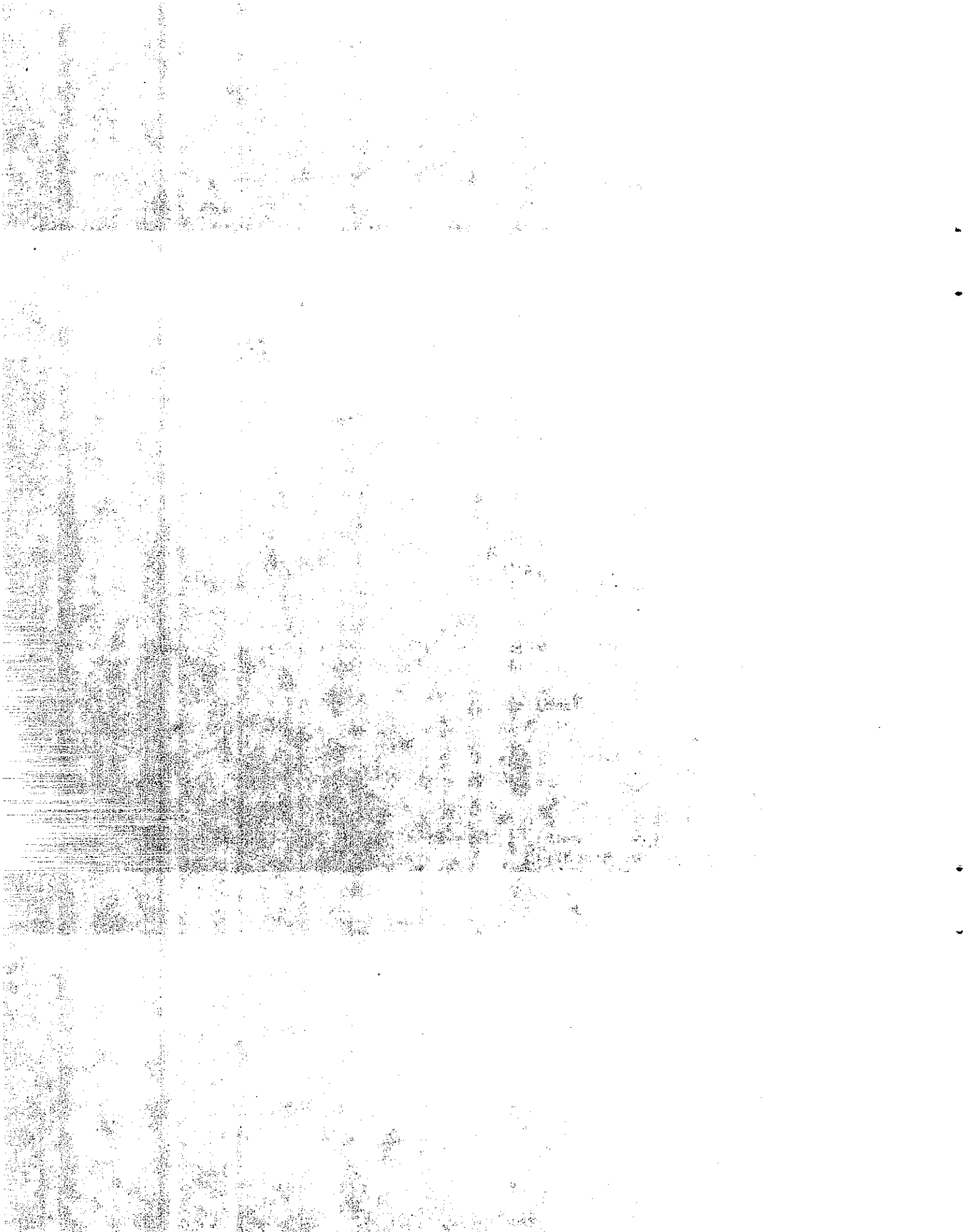

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4.3- DESIGN INFORMATION BROCHURE:

The Design Information Brochure (Appendix) consists of:

- The Research Findings
- The Research Recommendations
- The Construction Procedures and Practices

of the shoulder reinforcement and the channel slope protection. The brochure, including the two drawing sheets, contains the guidelines for the use of discarded tires for controlling erosion of embankment and controlling erosion on channel banks. These guidelines are plans which allow designers to develop discarded tire projects. They will also provide maintenance personnel with an immediate solution for an erosion problem until more permanent measures can be undertaken.

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APPENDIX

- Slide Presentation - Script
- Flier
- Brochure

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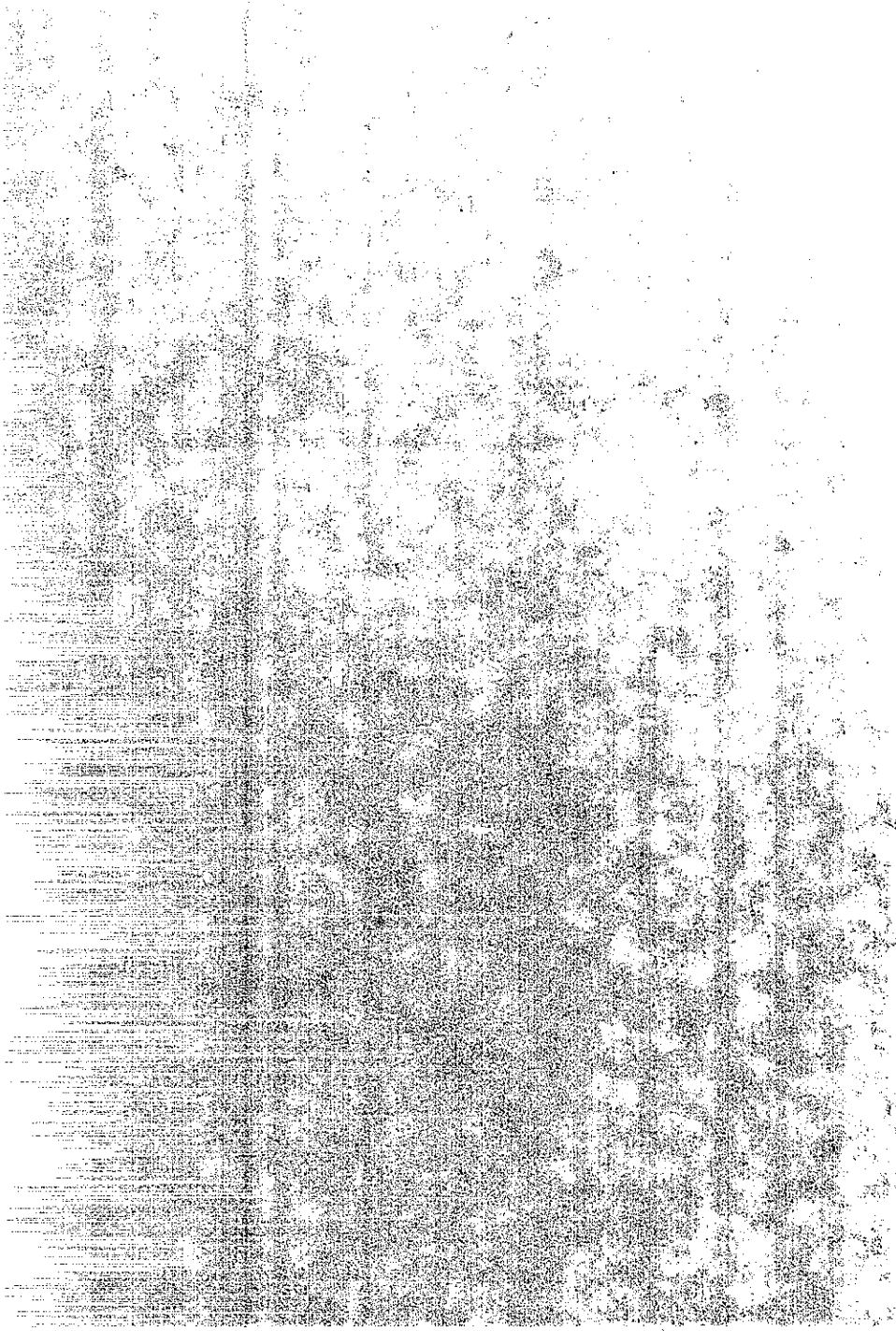

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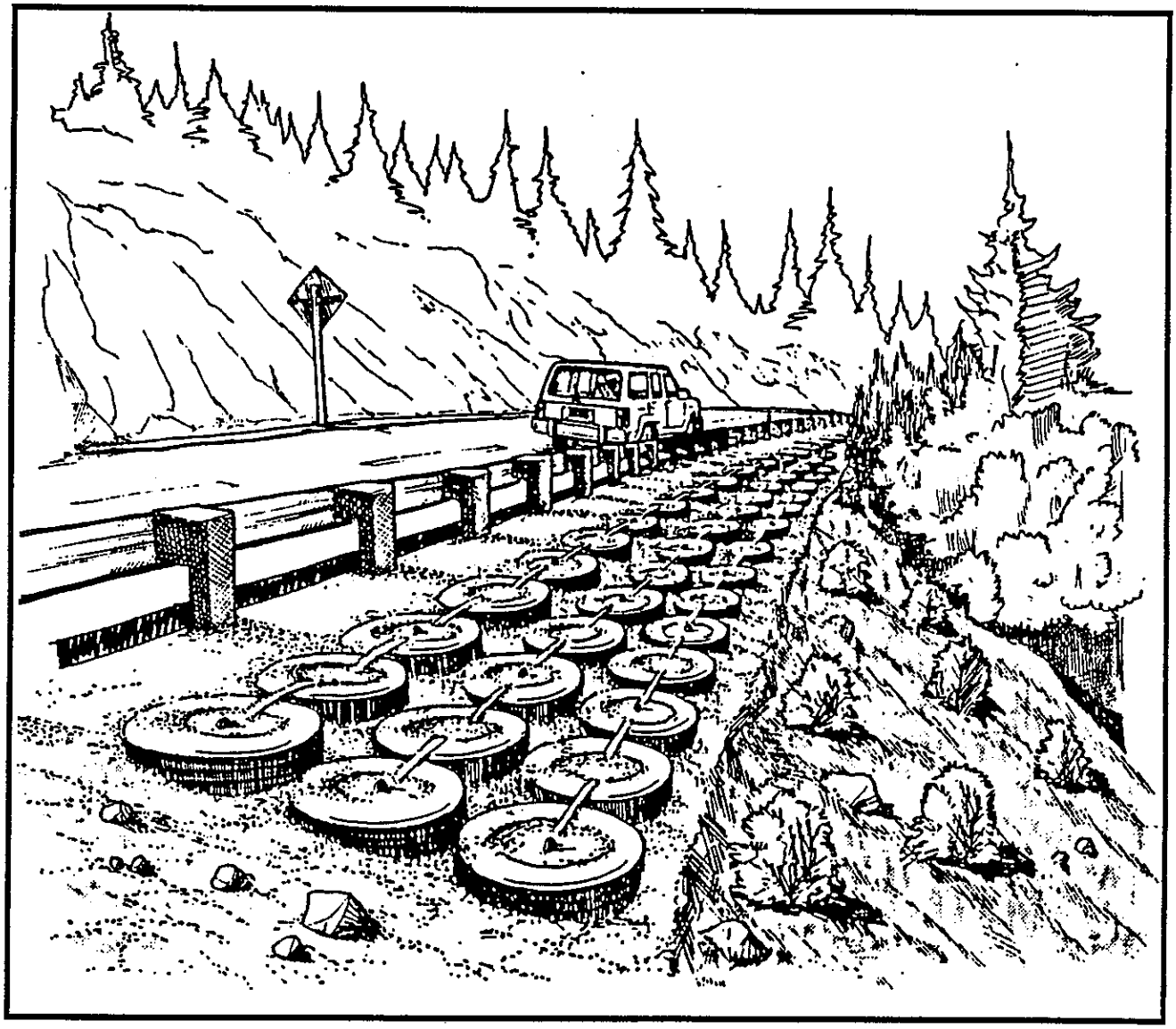
SLIDE PRESENTATION

USE OF DISCARDED TIRES IN HIGHWAY MAINTENANCE

SCRIPT



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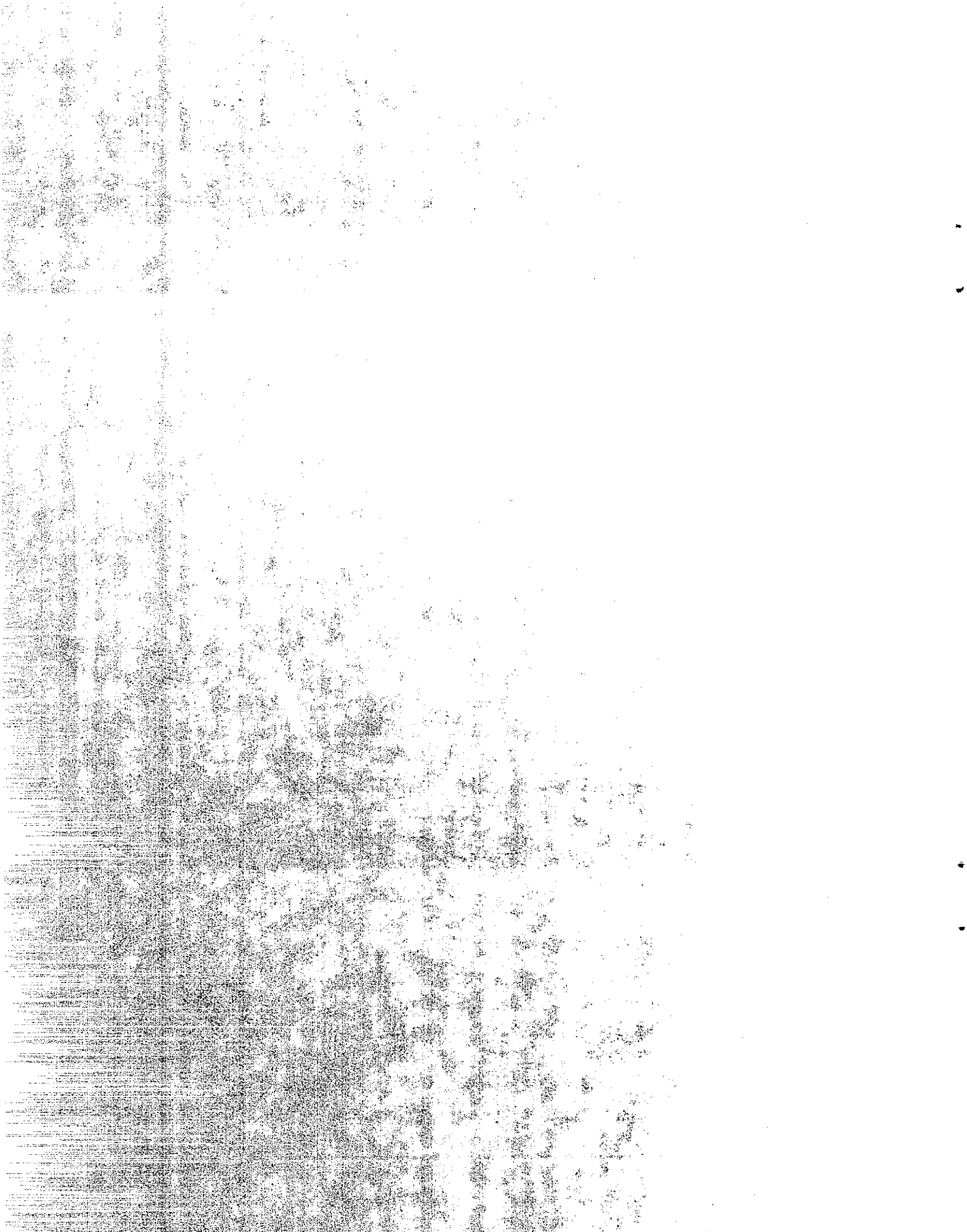

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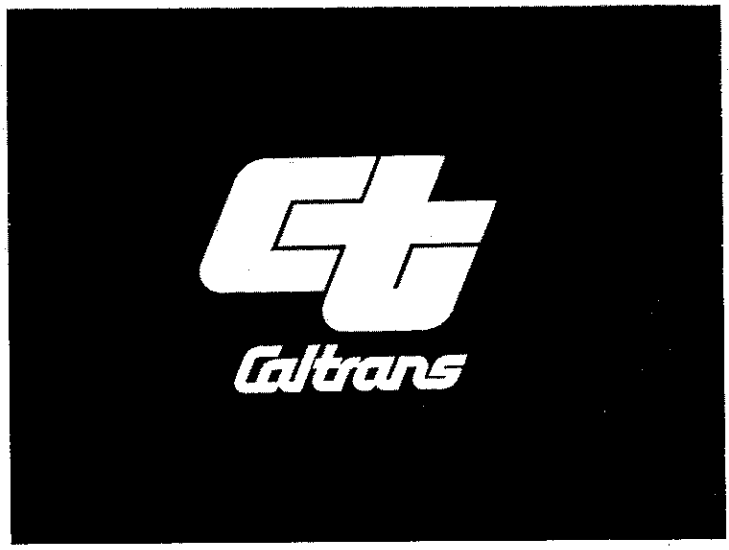

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SLIDE 1- This implementation package was prepared and presented by the Water Quality and Solid Waste Section of the Research and Enviro-Chemical Services Branch, at the Office Of Transportation Laboratory, Sacramento, California which provided the funding. This project received the Excellence In Research Award from the California of Transportation

"EXCELLENCE IN RESEARCH AWARD"

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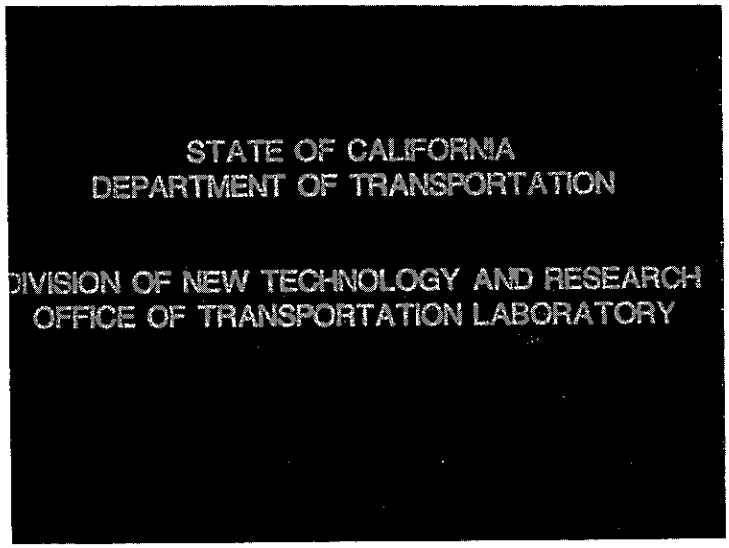
SLIDES 2,3- This is a presentation on how to use discarded tires for highway maintenance purposes. We are going to show you a couple of research projects using discarded tires for shoulder stabilization and channel slope protection. The research was conducted by the Caltrans-Transportation Laboratory between 1982 and 1986.

At the end of this presentation we will show you the method of installing discarded tires on shoulder stabilization and on channel slope protection projects.



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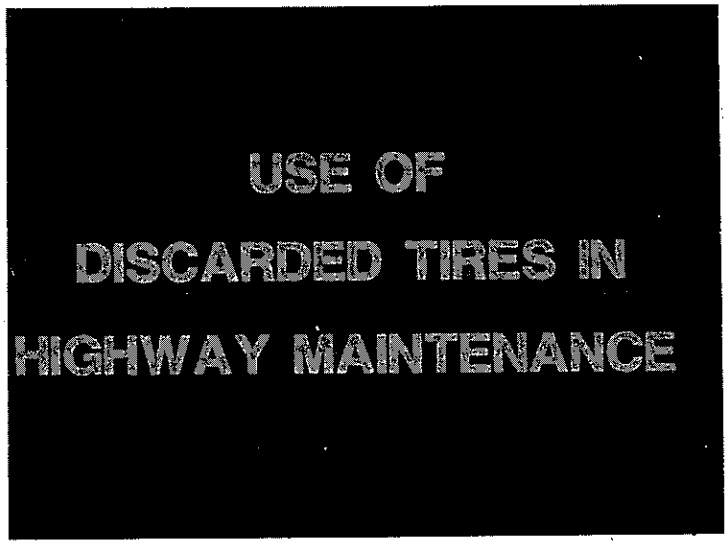

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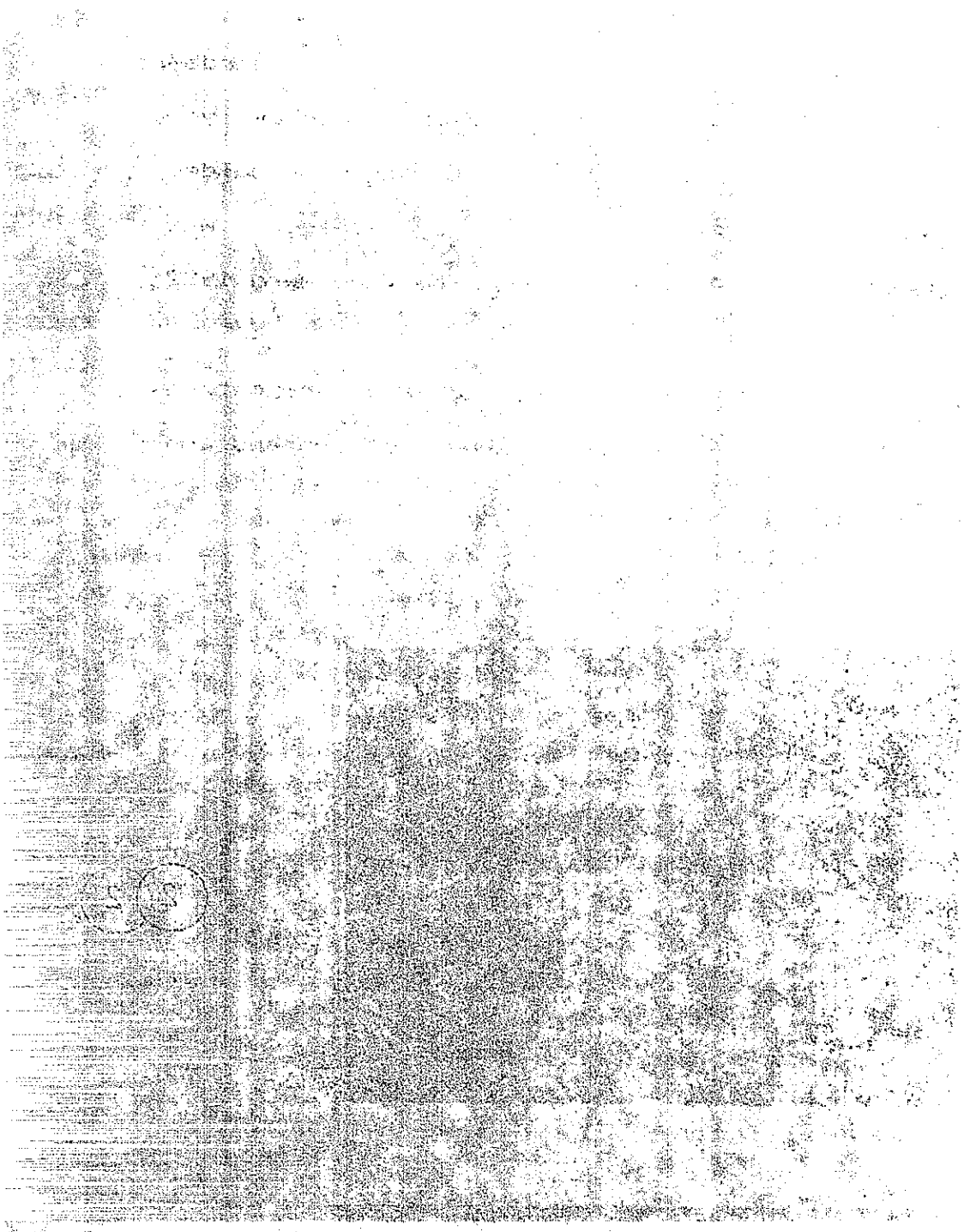

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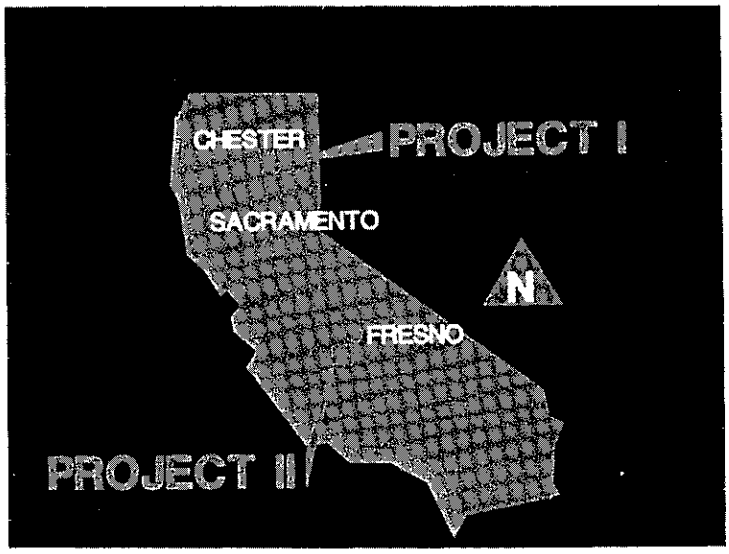

SLIDE 4 - Discarded tires have been used as retaining walls as well as many other purposes. This map shows the locations of two projects initiated by Caltrans' District maintenance personnel and studied by the Caltrans-Transportation Laboratory to control shoulder erosion and channel slope erosion.

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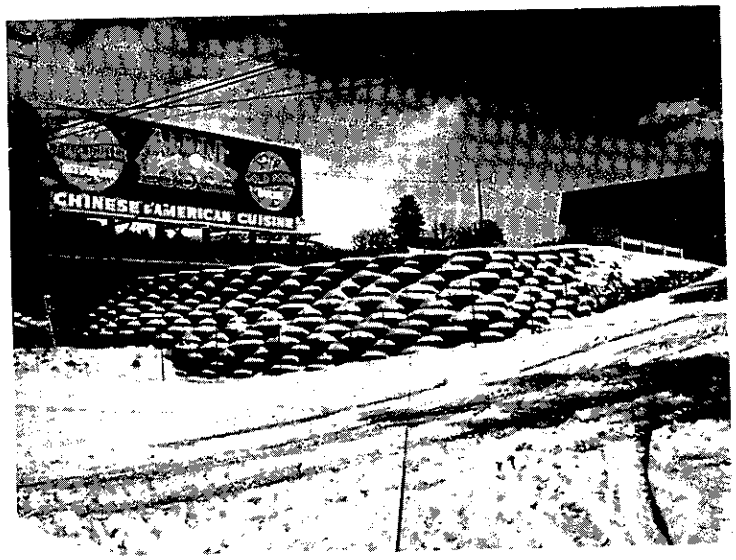

SLIDE 5 -There are numerous examples of how discarded tires are being used in our society. Here is an example of discarded truck tires installed by a private property owner in order to provide an elevated parking pad for his business in the City of Mt. Shasta.

SLIDE 6 -This is an example of an aesthetic treatment on the discarded tire retaining wall in the City of Mt. Shasta.

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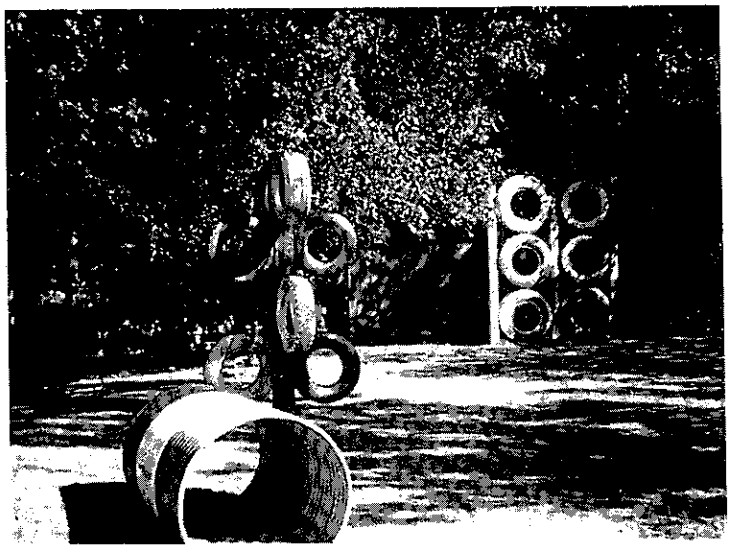

SLIDE 7 - Discarded tires used in a children's playground is another example.

SLIDE 8 - Discarded tires were used along Route 32 in Tehama County in 1981 to rebuild a severely eroded shoulder. This project was completed by Caltrans Maintenance personnel in Redding.

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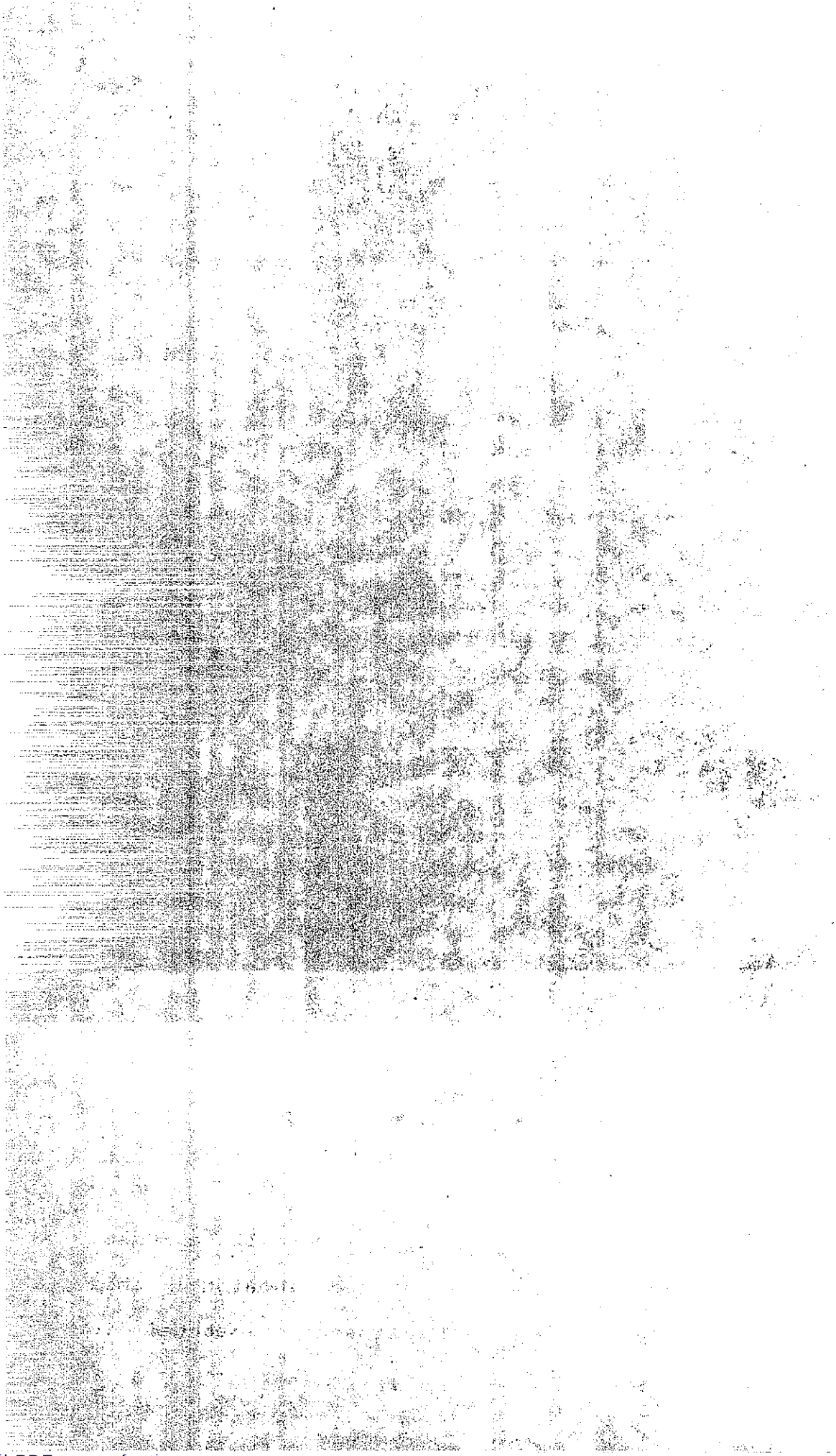

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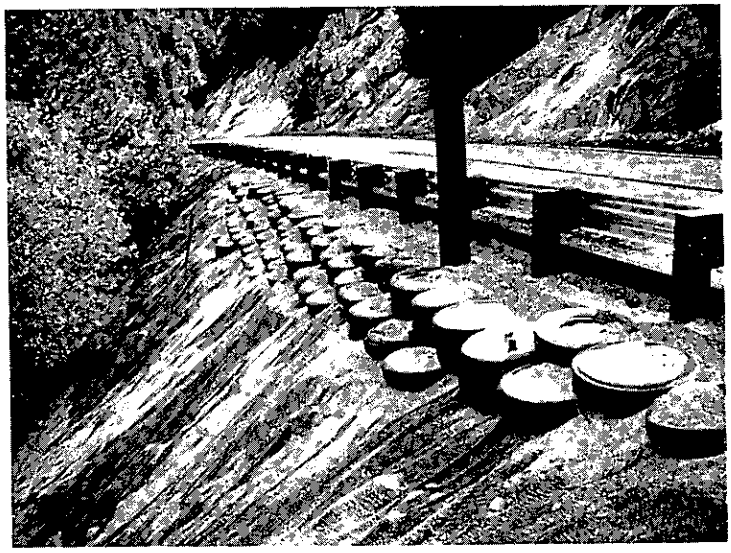
SLIDE 9 - Discarded automobile tires were also used in Plumas County along Route 70 at several locations in 1983 by Caltrans Maintenance personnel in Redding. The shoulders were stabilized and the slopes restored to normal condition.



SLIDE 10 - One of the methods of preventing slope erosion is to combine a discarded tire wall with other erosion control materials. This method is useful for restoring vegetation on the lower slope and put to use in Riverside County on Route 247 by Caltrans engineers in San Bernardino under a minor contract in 1984.

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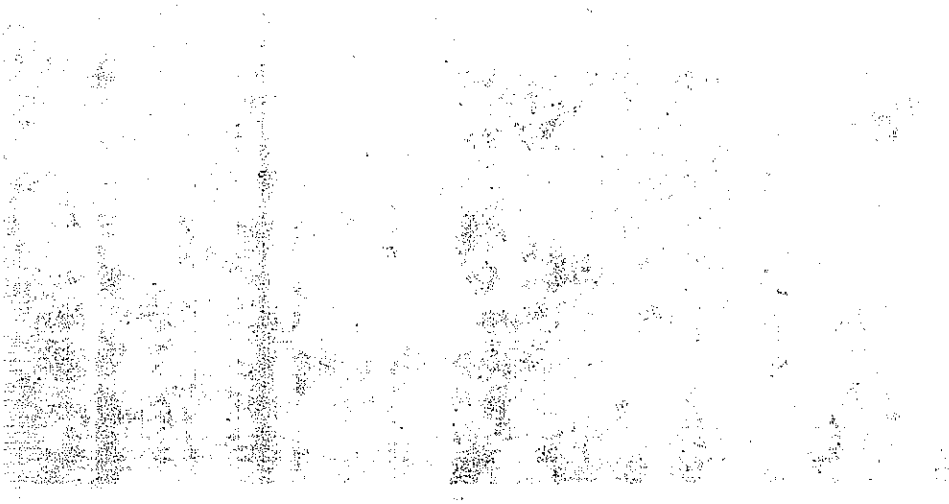

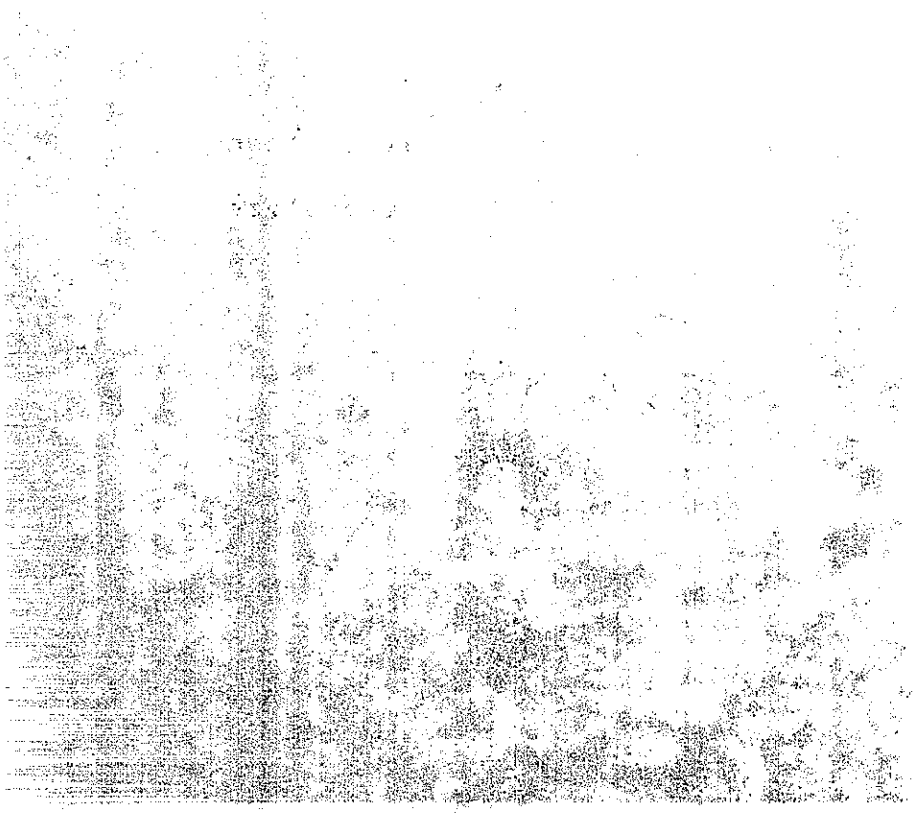

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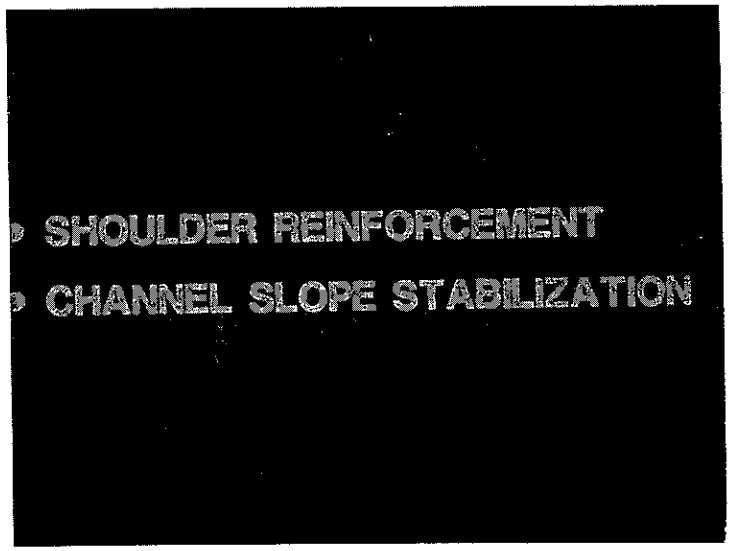

SLIDE 11 - Caltrans- Tranportation Laboratory studied the following two aspects using discarded tires. The main purpose of these studies is not only to restore eroded slopes to normal condition but also to minimize future erosion.The two methods SHOULDER REINFORCEMENT and CHANNEL SLOPE STABILIZATION were effective in reducing erosion and they were found to be cost competitive for short term solutions.

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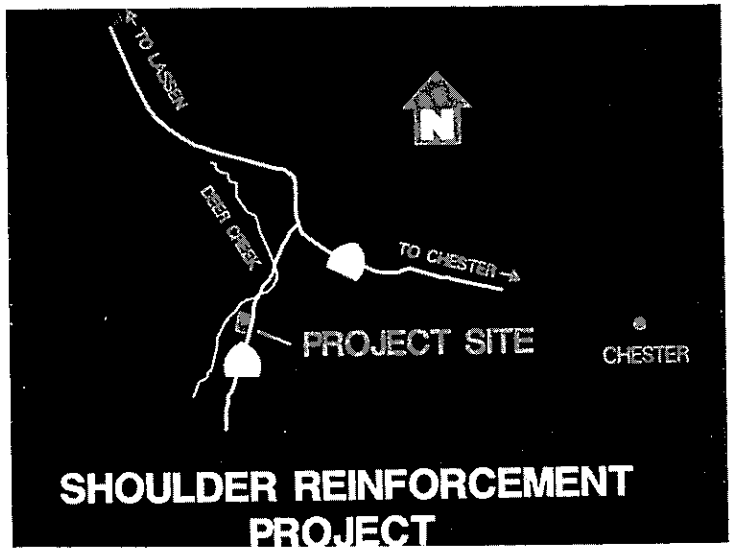
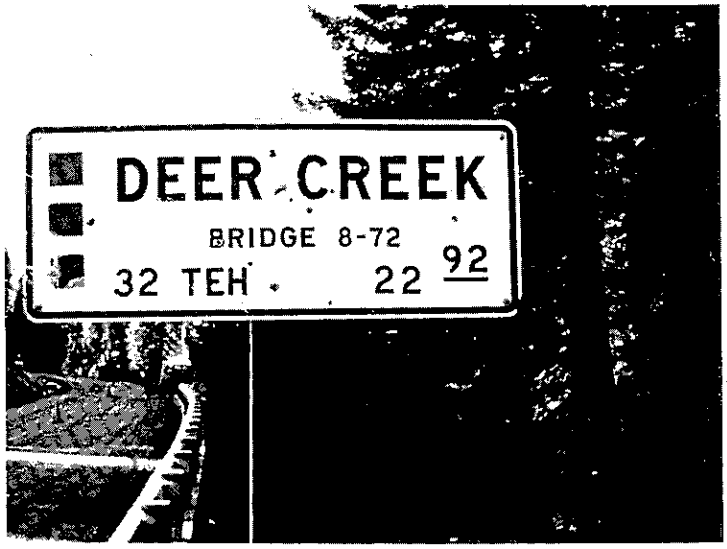
SLIDES 12,13 - The first Shoulder Stabilization project is located on Route 32 in Tehama County near Deer Creek. Two separate units were installed, one with engineering fabric and the other without engineering fabric .The purpose of using engineering fabric is to determine its effectiveness in retaining fine material, thus minimizing erosion.





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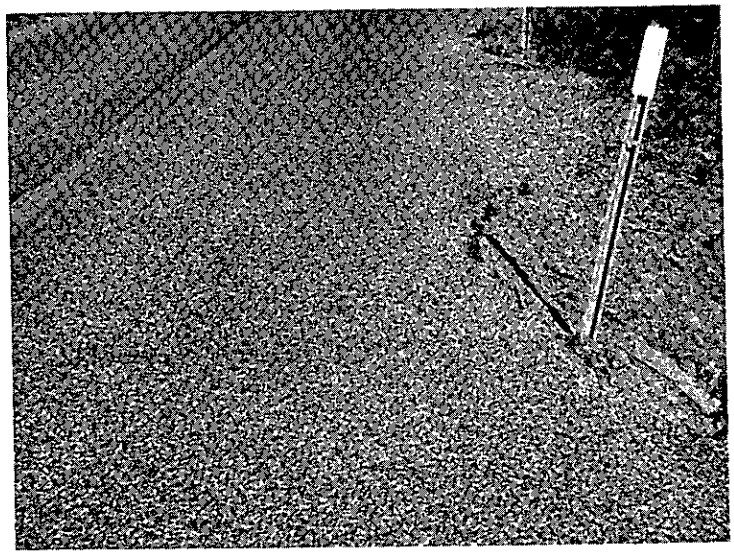
SLIDE 14 - The arrow shows engineering fabric used to cover the bottom layer of tires.



SLIDE 15 - Prior to the installation, the severely eroded slope was encroaching onto the travelled way. We will now look at the construction procedure adopted during the installation of the first unit.

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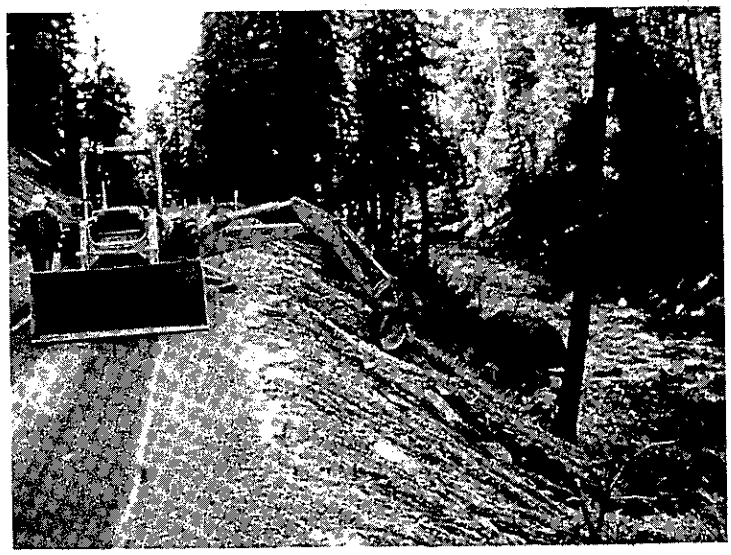

SLIDE 16 - A bench had to be excavated first in the eroded slope so engineering fabric could be placed prior to arranging discarded tires. The width of the bench was two truck tires wide plus a minimum of six inches. A backhoe was used for this excavation.

SLIDE 17 - Fine grading was done by Caltrans maintenance personnel to develop a level bench.

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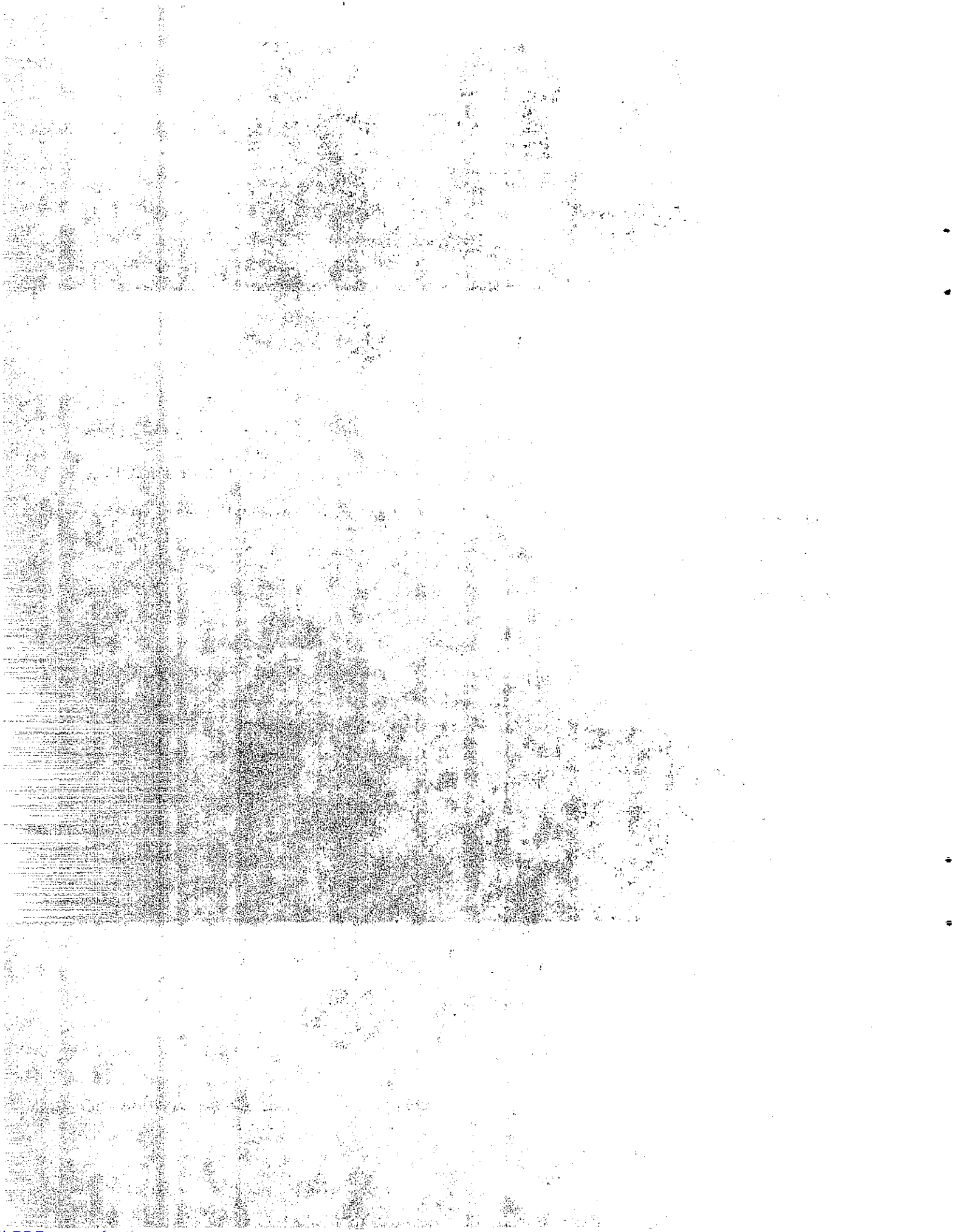

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SLIDES 18,19,20 - Engineering fabric was placed on the bench followed by two rows of discarded truck tires. The two rows were placed in a staggered fashion. The truck tires were held together by using steel clips fabricated from 1/2 inch steel rebars. The tires and steel clips became a tire mat. Salvaged orange snow poles , as shown by the arrow , were driven into every fourth truck tire in the inside row to increase the stability of the tire mat-fabric assemblage.

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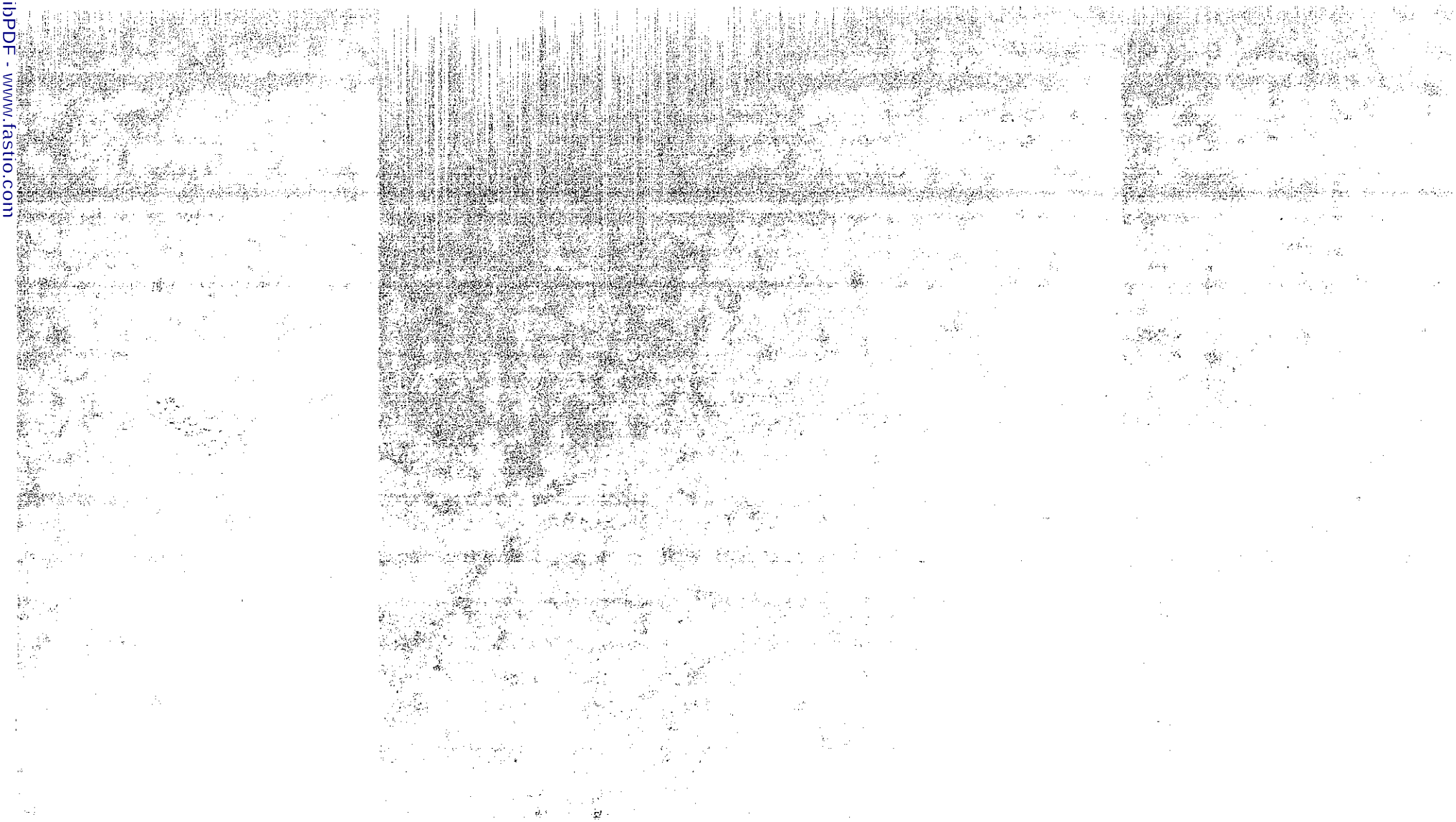

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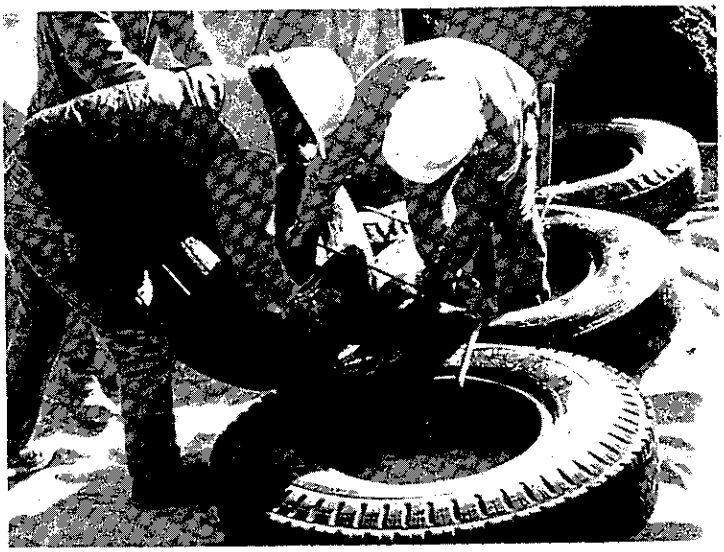

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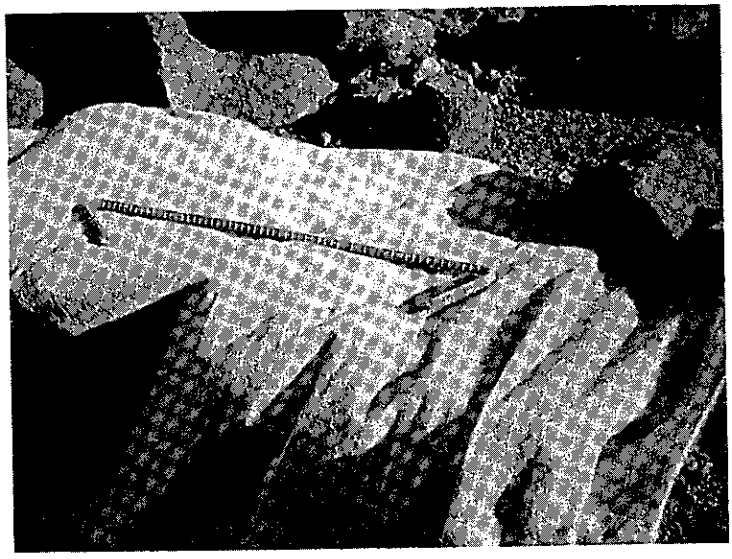

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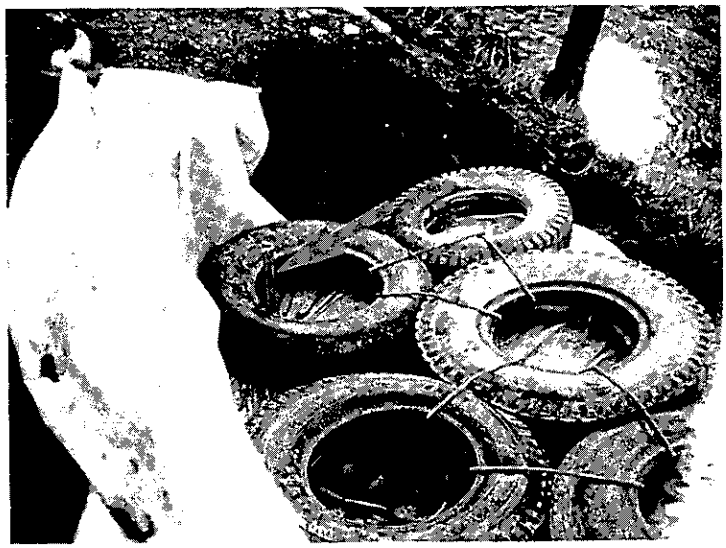

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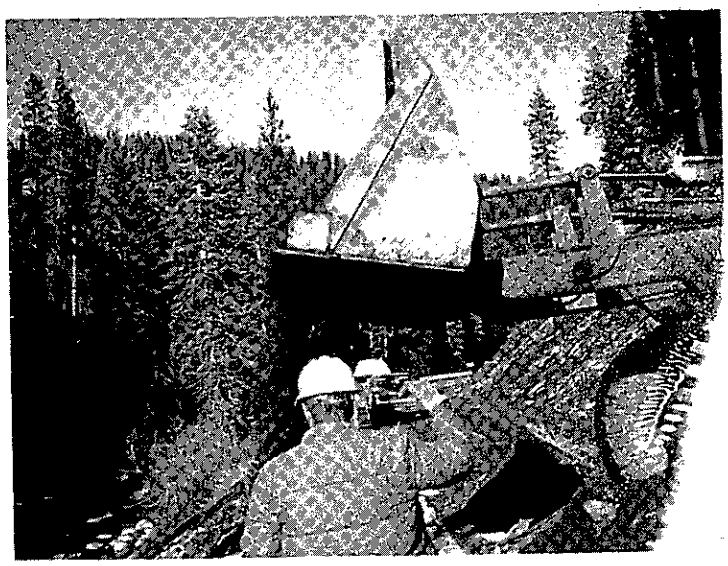
SLIDES 21,22 – The first layer of tire mat was backfilled with previously excavated soil material using a backhoe. The backfill was compacted using tampers. A six inch layer of soil was placed on top of the first layer of tire mat.



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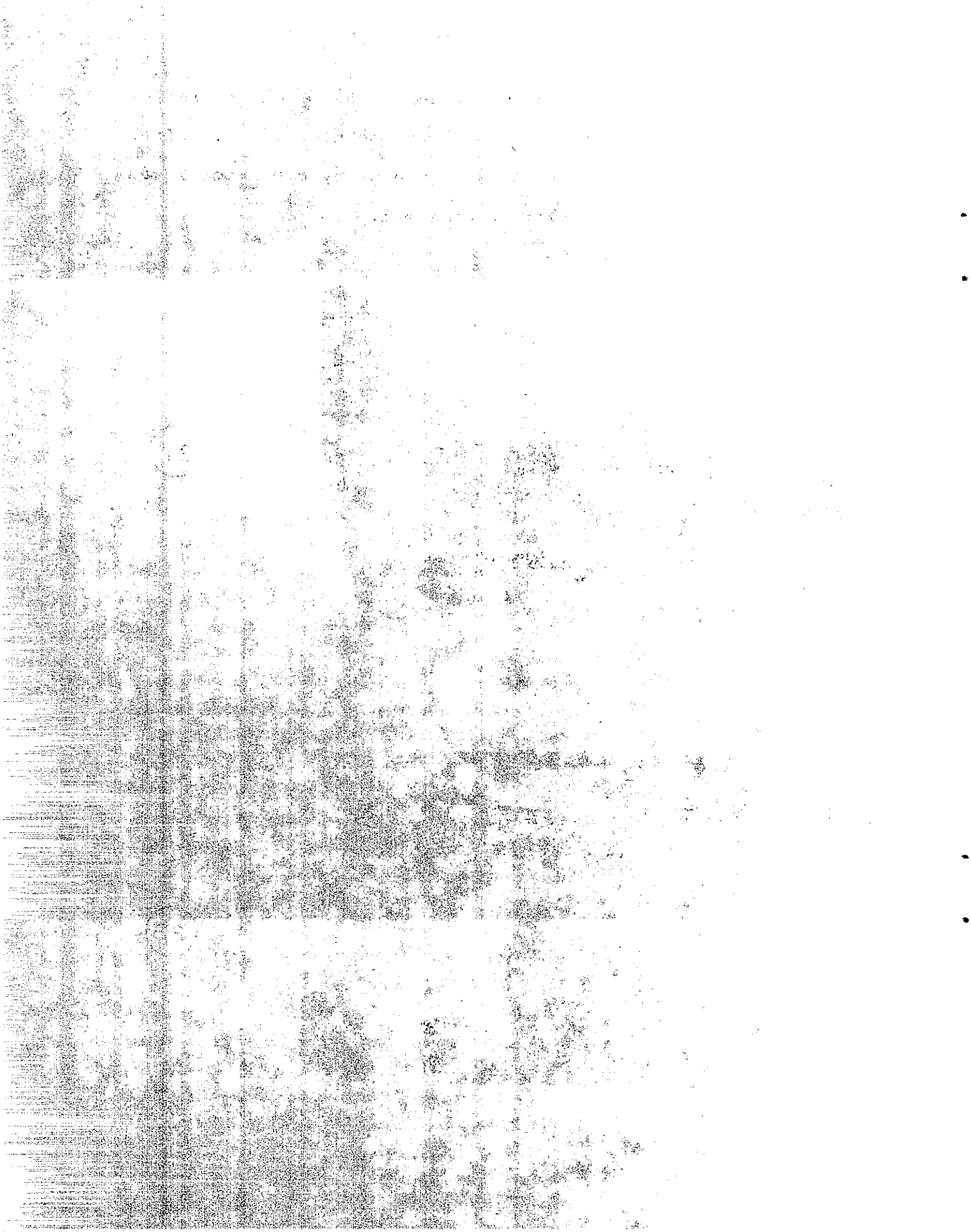

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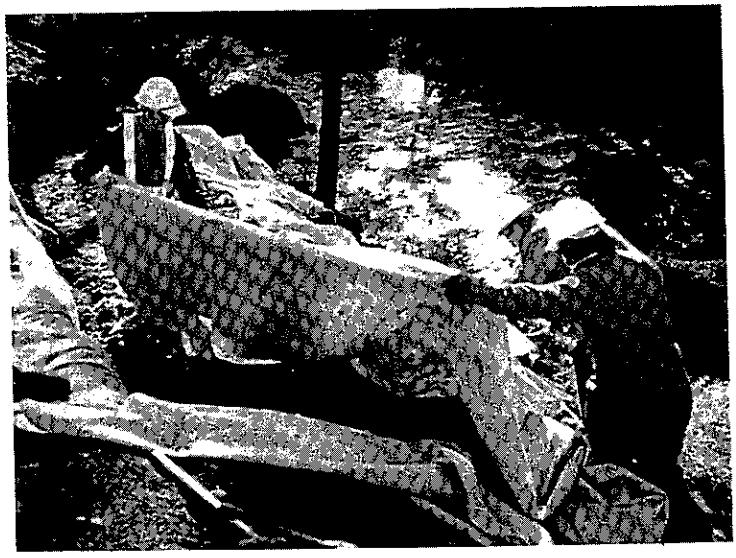

SLIDE 23 - The engineering fabric was then folded over the first layer of the tire mat.

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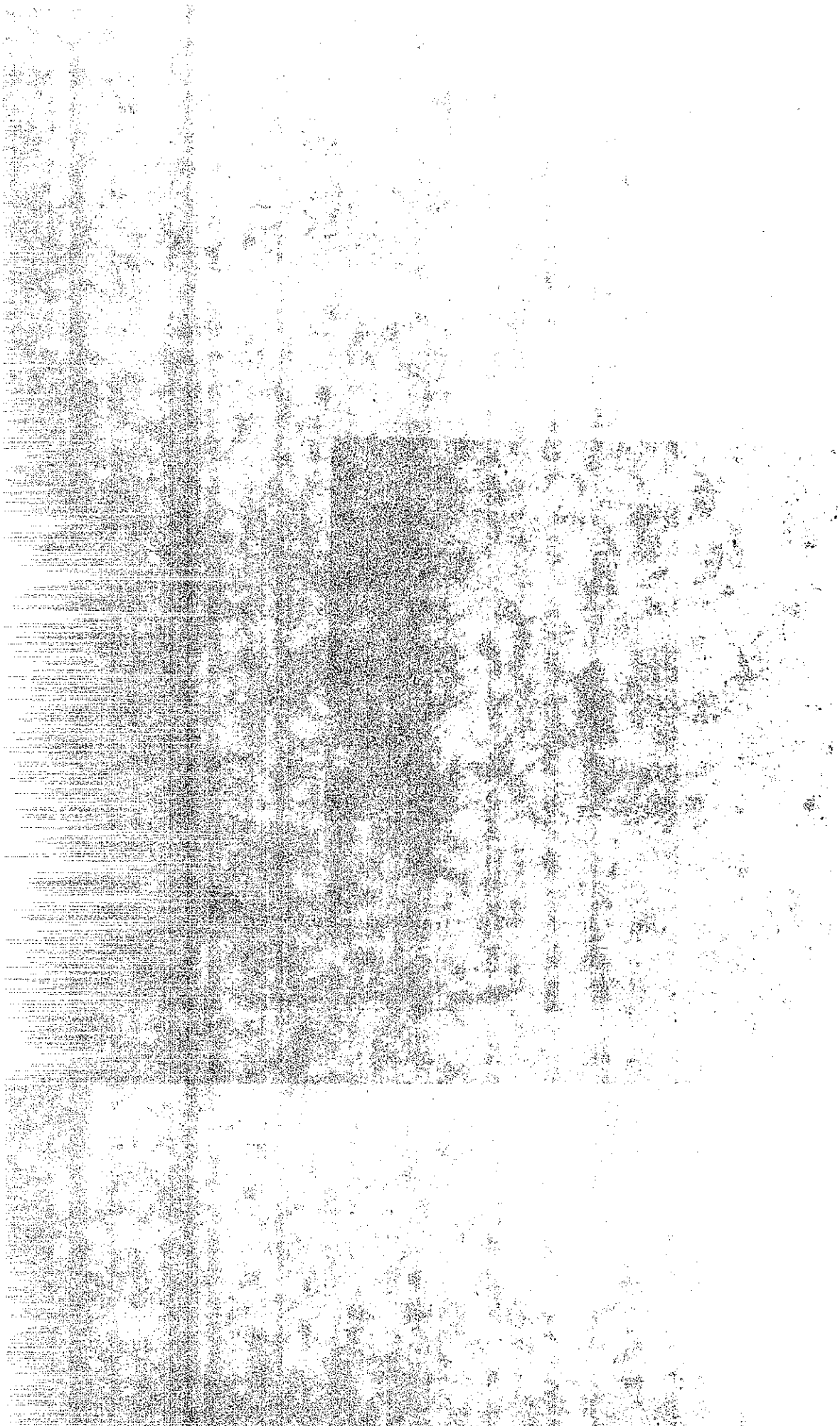

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SLIDES 24,25 - The second layer of truck tires was then placed on the engineering fabric in the same staggered way as the first layer. Tires were tied together with steel clips which were secured with salvaged snow poles. This second tire mat was then backfilled. Eighteen (18) inches of excavated soil was placed on top of this installation to provide an unpaved shoulder.

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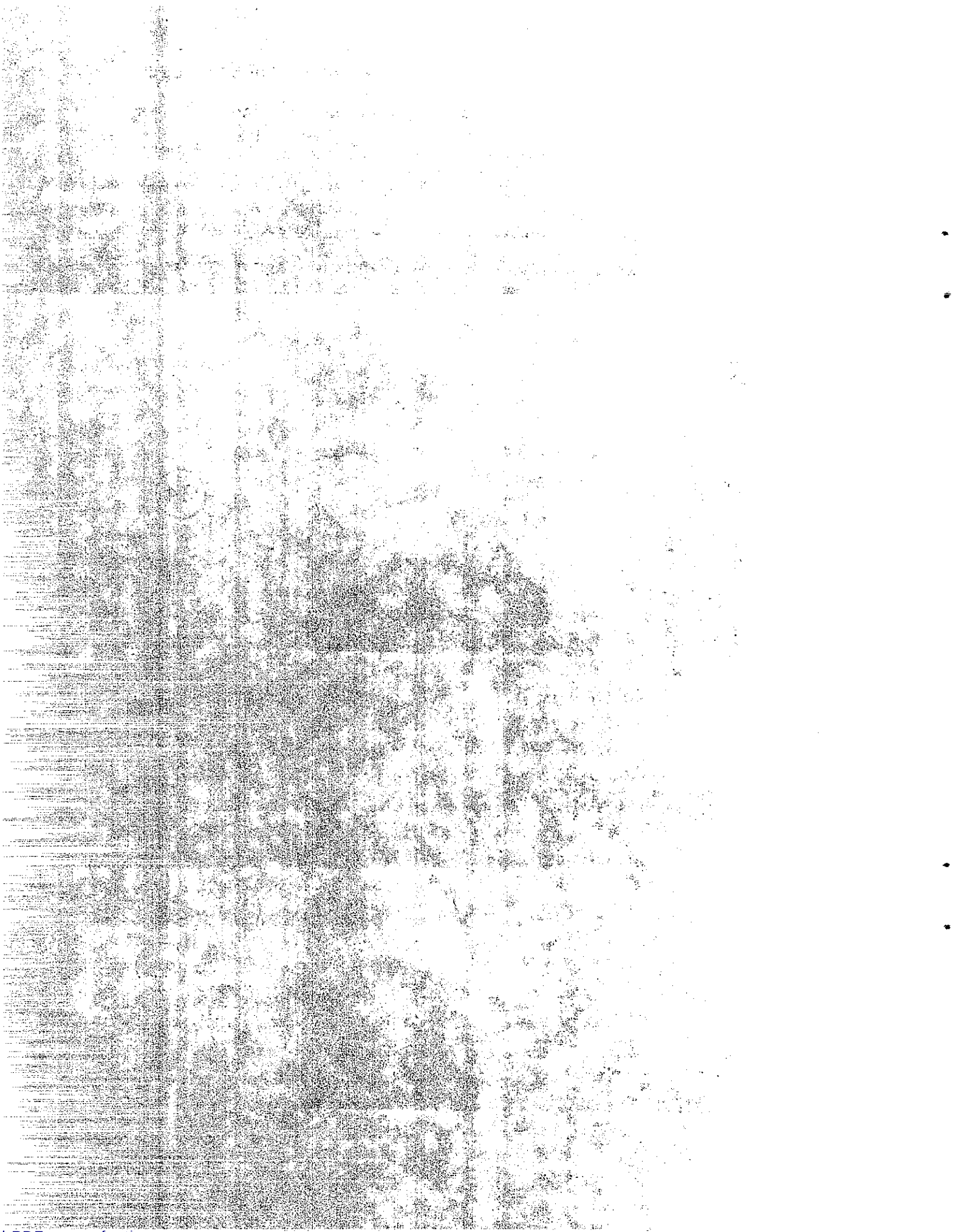

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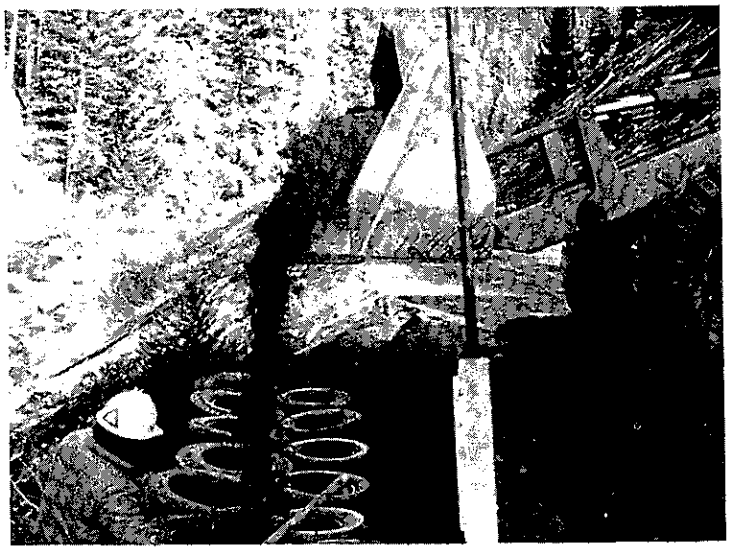
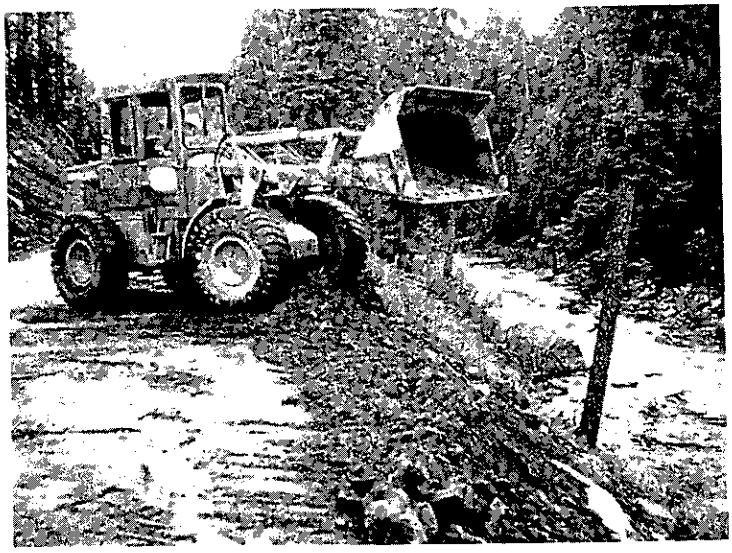


SLIDE 26 - In the second installation no engineering fabric was used. The first layer of truck tire mat was placed directly on the excavated bench and after compaction, a 6 inch layer of soil was placed on top of the first tire mat. A second tire mat was installed and finished with a 18 inch soil layer to provide an unpaved shoulder.



SLIDE 27 - In both installations, with and without engineering fabric, the top 18 inches of soil was compacted by wheel rolling to finished grade. There was some insignificant settlement observed after these projects were completed.

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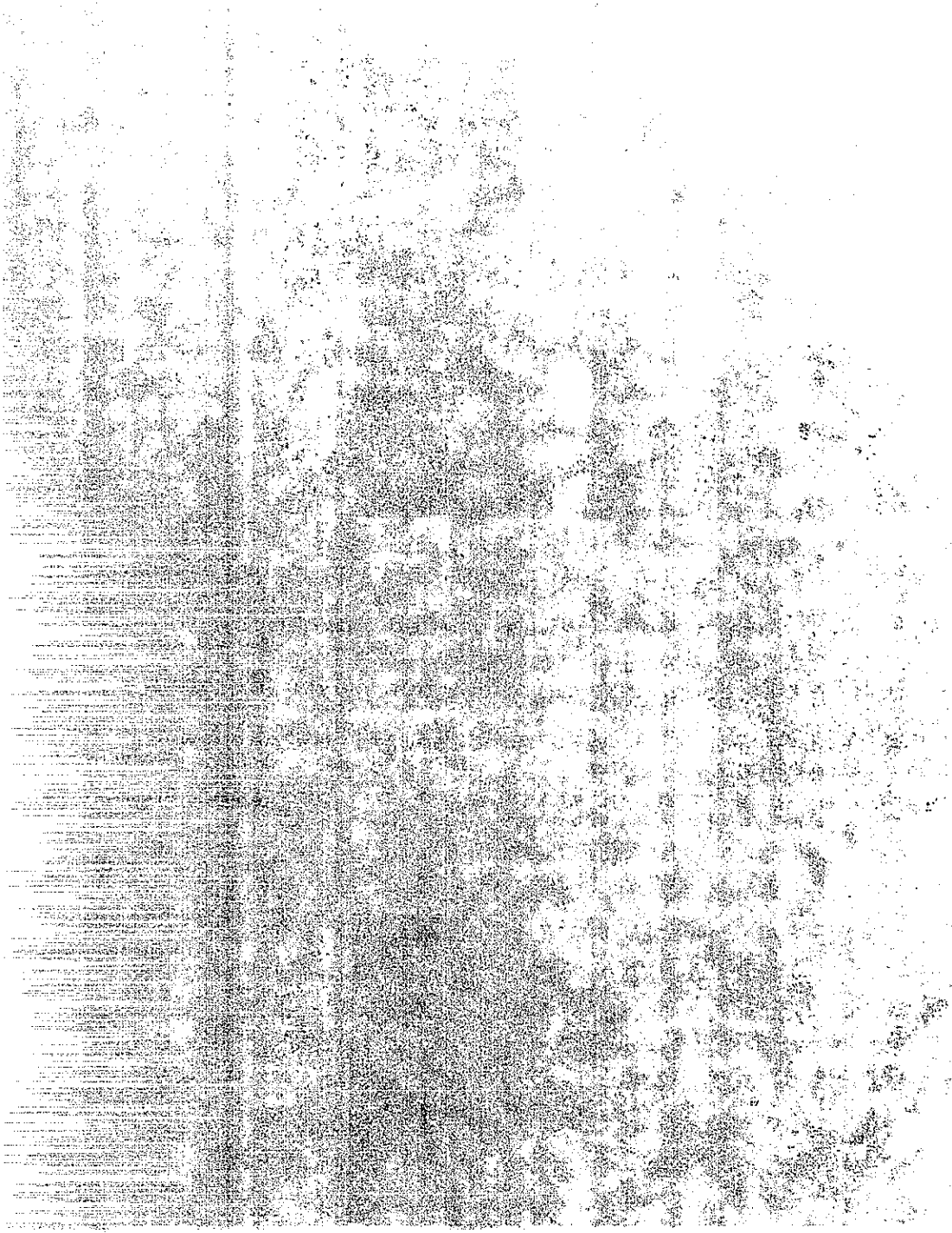

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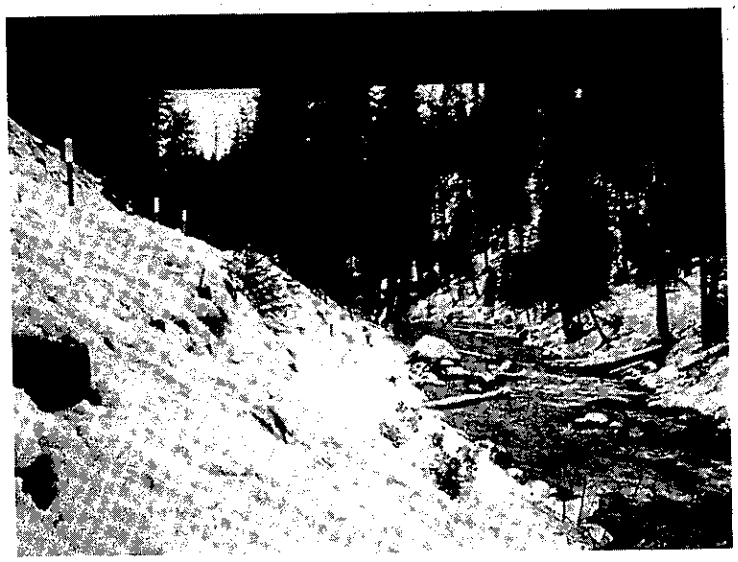

SLIDE 28 - These two installations were exposed to extreme weather conditions. Average snow depths ranged from 12 to 48 inches during winter months. The average annual rainfall in this region was 33 inches.

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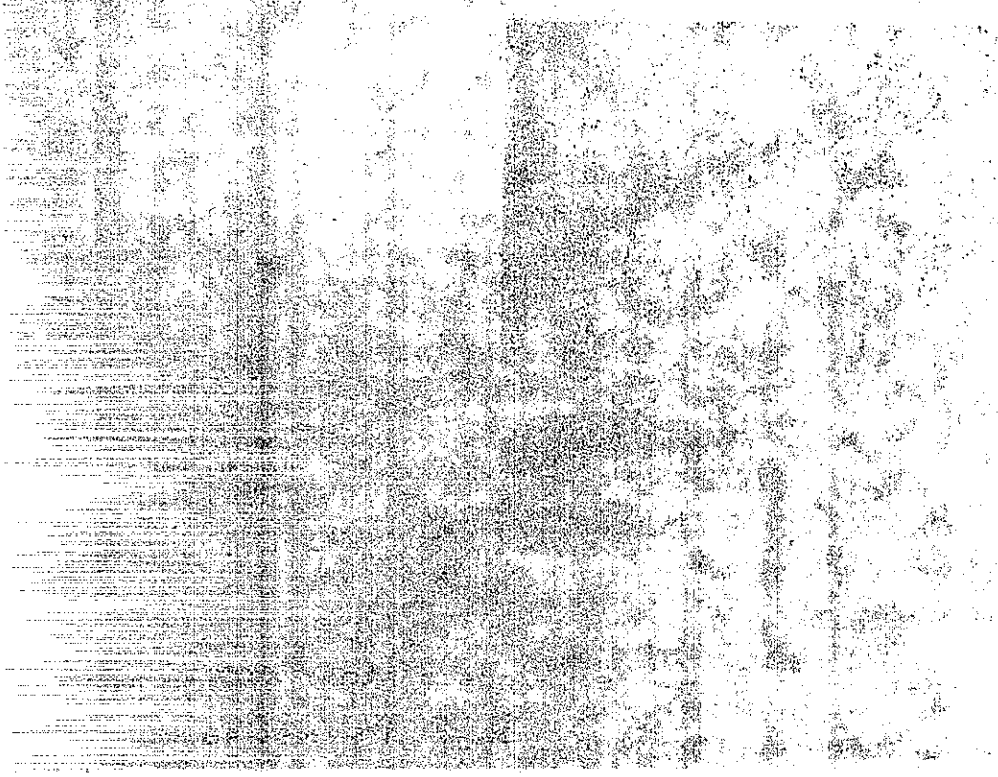

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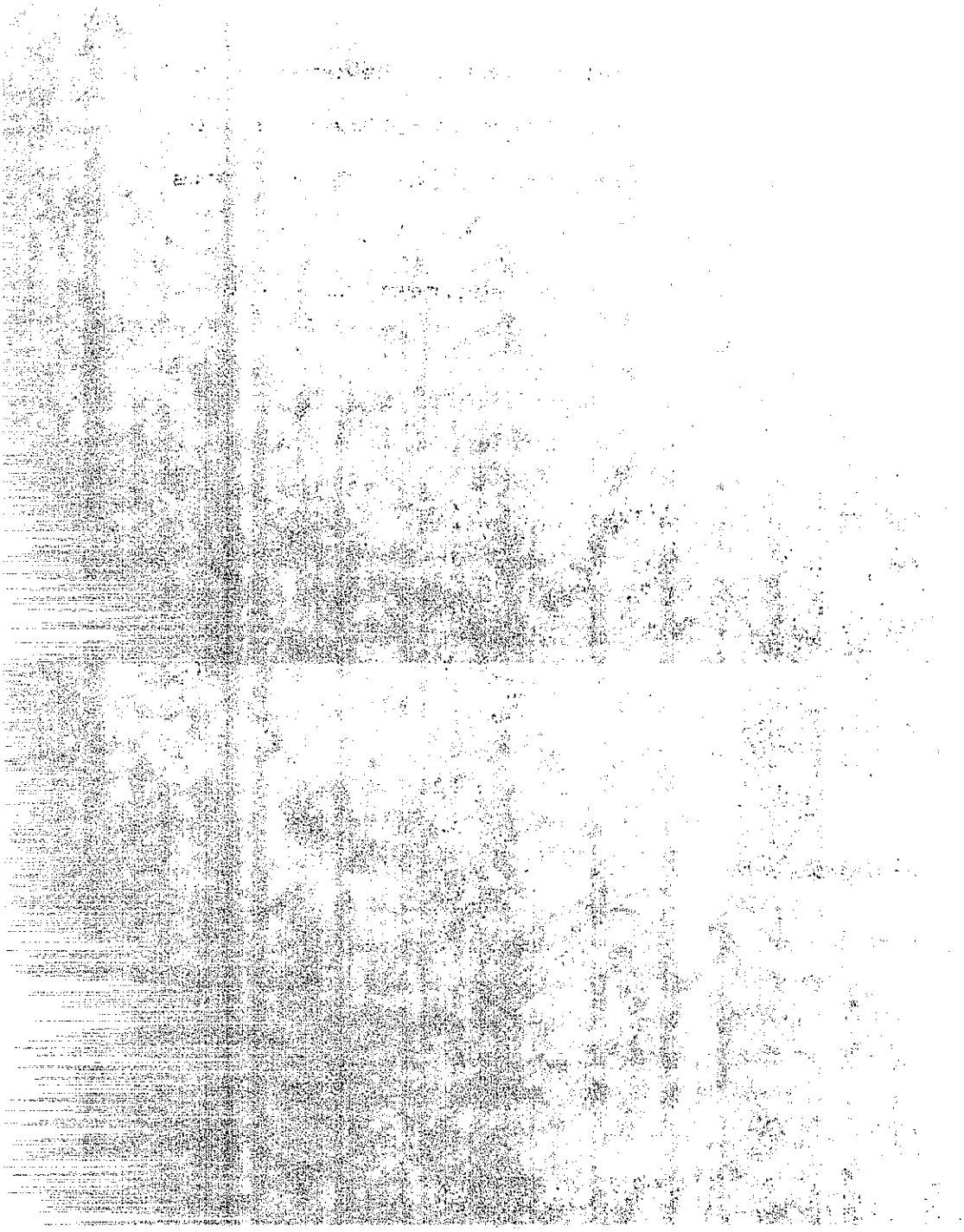

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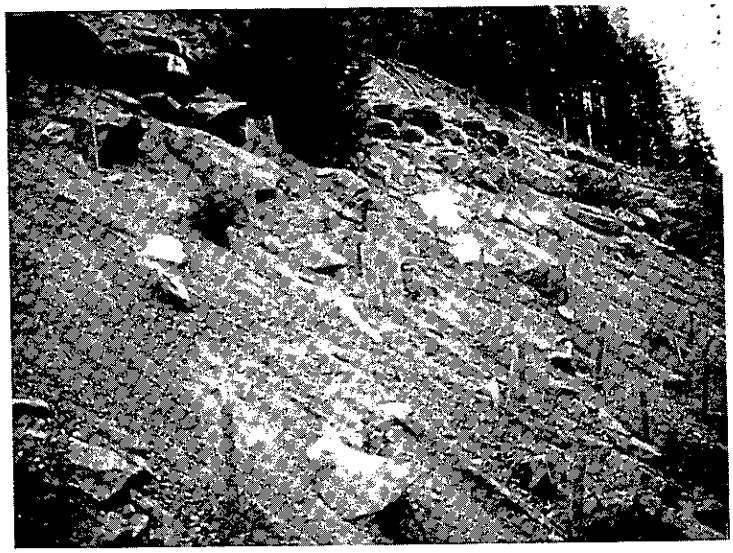
SLIDES 31,32 - Newly established slopes were revegetated with woody plants, manzanita and deer brush. Plastic and steel cages were used to protect the plants from foraging animals. After sixteen months only marginal succes was achieved. Overall soil erosion of the slope was reduced.



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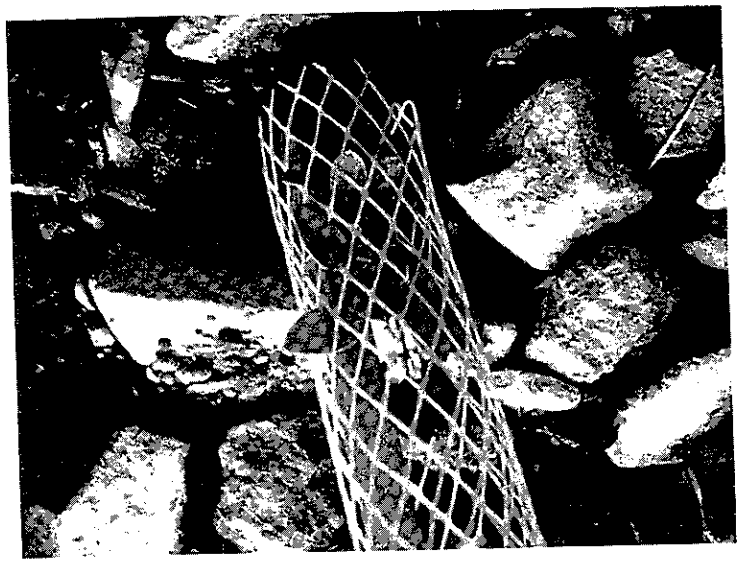

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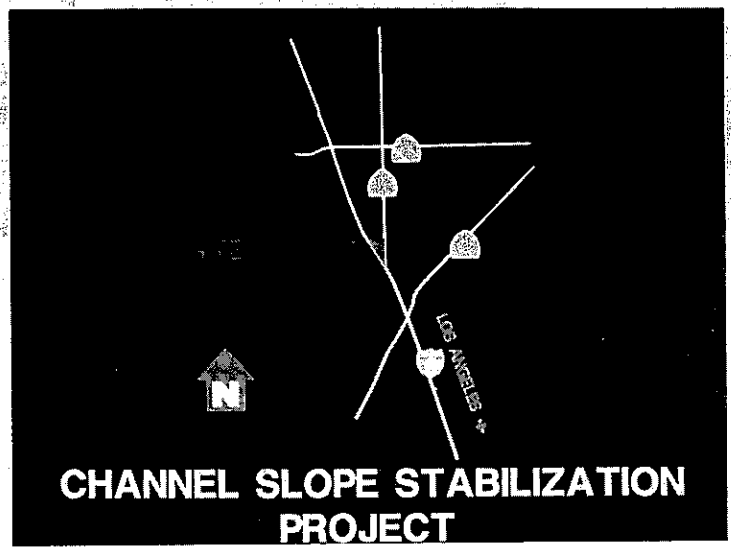

Slide 33 - Now let us take a look at the second research project. Discarded truck tires were used to provide channel slope protection and rebuild severely eroded channel slopes. The project site was in Fresno County on Interstate 5 at the Lassen Interchange.

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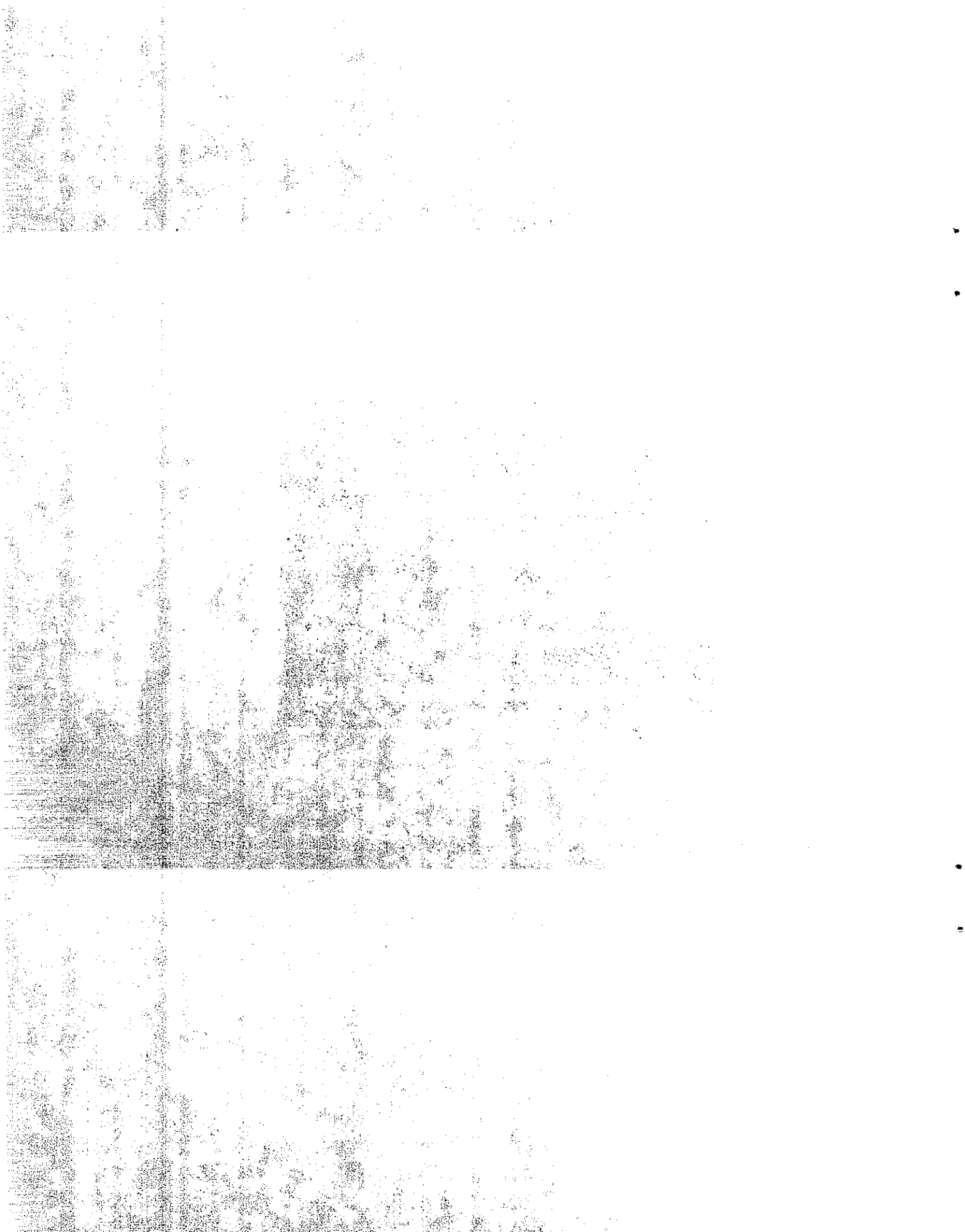

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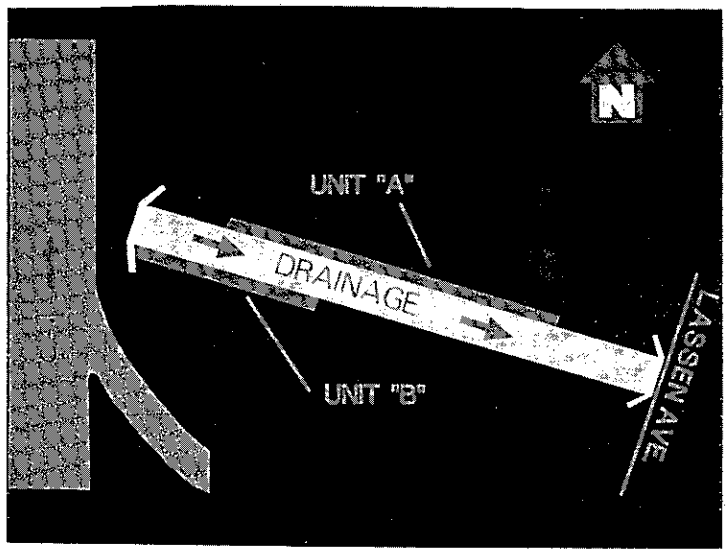
SLIDES 34,35 -This drainage channel at the Lassen Interchange runs in a west to east direction. Large portions of the drainage channel slope were severely eroded. Caltrans maintenance personnel in Fresno initially chose two locations, units A and B and installed tire-wall systems. Unit A is the north channel slope, as can be seen,was severely eroded, encroaching into the private property outside Caltrans right-of-way.



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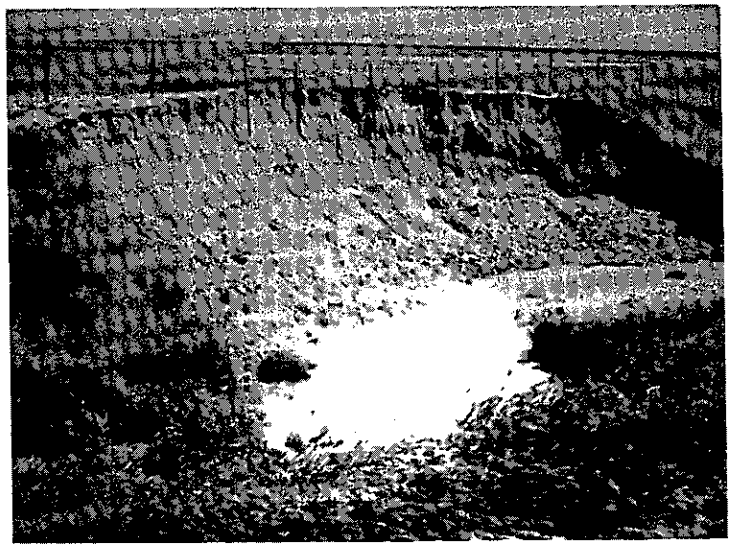

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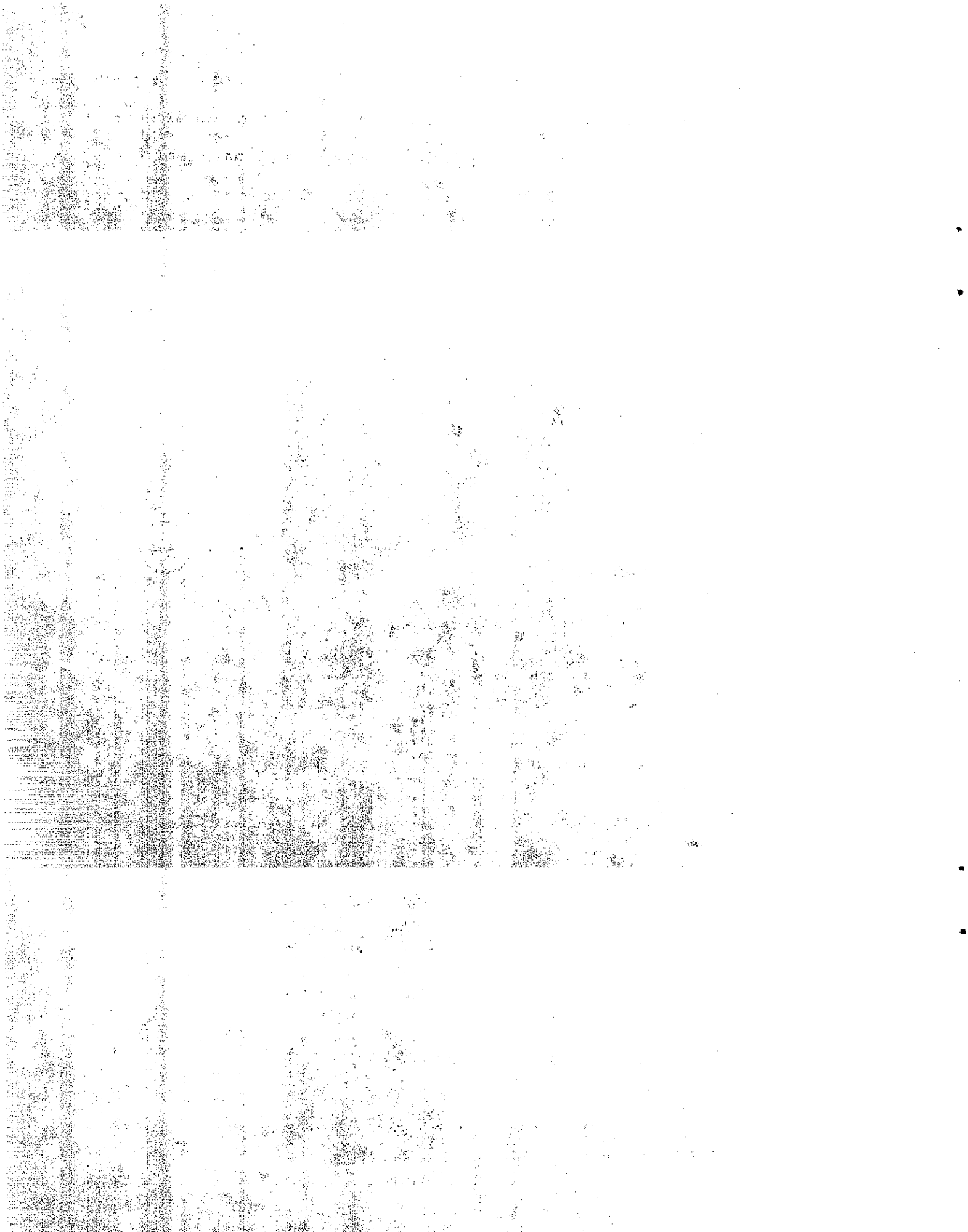

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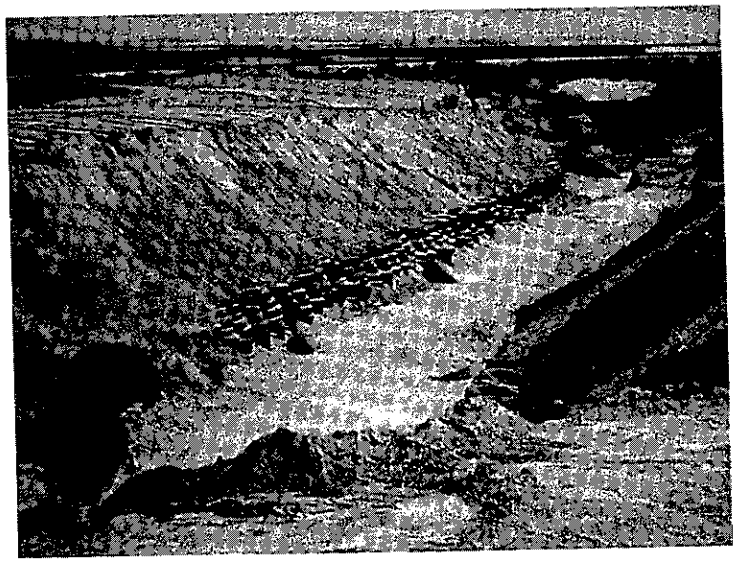

SLIDE 36 - The channel width of 20 feet was not reduced. It was kept the same as in its original condition. Initial hydraulic analysis indicated low velocities in the channel. The discarded tires were stacked vertically one on top of another as a column, and tied together. In effect a tire-wall was constructed using wire ties and backfilling the tires. The eroded slope was then restored by backfilling the back of the tire wall. This tire-wall-slope system was completed in 1978.

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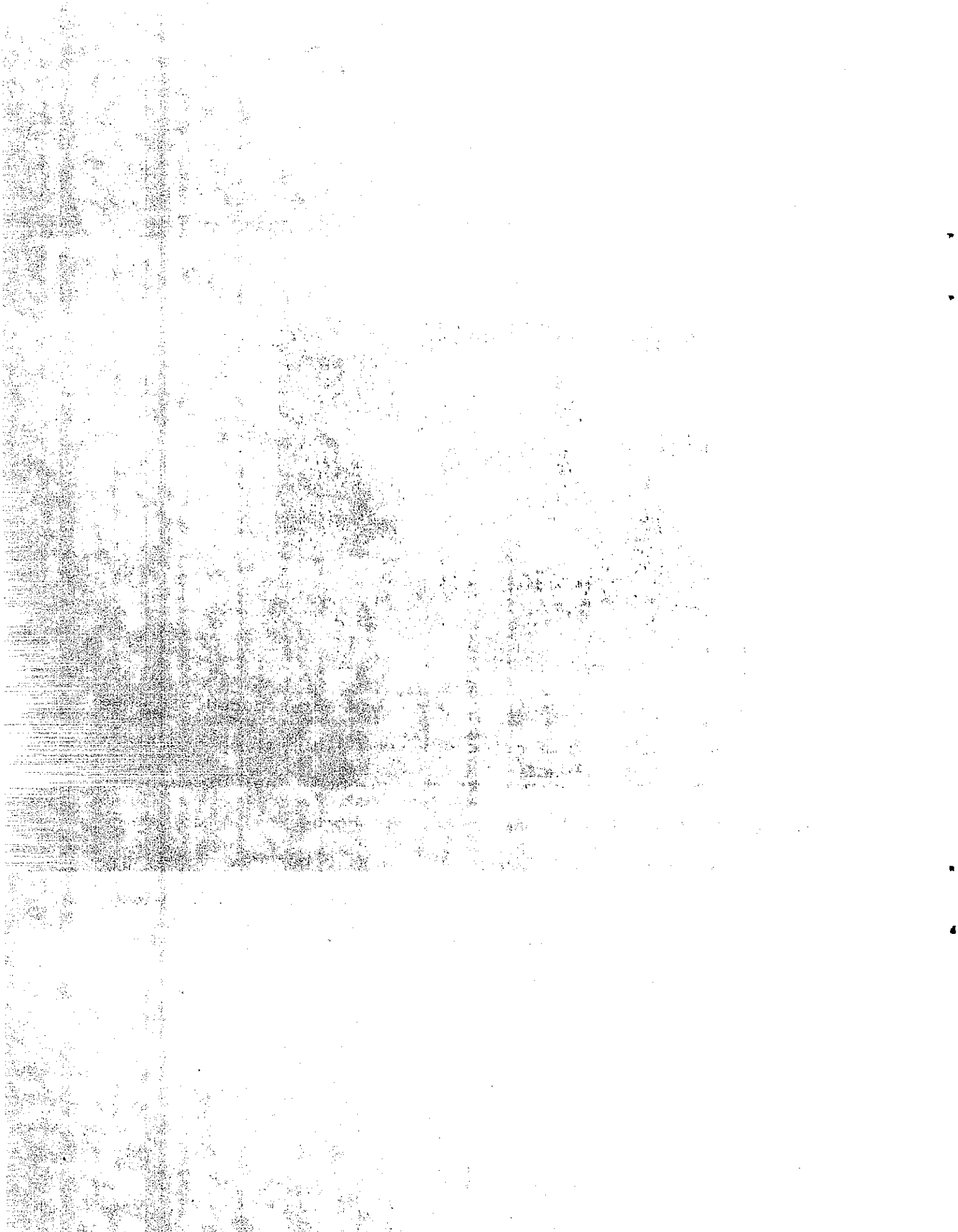

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SLIDE 37 - After the slope was restored, revegetation was initiated by seeding it with a grass seed mixture of blando brome and Belford Barley. There was significant growth within three months. Here we see the growth after two years . The scouring by channel flow was effectively stopped. Regevetation drastically minimized slope erosion.

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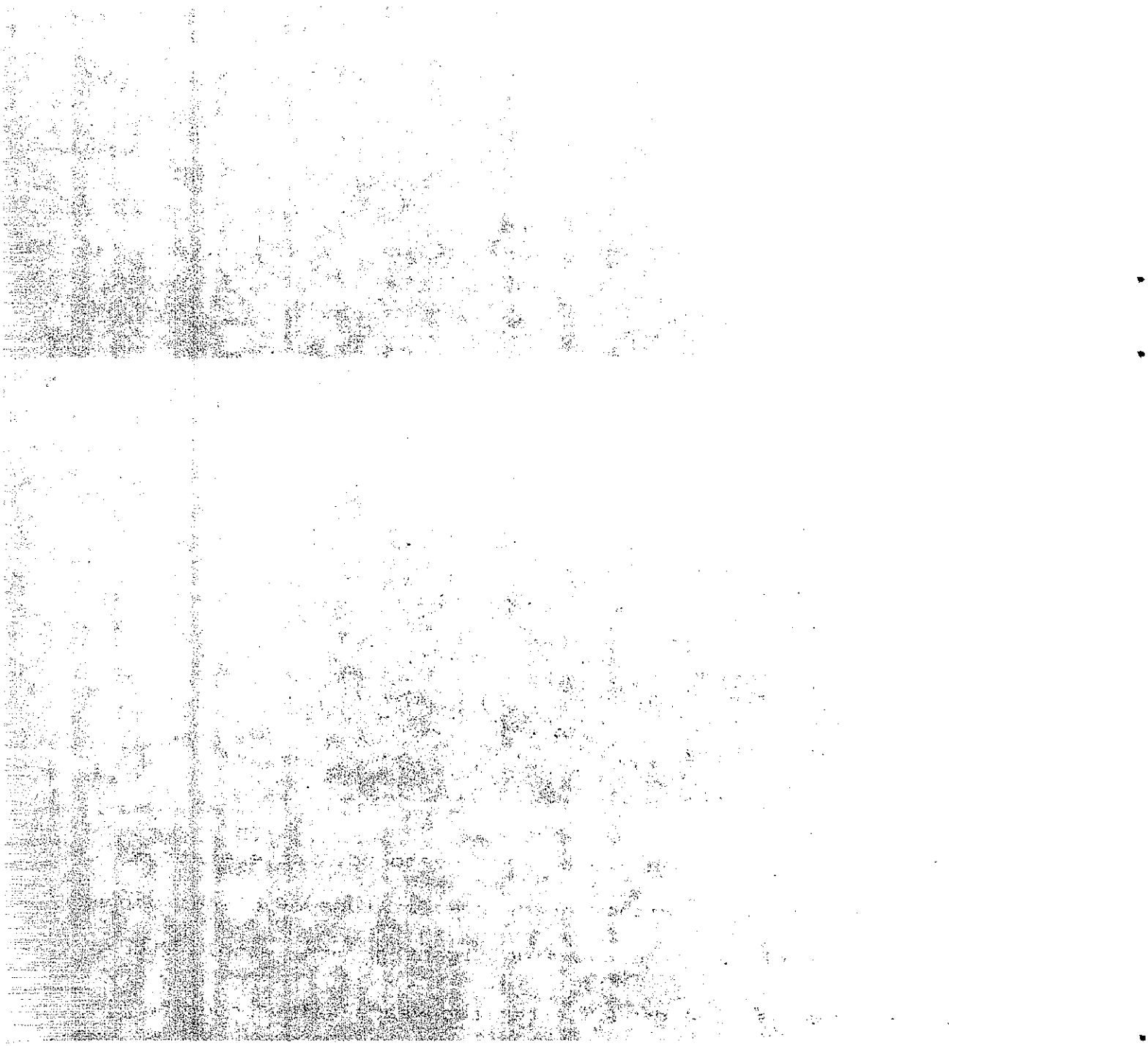

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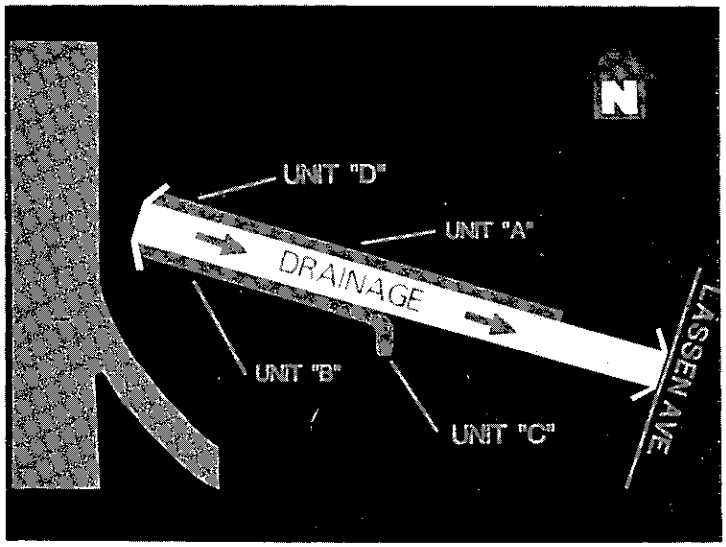

SLIDE 38 - The scouring and erosion started to develop west of Unit A and east of Unit B. Hence Caltrans - Transportation Laboratory personnel decided to try two different methods of stacking and constructing a tire -wall using discarded tires. Unit C was constructed east of Unit B, and Unit D was constructed west of Unit A.

SLIDE 39 - A footing was dug to a depth equal to the thickness of one tire to anchor the tire-wall. The channel bank was sloped to a batter of one in twenty.

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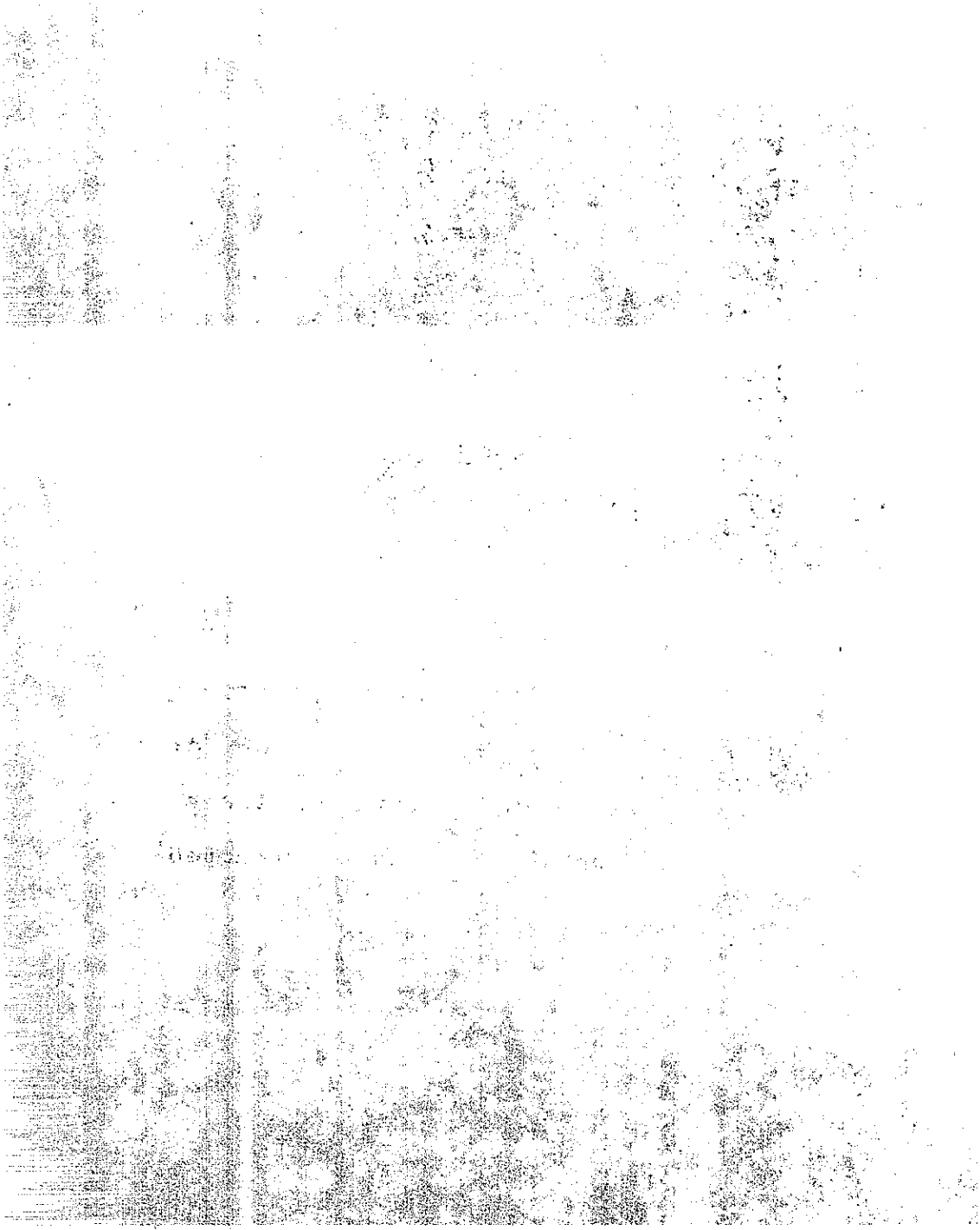

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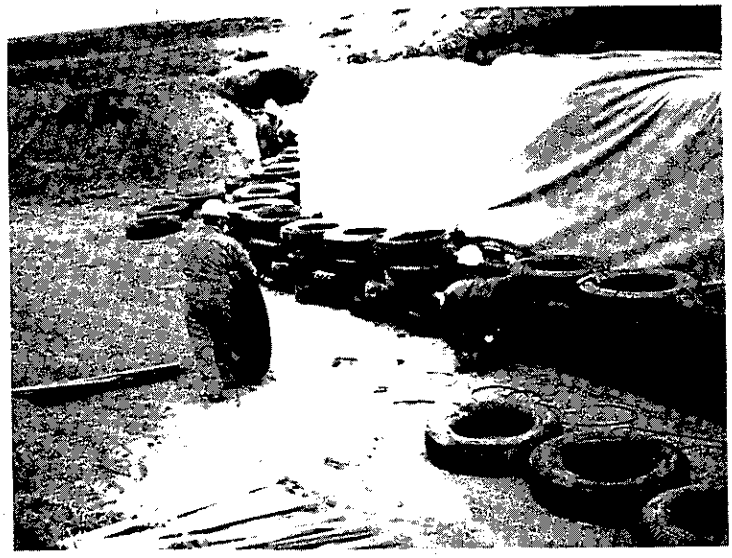

SLIDE 40 - The engineering fabric was spread on the excavated footing bench. In Unit C a staggered method of stacking tires was adopted. A total of 8 truck tires were used one on top of another. The engineering fabric was wrapped on the back of the tire-wall and brought to the top of the wall.

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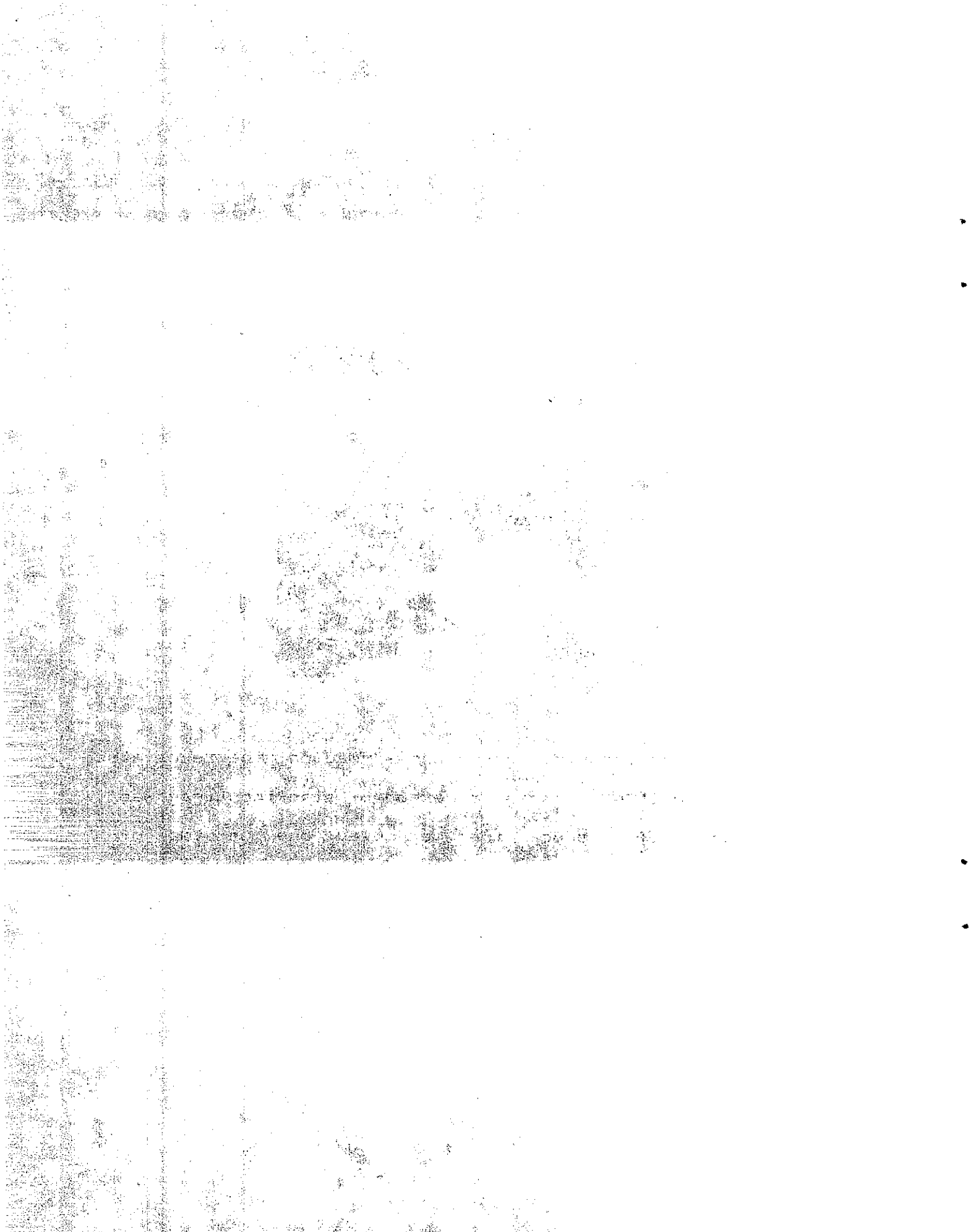

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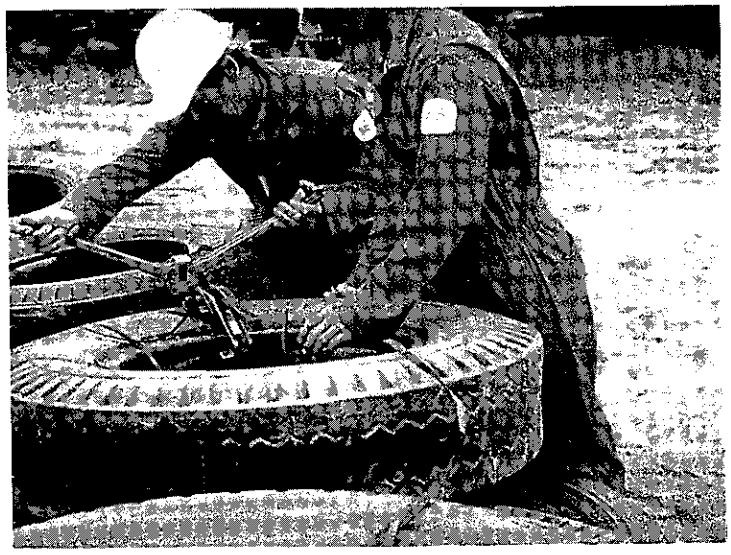

SLIDE 41 - The tires were banded together both vertically and horizontally using polypropylene strapping. The bottom five layers of tires were banded together vertically. The top five layers were also banded together vertically, thus introducing an overlapping of two layers of tires vertically. Horizontally each adjacent tire was banded together. Using polypropylene proved unsuccessful as it elongated and failed to hold the tire columns tightly together. Tying tires together with steel clips only is recommended as it provides a more secure installation.

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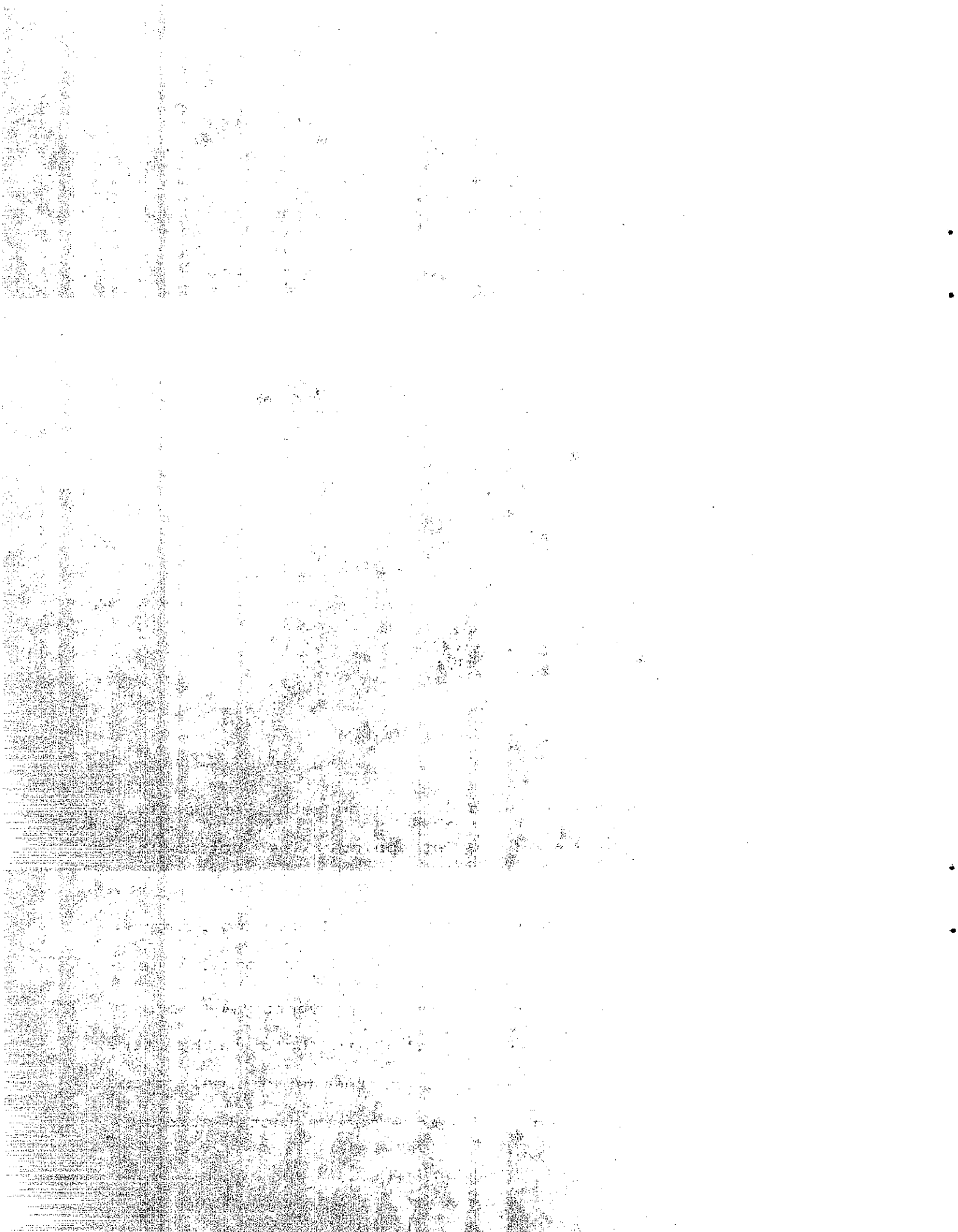

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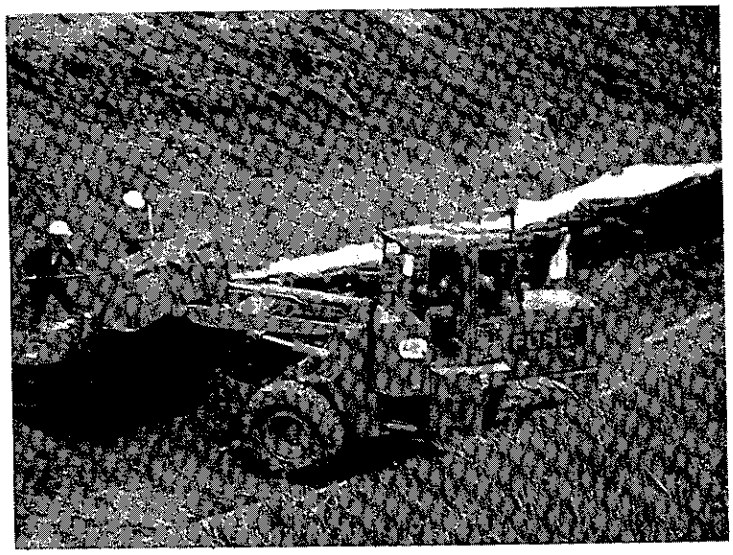
SLIDE 42 - Guide posts were driven into the ground at every third tire in order to anchor the tires together and provide additional stability to the tire assemblages.



SLIDE 43 - The engineering fabric was wrapped around the back of the tire-wall. The backfill material was dumped into the tires using a loader and compacted.

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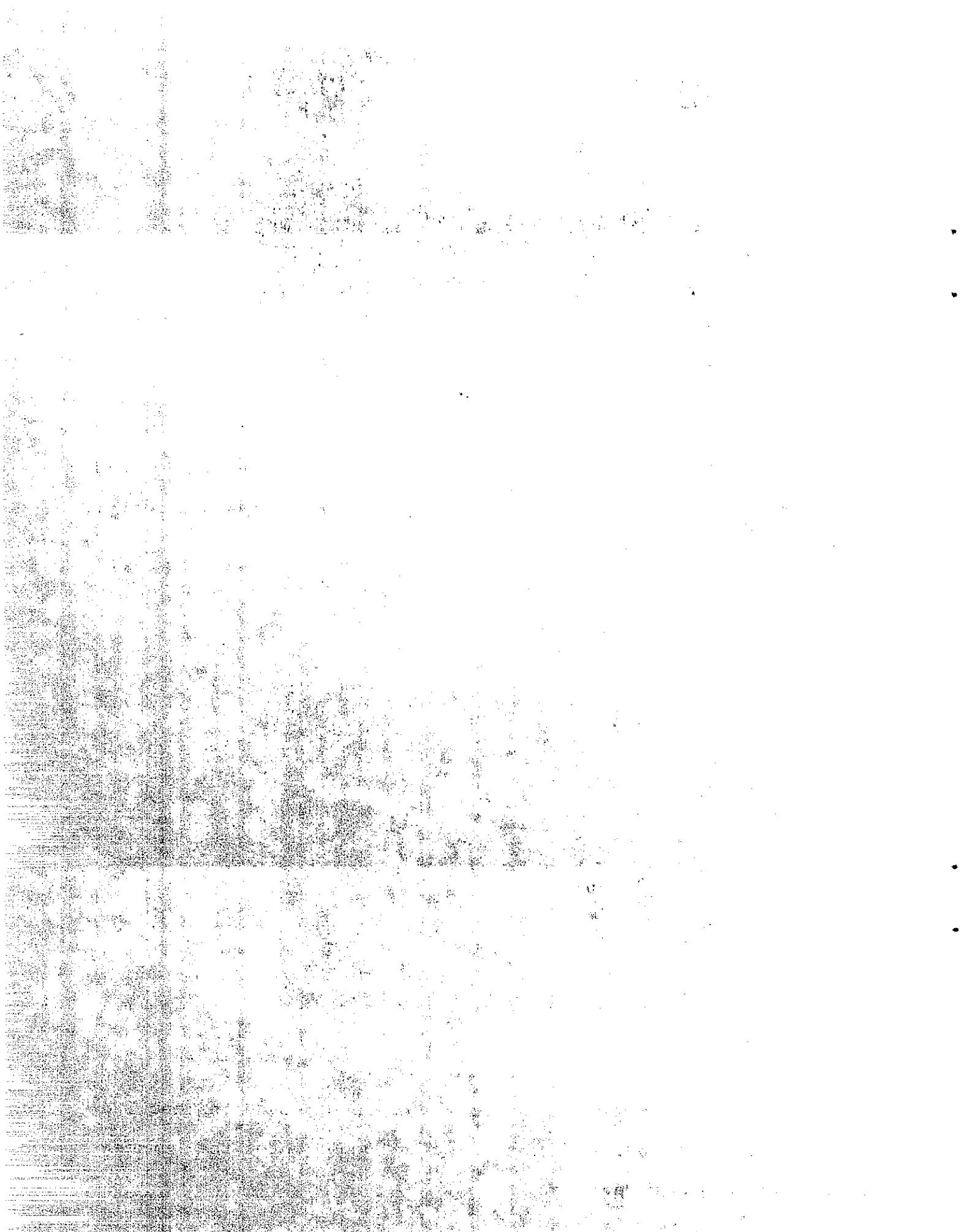

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SLIDE 44 - The first row of tires was placed and backfilled. This was done to provide a stable and level base to build upon. Difficulty was encountered in the backfilling operation in that the soil did not easily flow into the tires thus leaving large voids. A vibrator compactor was used in an attempt to assist the movement of the soil into the voids. This procedure proved to be ineffective. Ponding and jetting was then tried and this method proved successful. The backfill material had a tendency to flow out of the tires.

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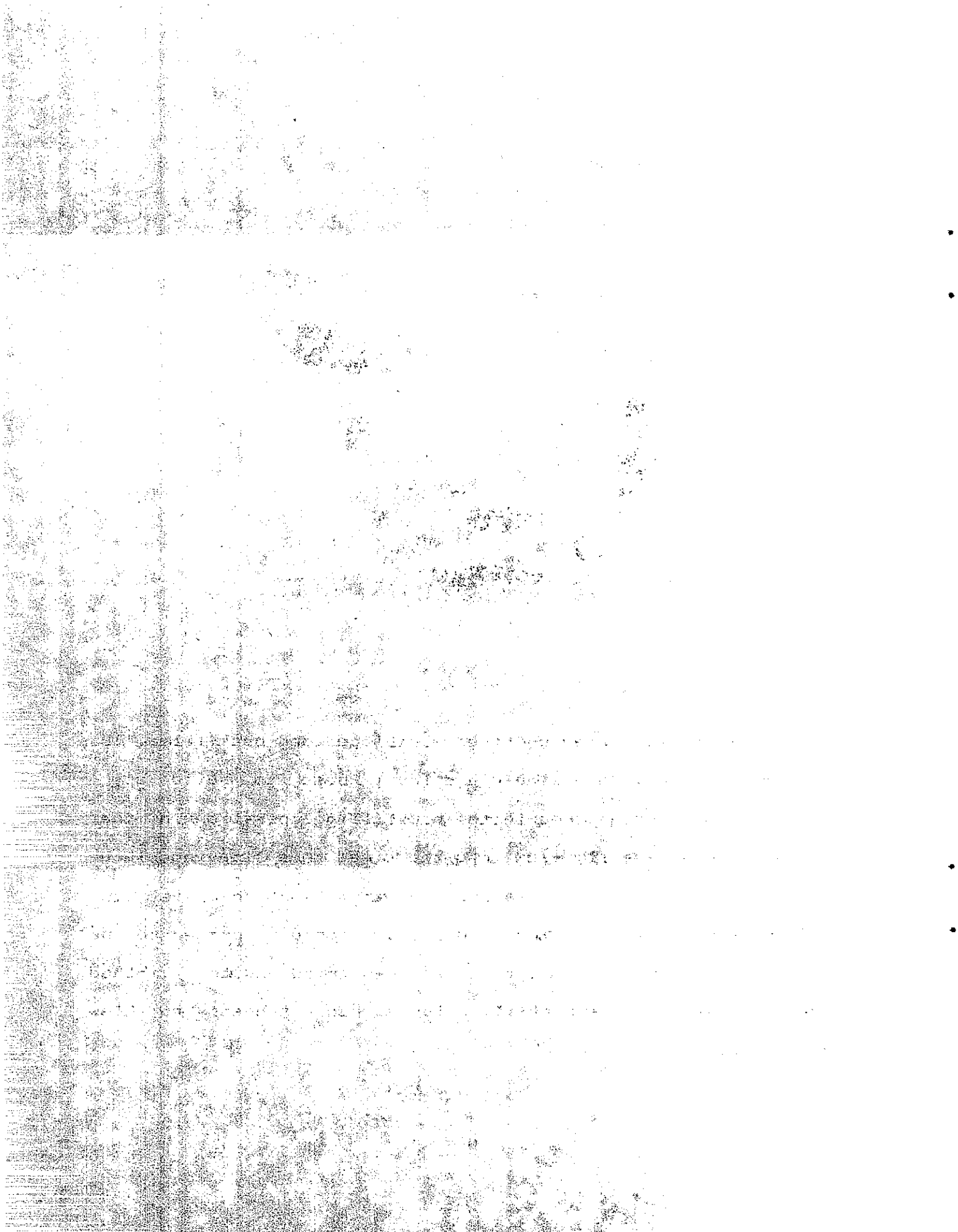

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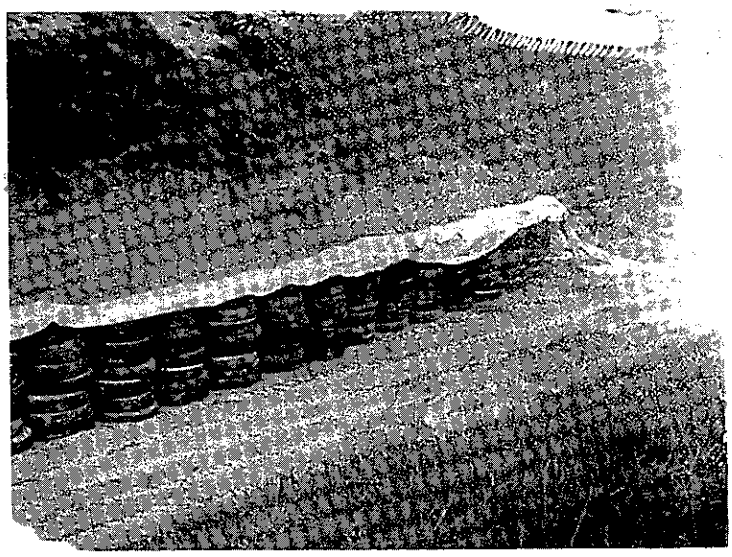

SLIDE 45 - In Unit D, tires were staggered instead of stacking in a vertical column.

Metal posts were driven through the center hole of every fourth tire. It was easy to drive them when the tires are stacked vertically as a column. It was difficult to drive the metal post when the staggered configuration is used. Units C and D were revegetated using a grass seed mixture of 10% of blando brome and 90% Belford Barley. Significant growth was achieved in a very short time.

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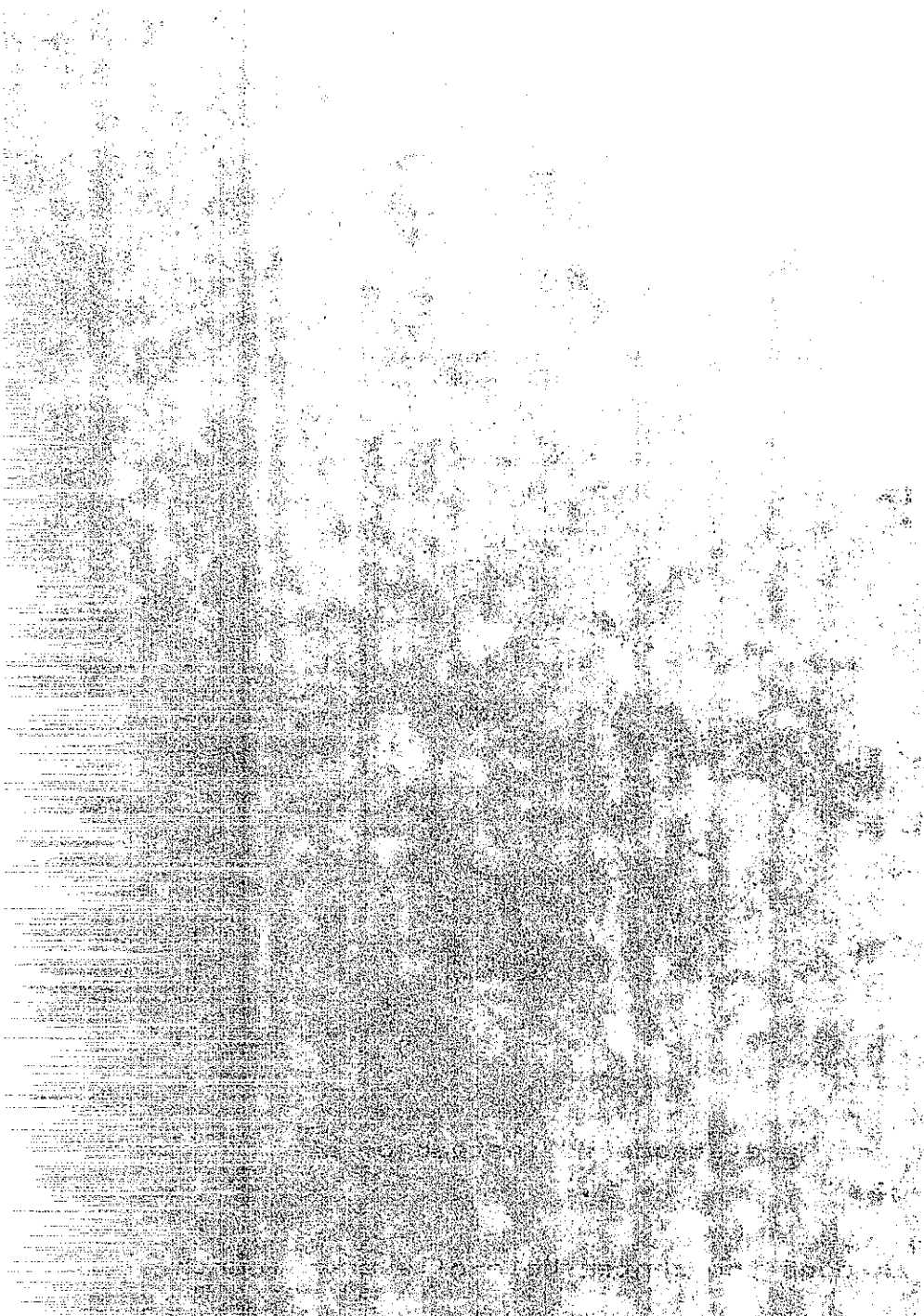

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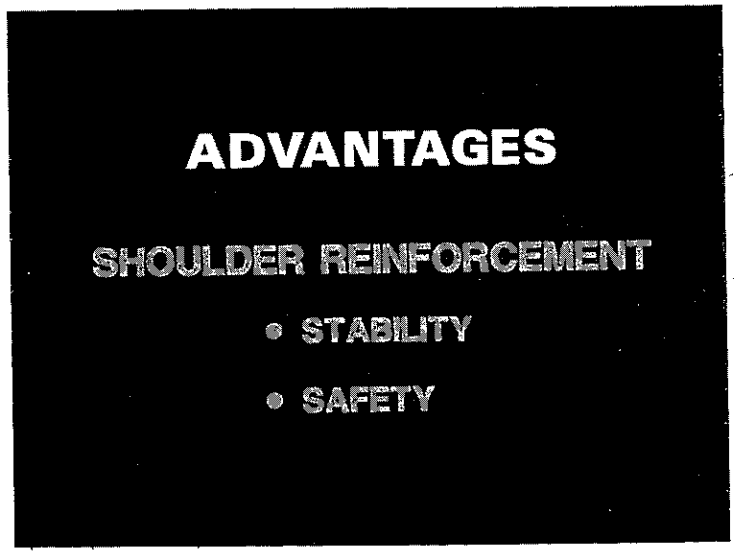
SLIDE 46 - Revegetation was a great success. After several months the installations at Units A, B, C and D looked very stable. There was some insignificant settlement.



SLIDE 47 - Stability and safety are two advantages of using tires for shoulder reinforcement. The tires remained stable and maintained their integrity. Shoulder reinforcement provides a safer highway because it allows a wilder travelled way.

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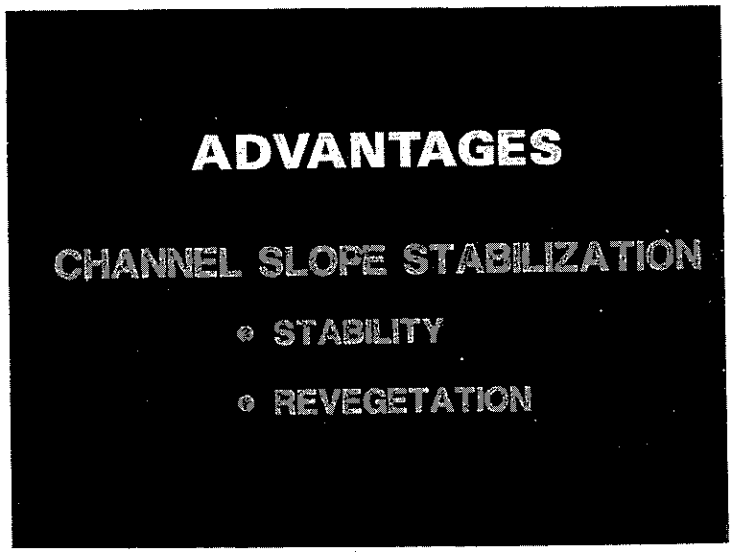
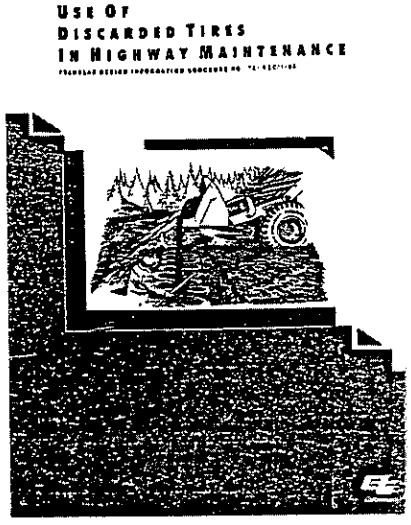
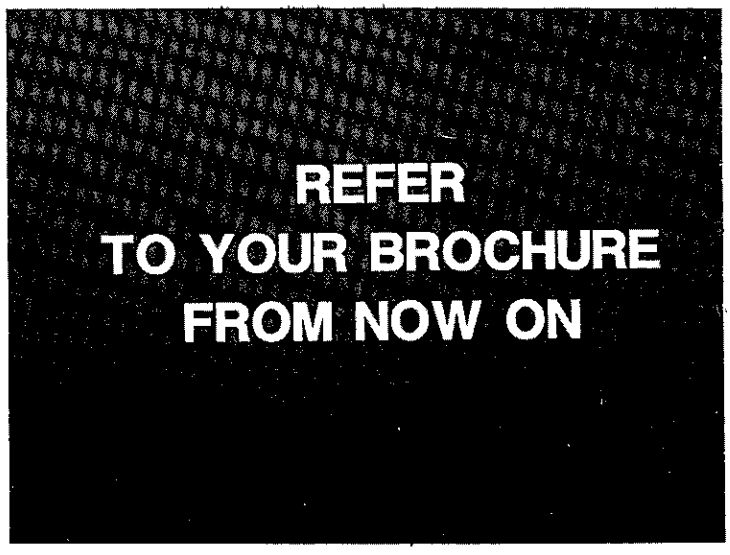


SLIDE 48 - It was found that tires used for channel slope protection remained stable at low velocity flow drainage. Excellent stands of vegetation grew and effectively stabilized the upper slope.





SLIDE 49 - You received a design information brochure at the beginning of this presentation. Read this brochure after this presentation to get started on using discarded tires in highway maintenance.

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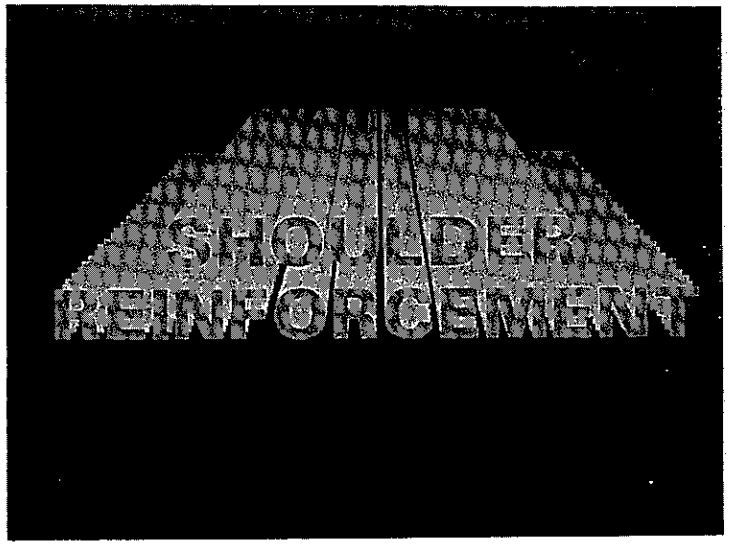
SLIDES 50,51 - The first part of the guidelines in the brochure considers shoulder reinforcement using discarded tires. Only discarded truck tires are recommended.



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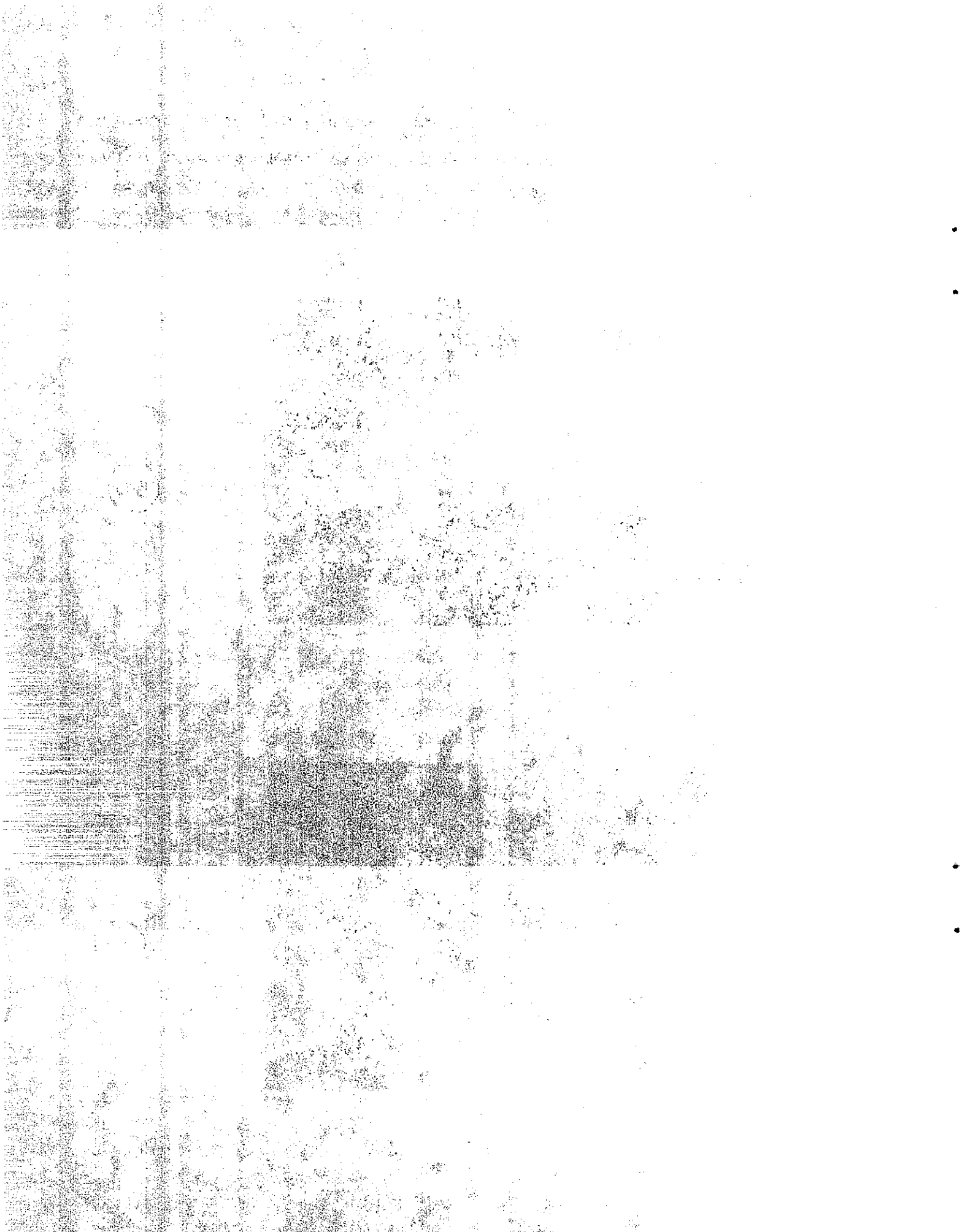

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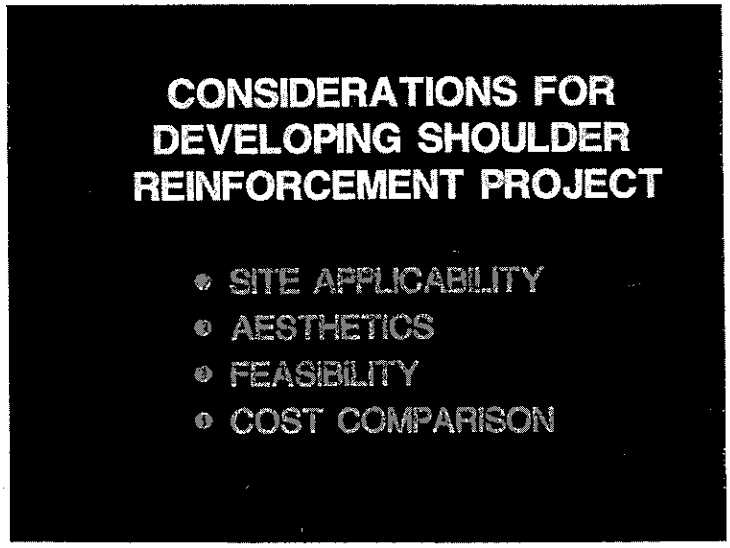
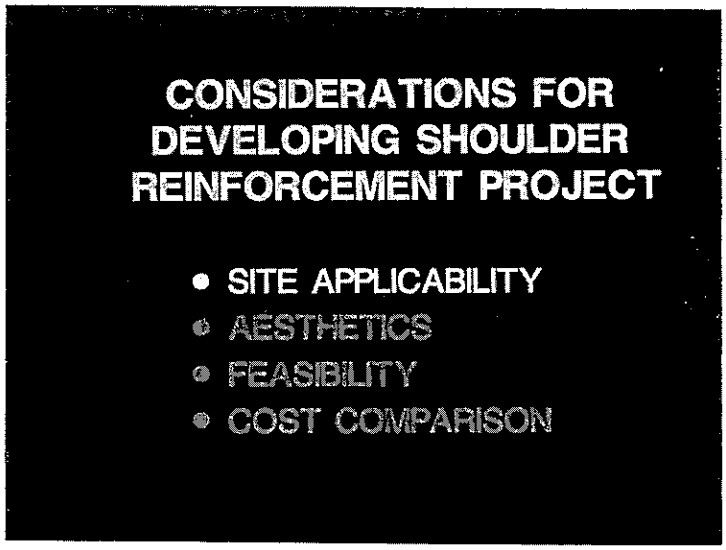


SLIDE 52 - Four aspects should be considered during design of a shoulder reinforcement project. These aspects are:

- o Site applicability
- o Aesthetics
- o Feasibility
- o Cost comparison



SLIDE 53 - Shoulder reinforcement projects should be used on lower slopes and in locations where they are not visible to the travelling public.

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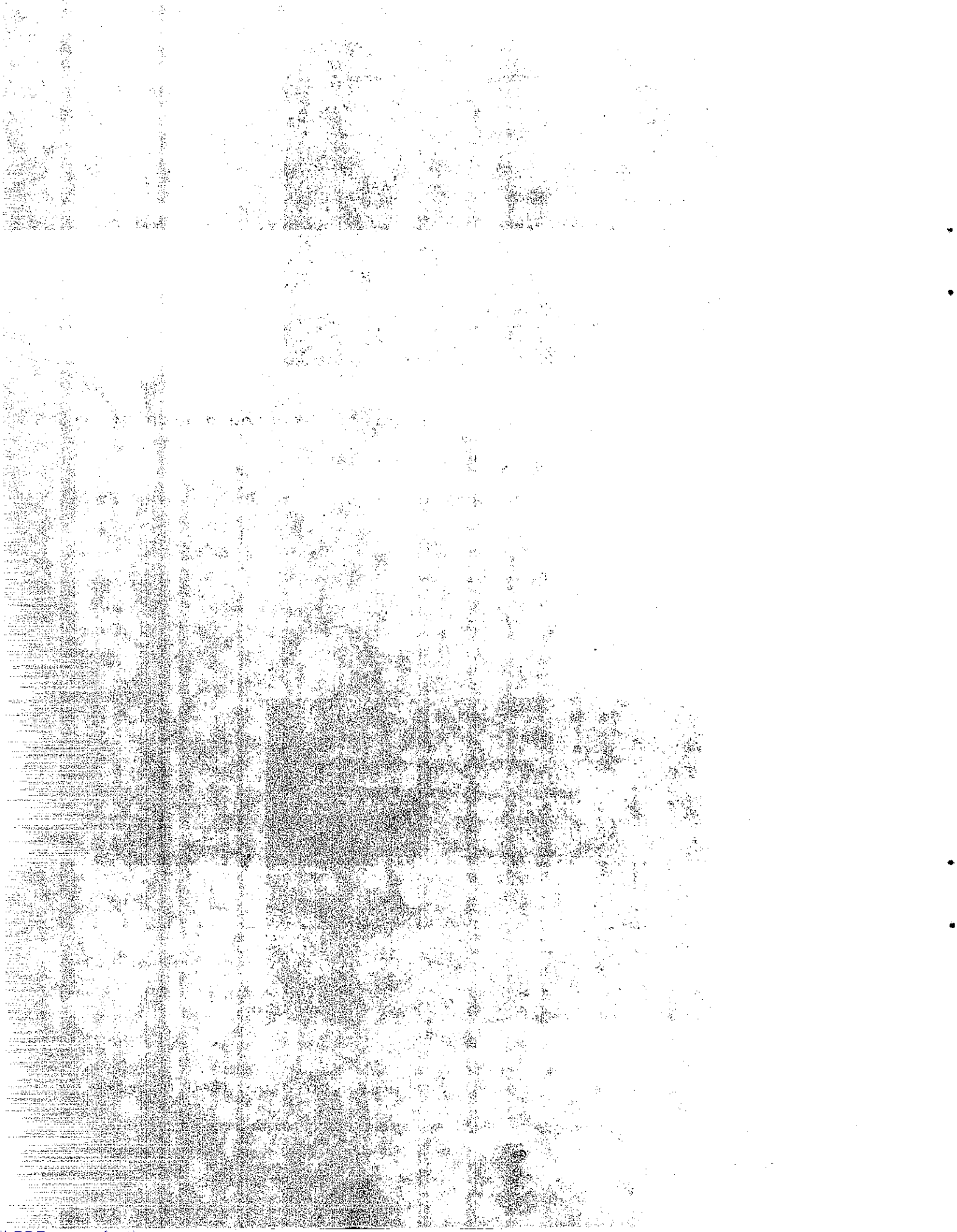

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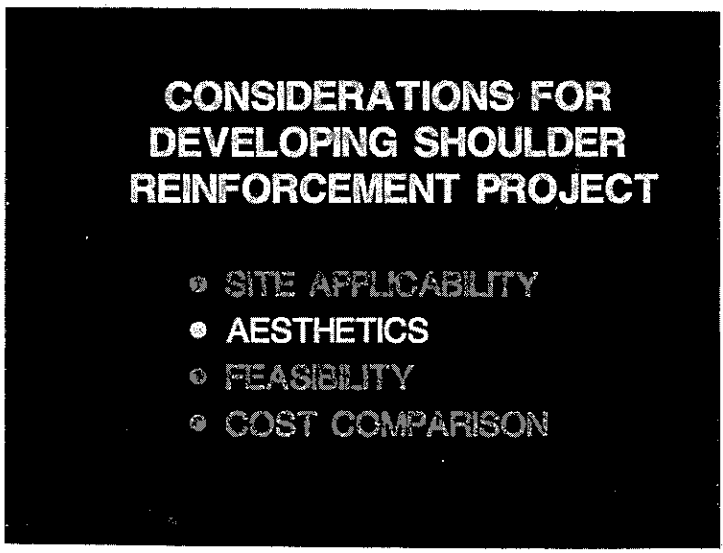
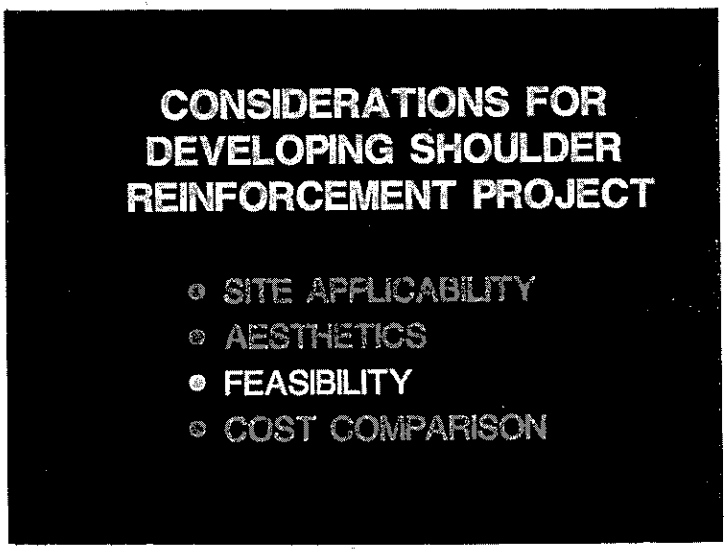


SLIDE 54 - Painting the tires or planting vegetation to blend with the surrounding terrain will improve the aesthetics of the installations.



SLIDE 55 - Determine if a discarded tire wall is the most satisfactory solution for the problem. There may be other solutions possible.

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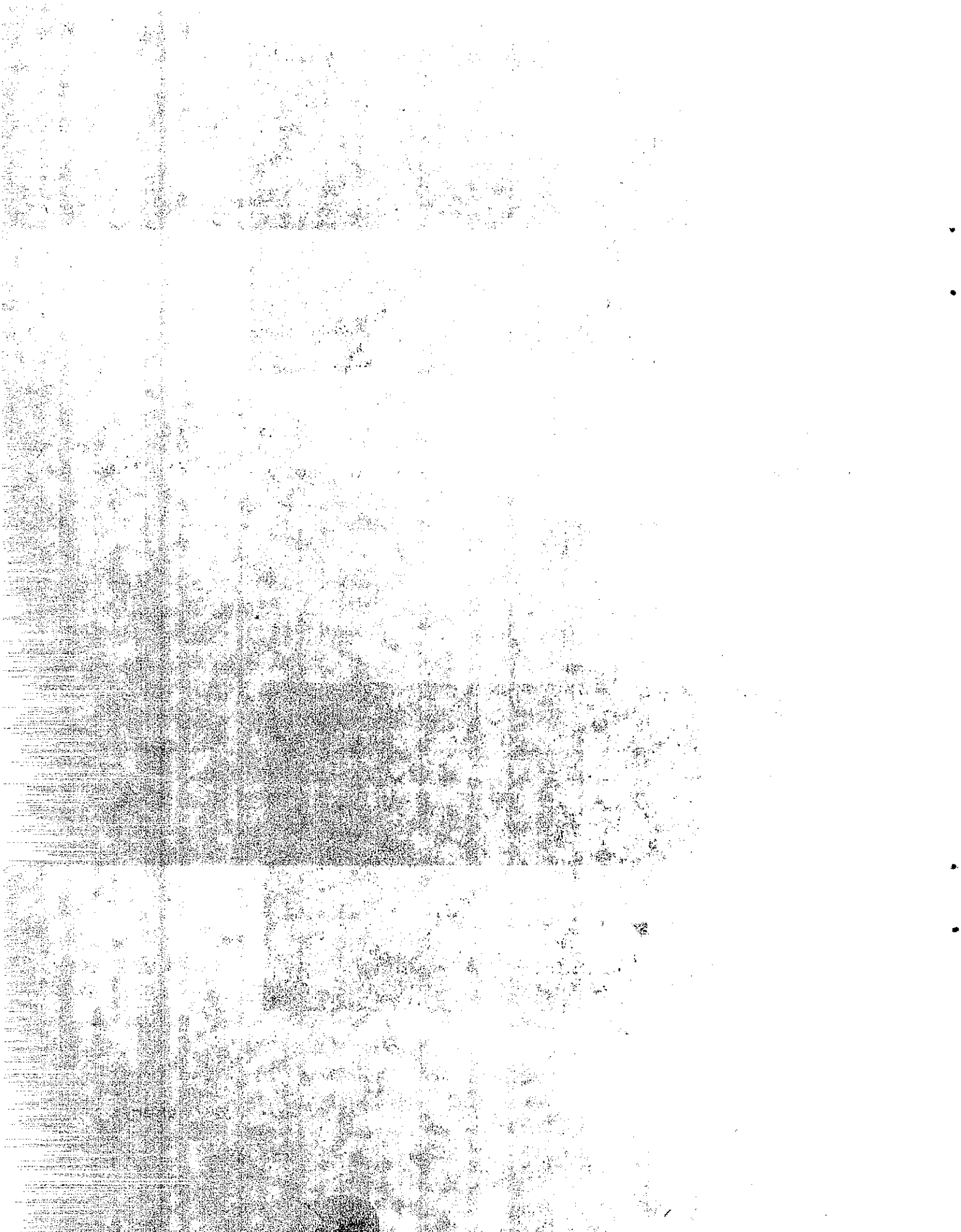

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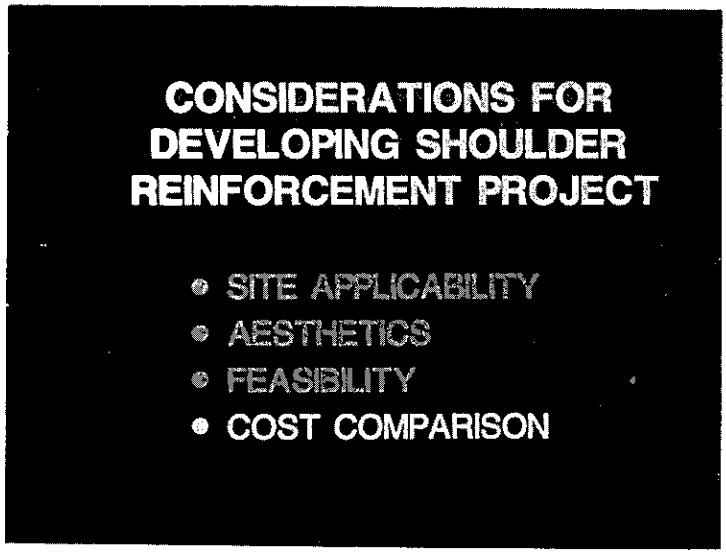

SLIDE 56 - The cost of a discarded tire wall is approximately half the cost of the next possible solution such as a gabion wall.

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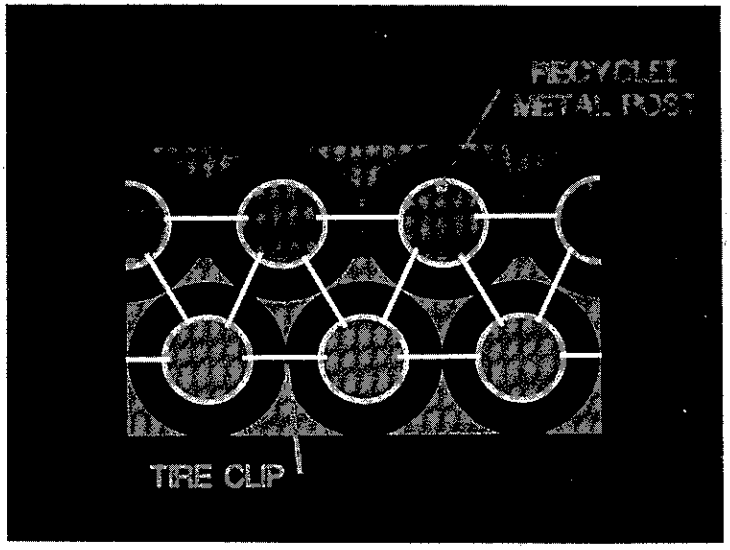
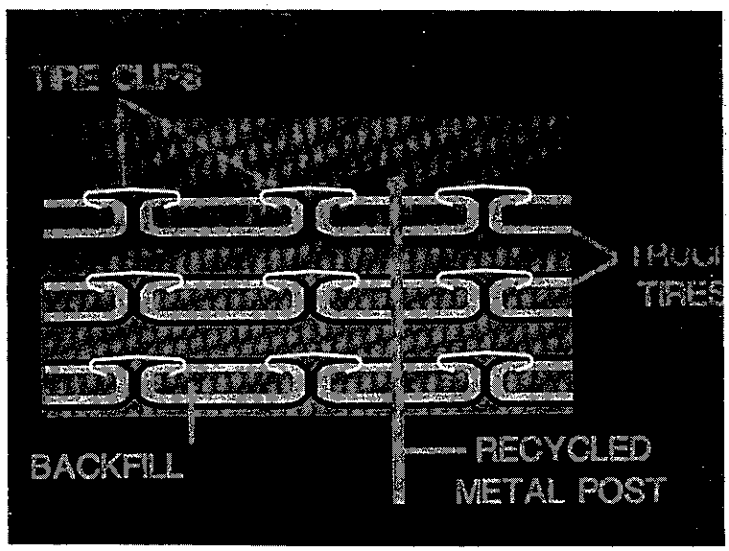


SLIDE 57 - In forming the tire-mat, certain factors should be taken into account. Note that all tires are clipped together. The mat should not encroach into the travelled way. Recycled metal posts may be used as frequently as necessary to secure mats to the slope.



SLIDE 58 - Sidewalls may require spreading during the backfill operation. Note that tires are stacked one on top of the other. Staggering of tires is not recommended.

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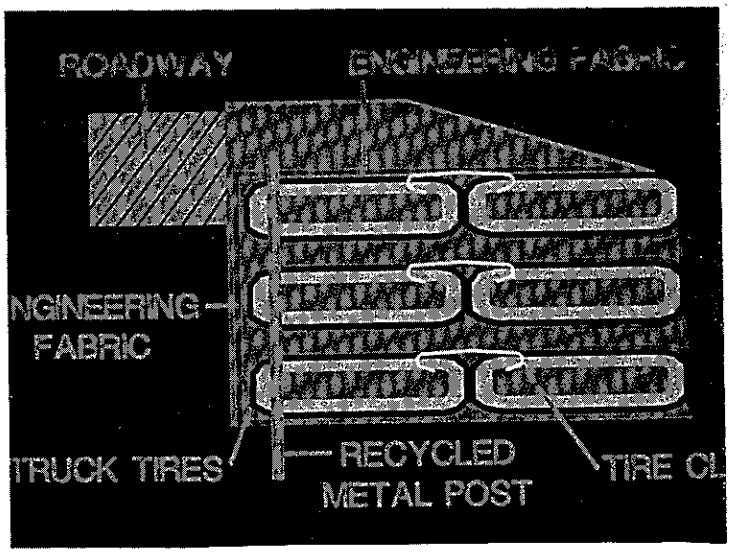
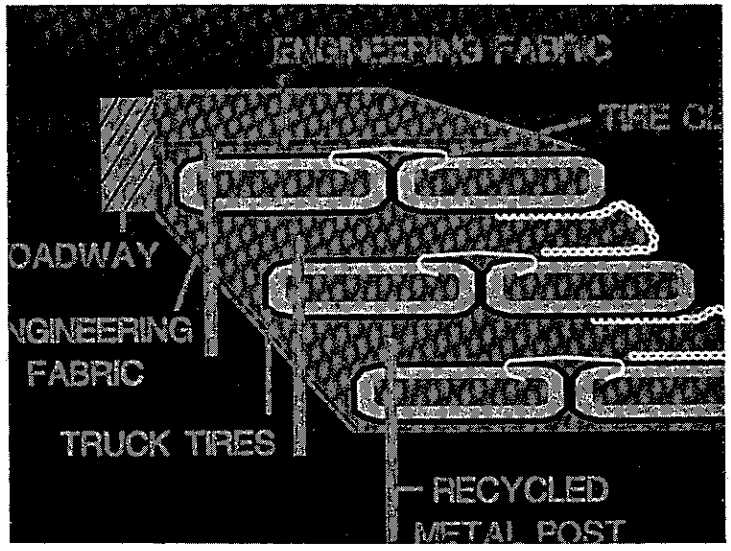


SLIDE 59 - The recycled metal post should be positioned firmly against the tire bead. The engineering fabric should be placed against the wall of the slope and on top of the tire wall. There should be a layer of soil between each tire mat. The tires are stacked vertically one on top of the other. This is the recommended method.



SLIDE 60 - An alternate method of placing tires can be adopted if revegetation of the slopes is planned . In this case each tire mat needs to be separately anchored using a recycled metal post. All the other placement criteria will be the same as in the recommended method. Here the tire wall will have an external face which is a slope.

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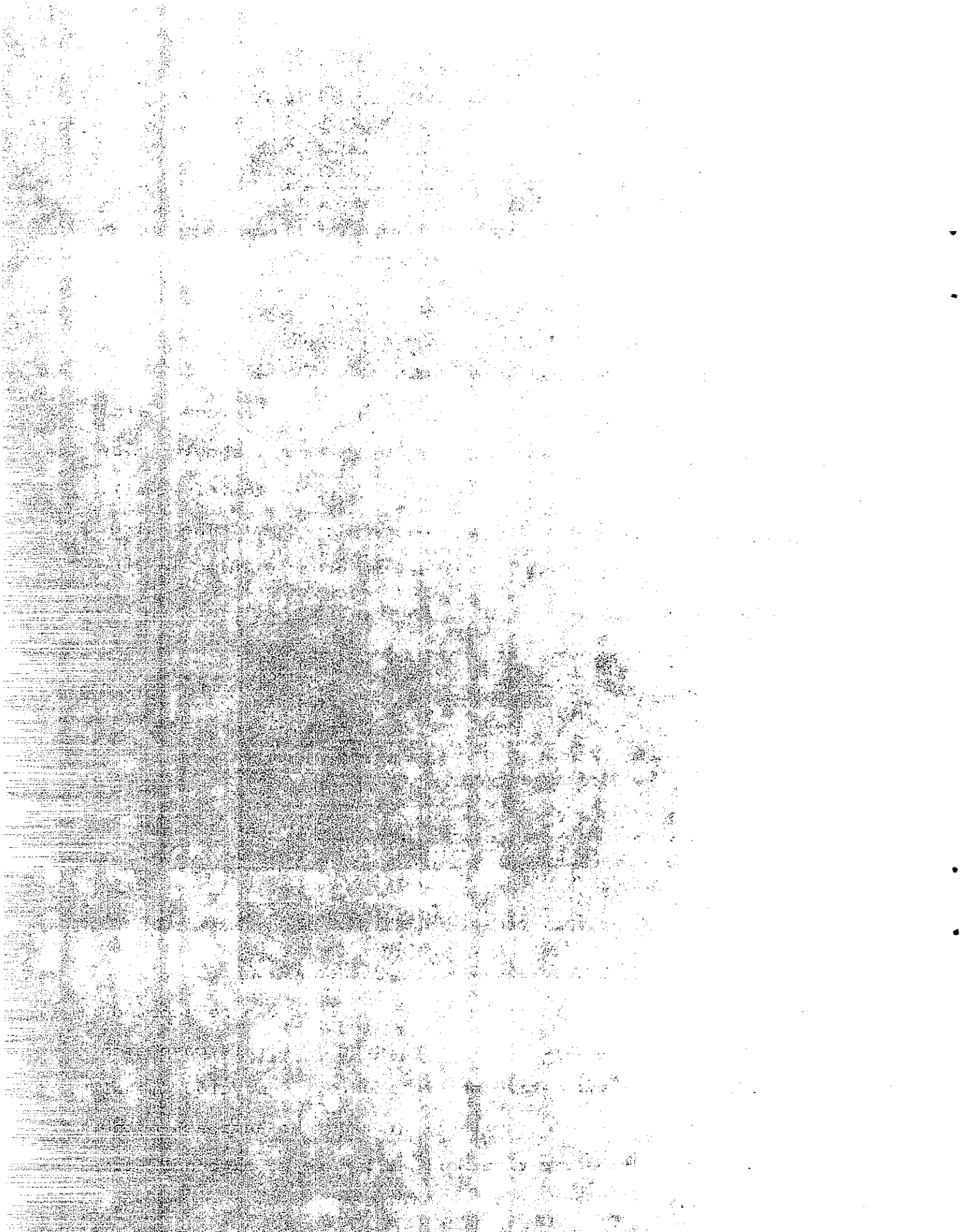

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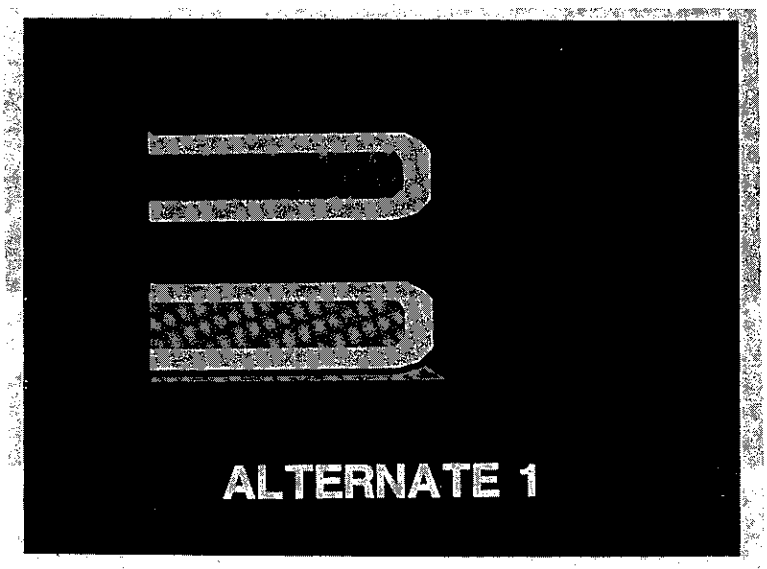
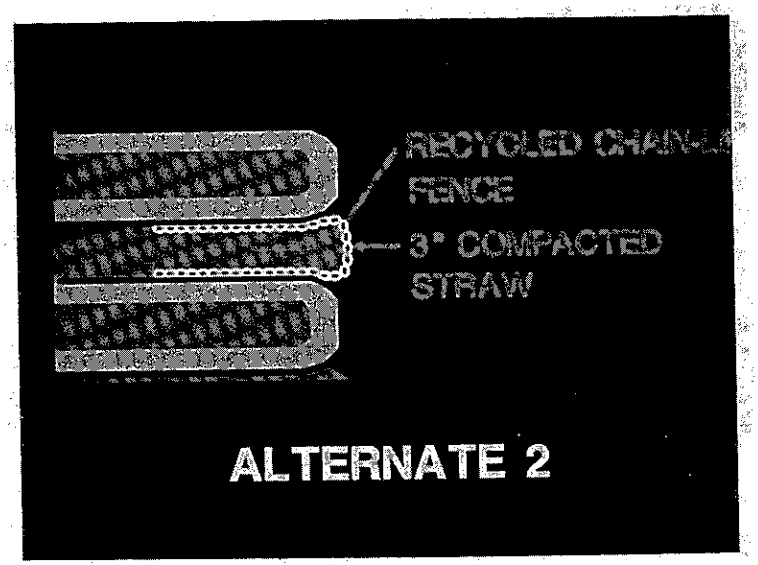


SLIDE 61 - There are three alternate methods of preventing erosion of soil contained between tire mats. Engineering fabric can be used to wrap around the soil layer between tire mats.



SLIDE 62 - Recycled mesh material such as a chain link fence can be wrapped around the soil layer between tire mats with a 3 inch plug of compacted straw to prevent the soil from falling through the fence material.

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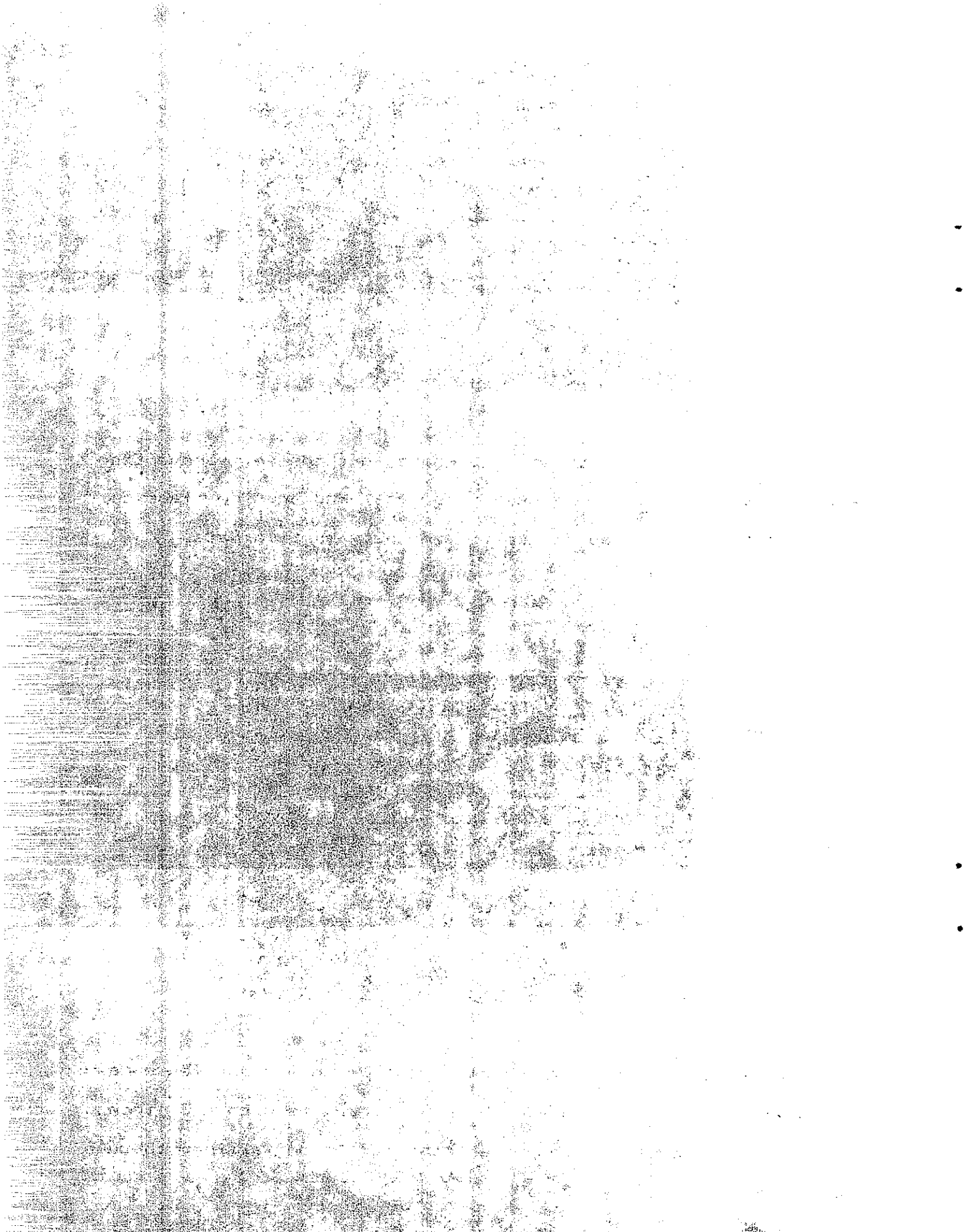

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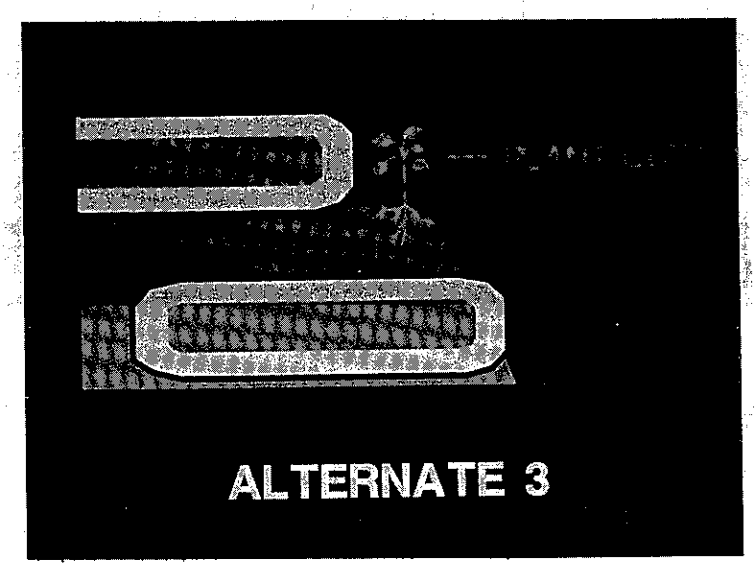
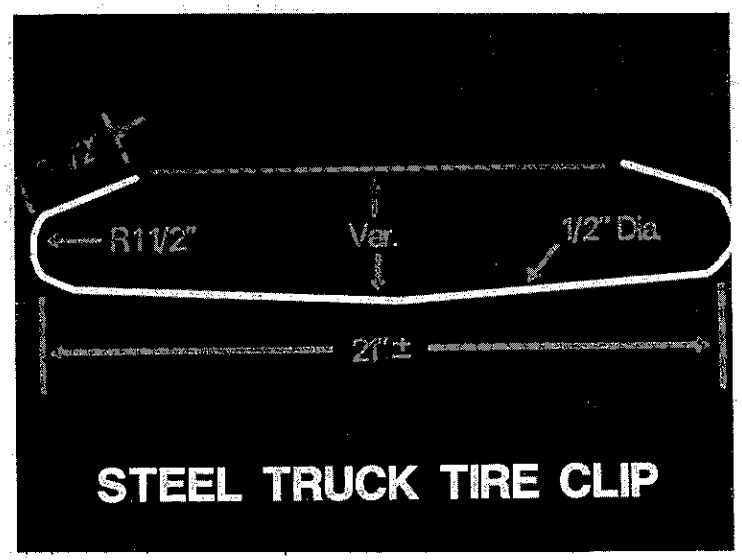


SLIDE 63 - If the slopes are laid back, woody plants can be established with,or without,the use of engineering fabric.



SLIDE 64 - The tire clip used to tie the truck tires measures approximately 21 inches in length and is fabricated from cold rolled 1/2 inch diameter steel.

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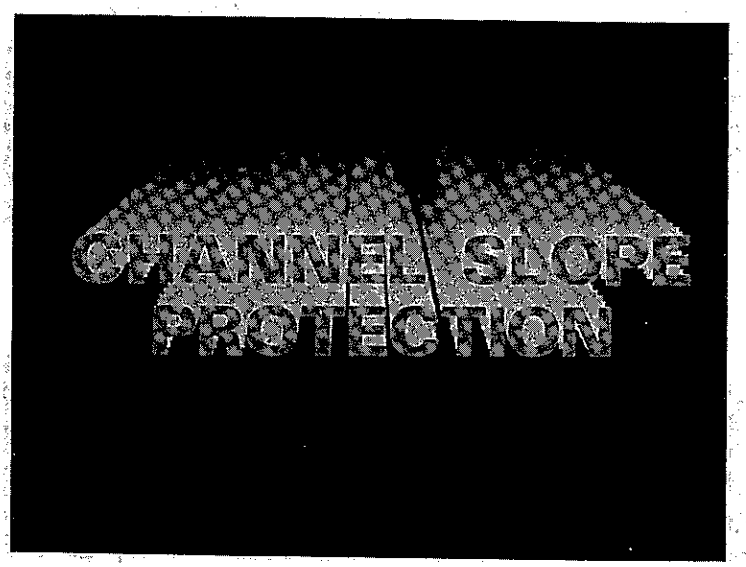

SLIDE 65 - In the first part of the brochure we considered shoulder reinforcement techniques using discarded truck tires. In the second part let us look at guidelines for channel slope protection using discarded truck tires.

SLIDE 66 - The tire wall consists of at least six truck tires stacked vertically and are tied together using steel clips. Vegetation was established after the completion of the project and has held the soil on the slope very well.

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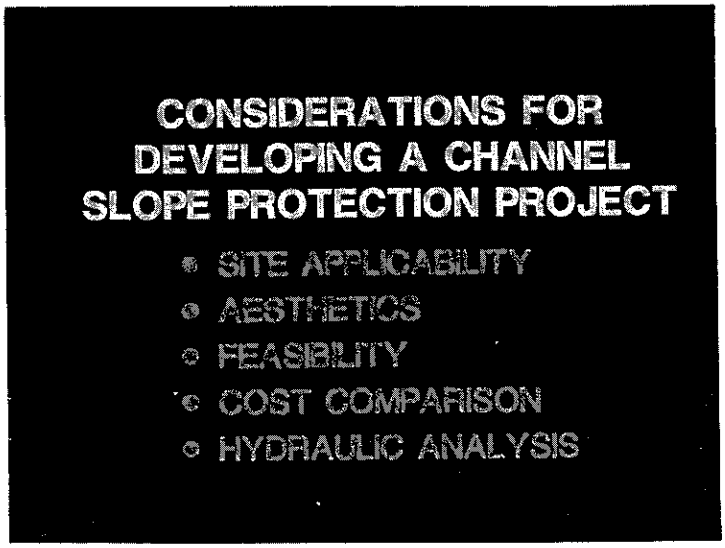

SLIDE 67 - Five aspects should be considered during design of a channel slope protection project. They are:

- Site applicability
- Aesthetics
- Feasibility
- Cost comparison
- Hydraulic analysis

SLIDE 68 - Discarded truck tires should be used in locations of low visibility to the traveling public.

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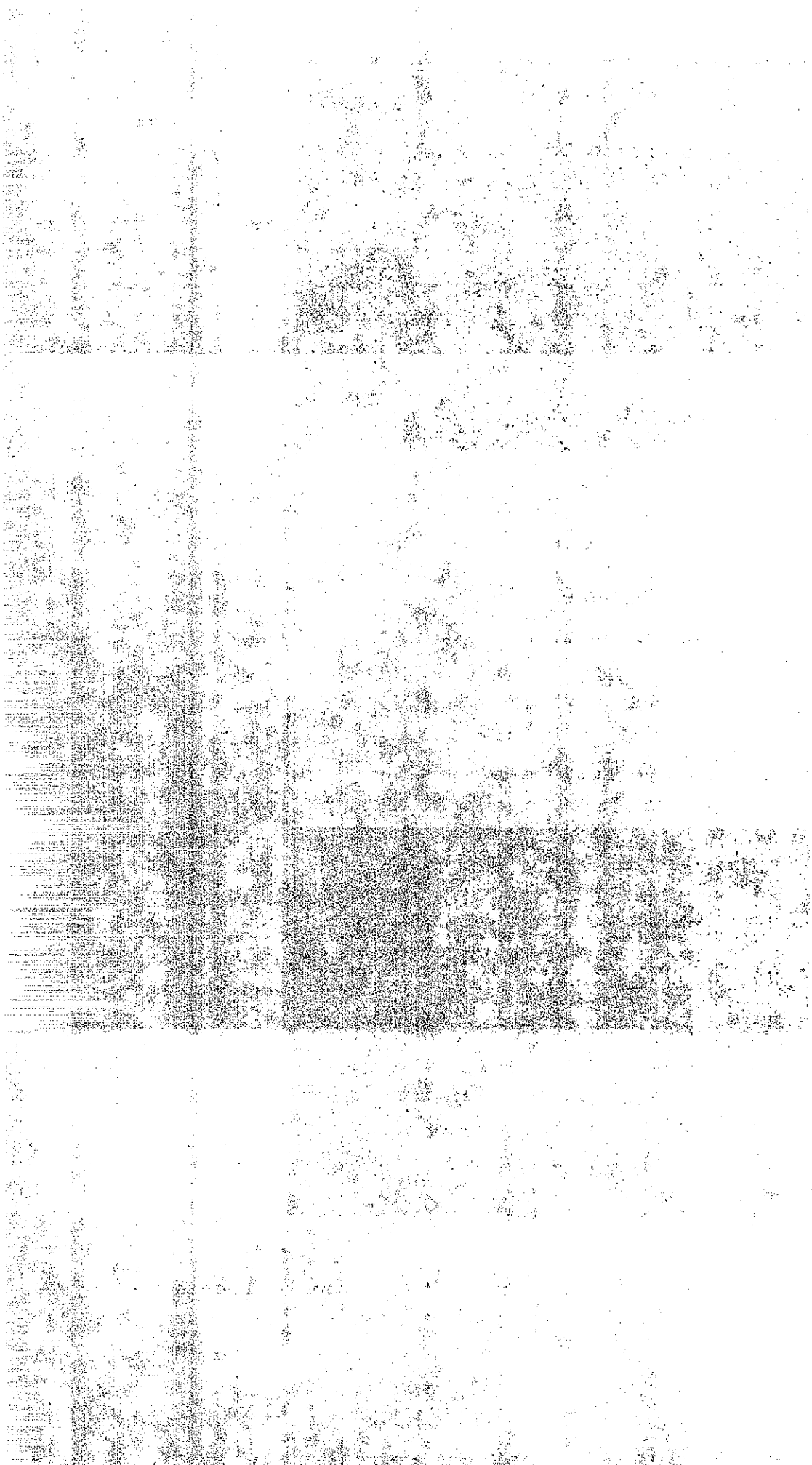

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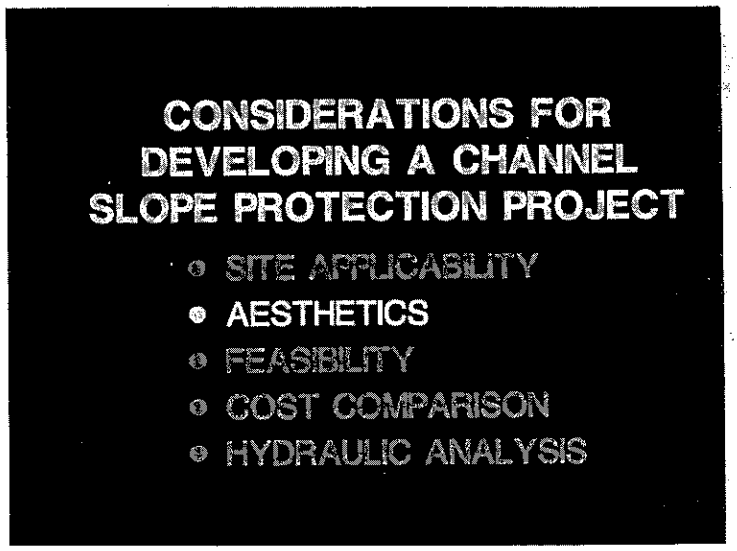
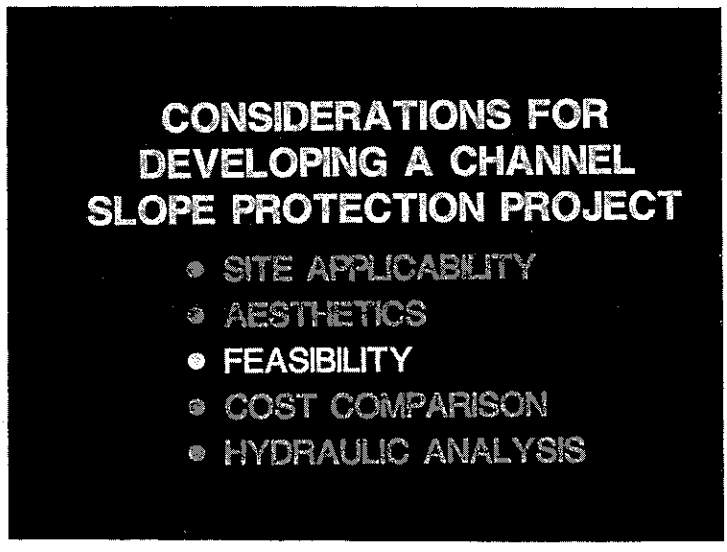


SLIDE 69 - Tires can be successfully covered by natural sloughing of the soil combined with the growth of native grasses.



SLIDE 70 - Determine if discarded tires are the most satisfactory solution for the problem. Other alternate methods should be considered too.

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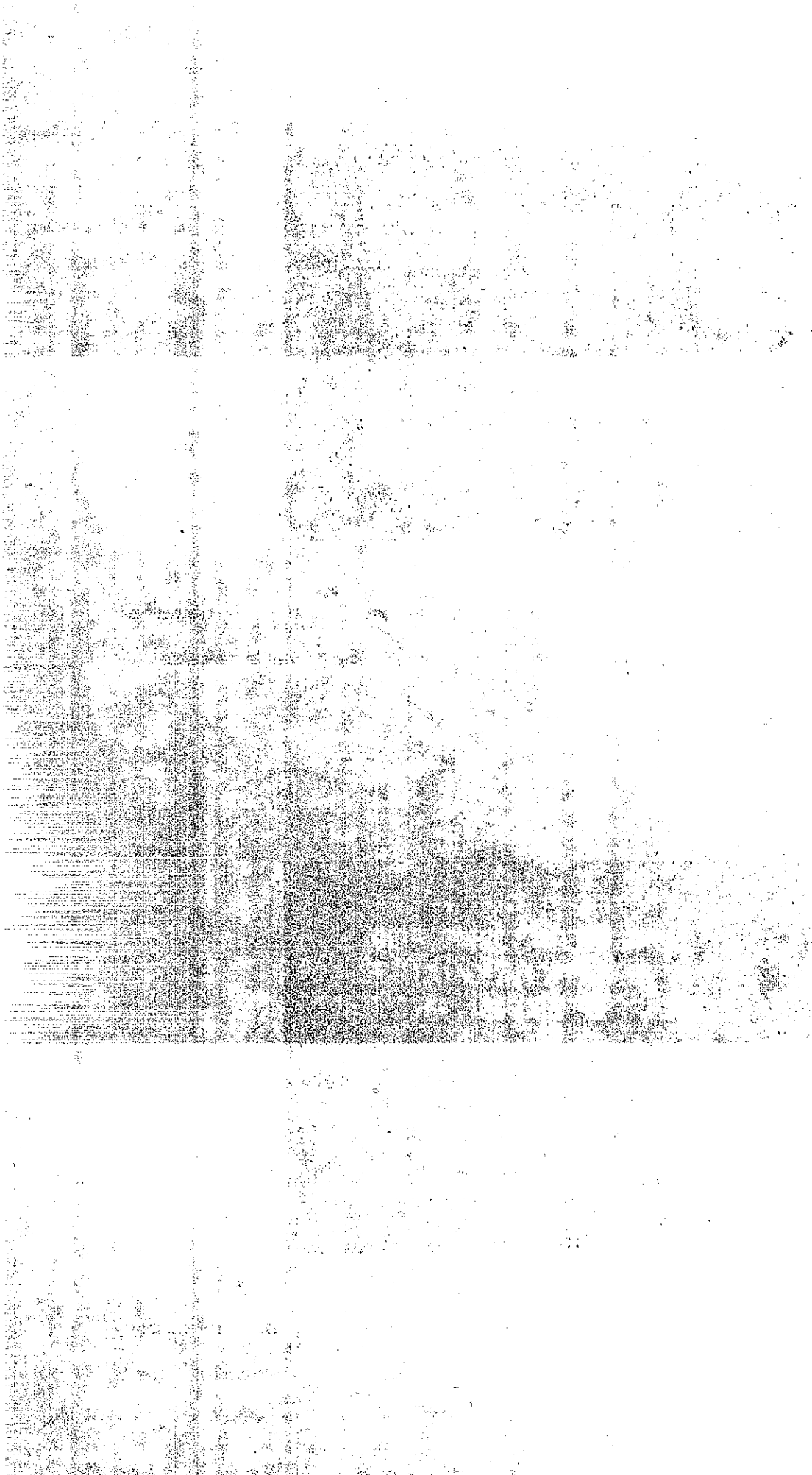

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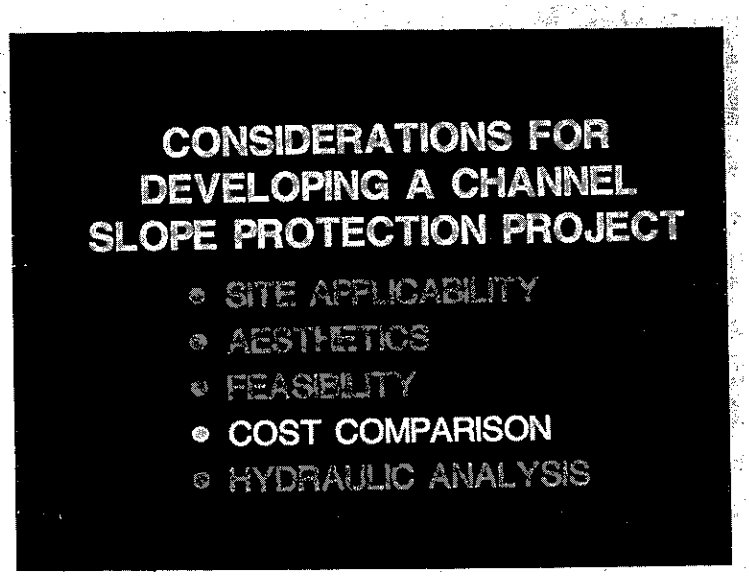
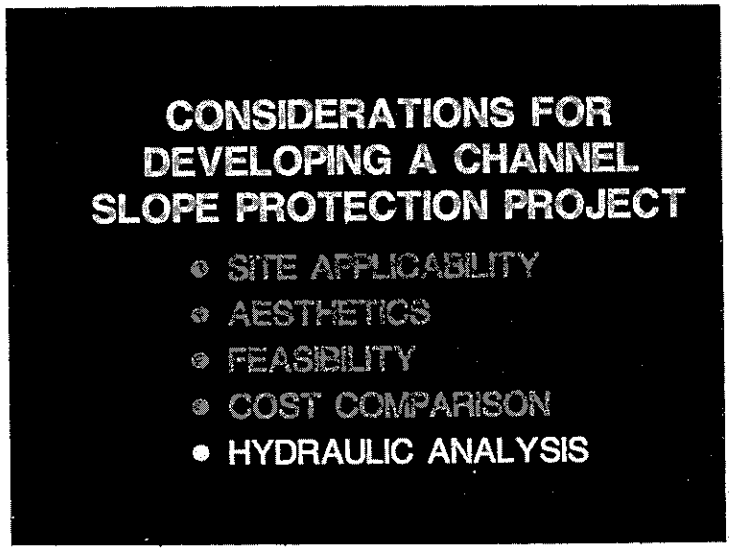


SLIDE 71 - The cost of discarded tires for channel slope protection is approximately 1/2 the cost of other mitigation measures such as gabion walls.



SLIDE 72 - Hydraulic analysis should be conducted prior to considering any application to a channel problem. Determine if there is low velocity flow in the channel. If the flow is excessive, this method may not be applicable.

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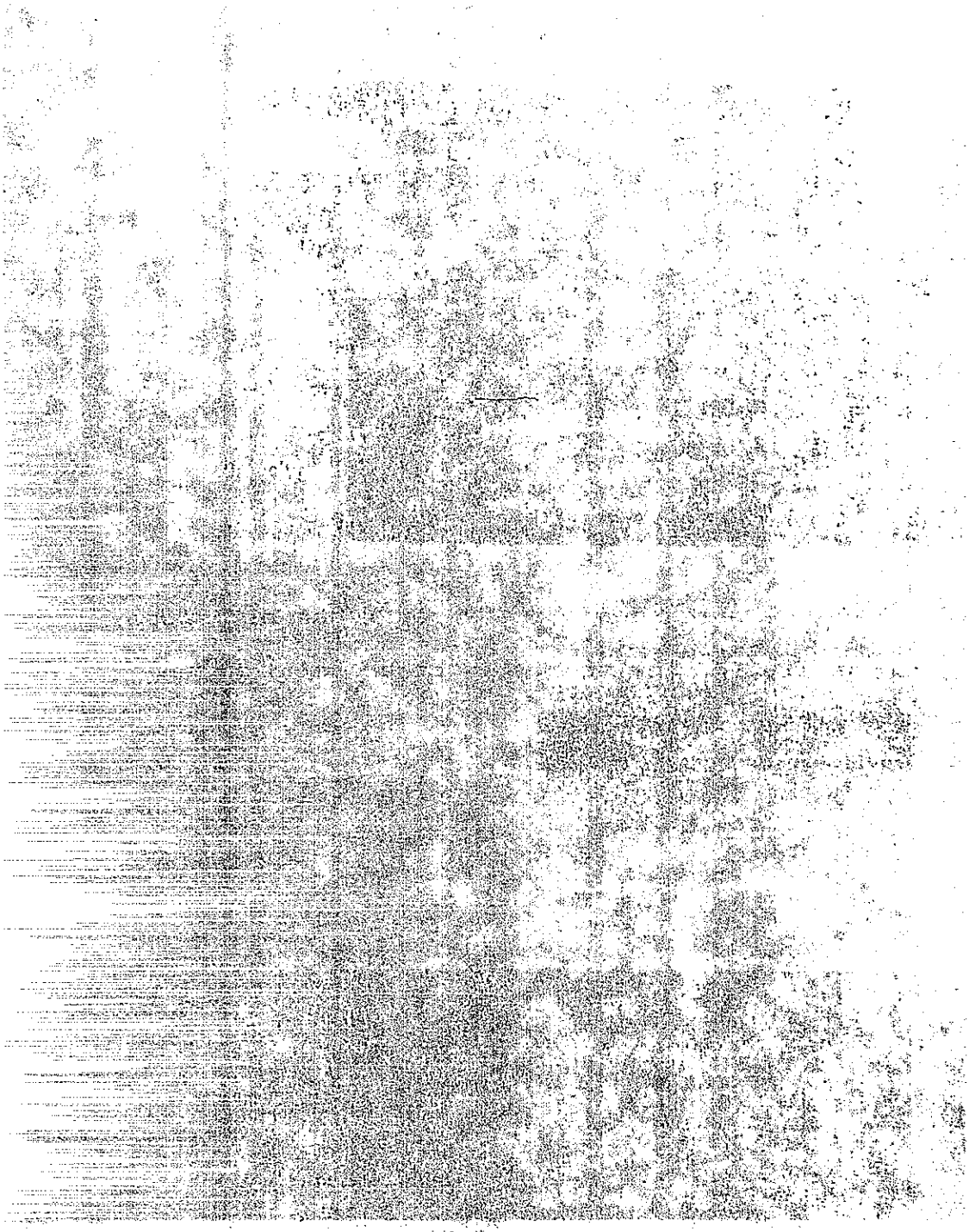

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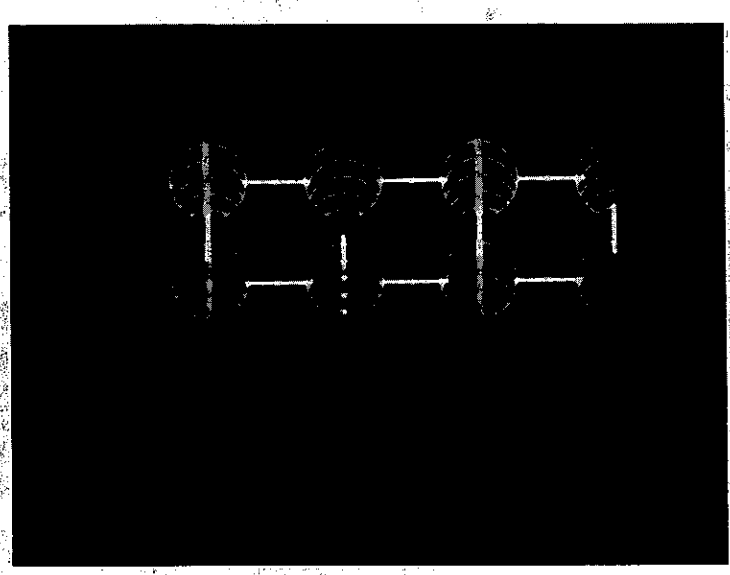

SLIDE 73 - Discarded truck tires are stacked vertically to make columns of tires. Note in each layer, all the tires are clipped together. Recycled metal posts are driven a minimum of every third tire to secure the tires in position.

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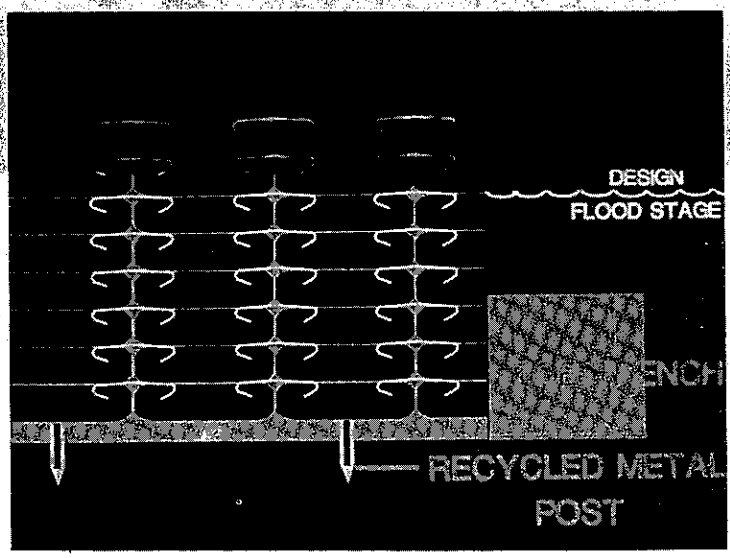

SLIDE 74 - During the installation process, certain precautions should be taken. A toe trench equal in depth, to at least the total thickness of three truck tires, should be provided. This will anchor the entire tire wall assembly, and prevent the destabilizing action of scouring. The top of the truck tire wall should be the thickness of two truck tires above the design flood stage.

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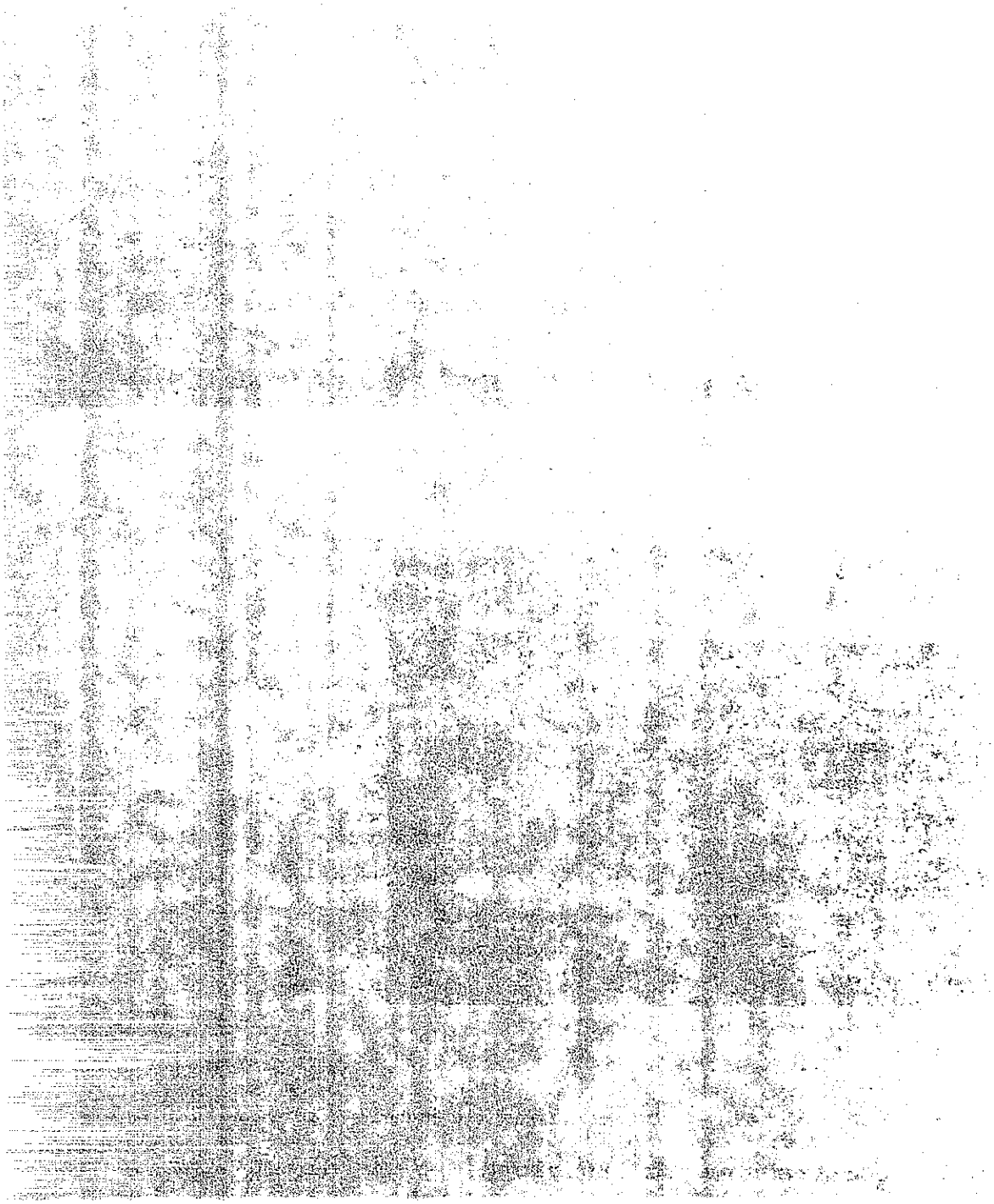

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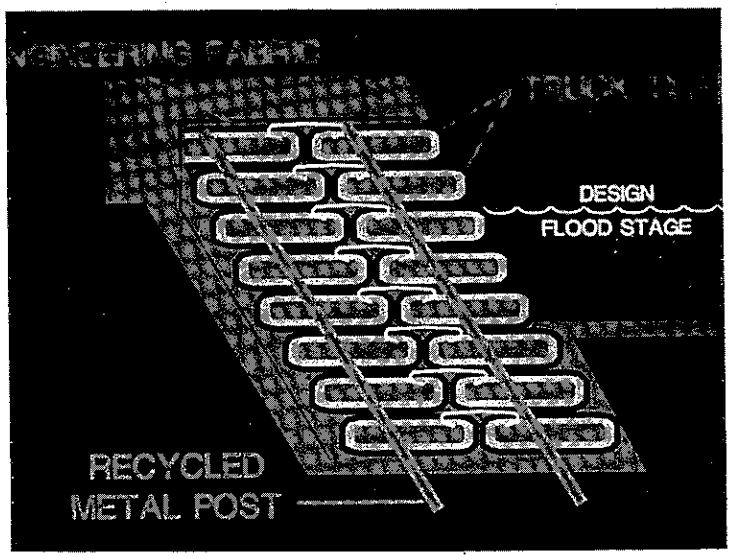

SLIDE 75 - The truck tires can be stacked on a battered slope. The engineering fabric can be placed against the soil wall of the slope and over the top of the tire wall assembly. Note that the recycled metal posts are driven in a battered manner through the columns of tires to anchor the tire wall assembly.

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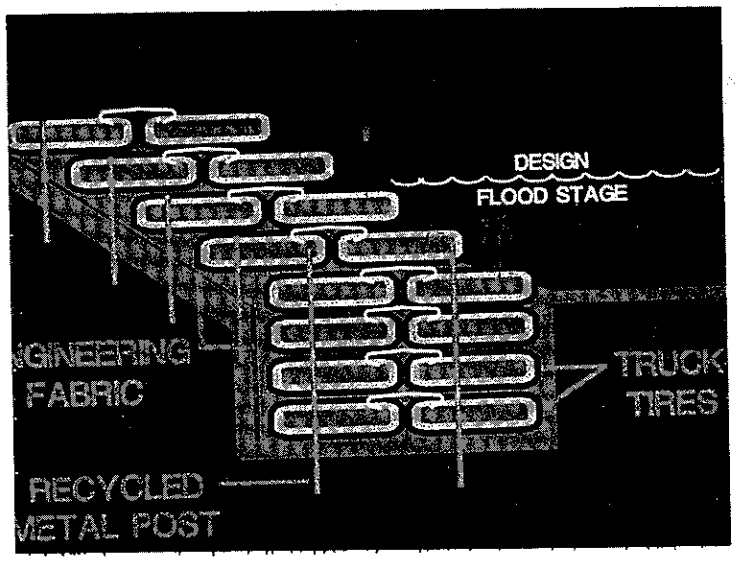

SLIDE 76 - Step placement of truck tires can be used as an alternate method. It consists of two parts. The first part consists of vertical columns of tires with most of the column in a trench below the channel bed level. The second part consists of a series of steps. In this case each layer of tires is anchored into the soil slope by metal posts. Engineering fabric can also be used as explained earlier. These steps, if filled with soil material,will allow for the establishment of plants and cuttings.

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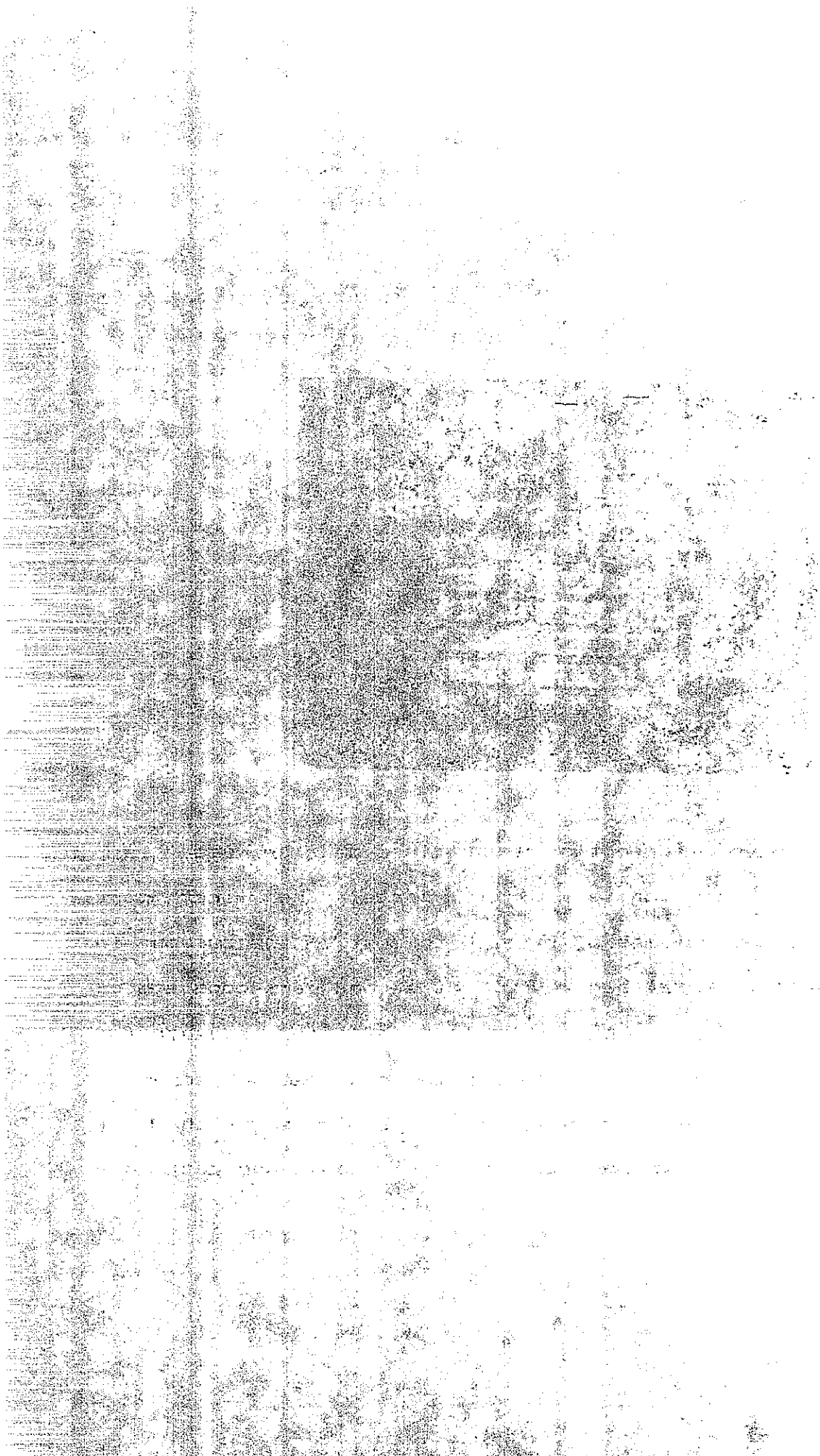

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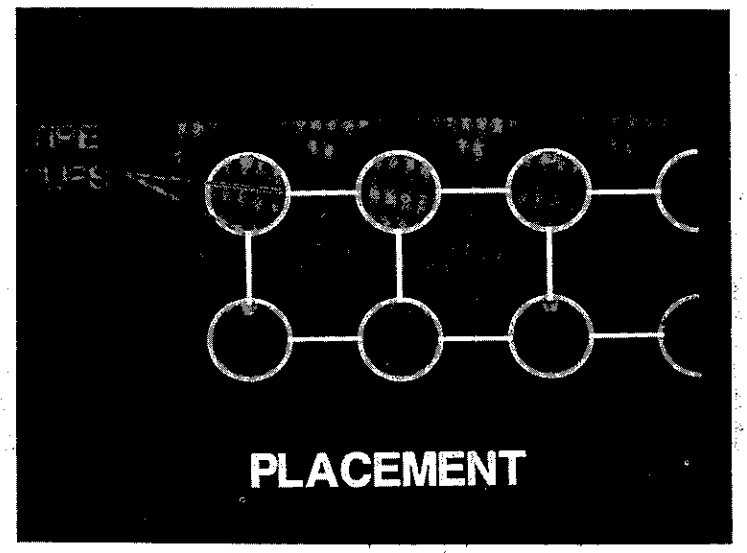
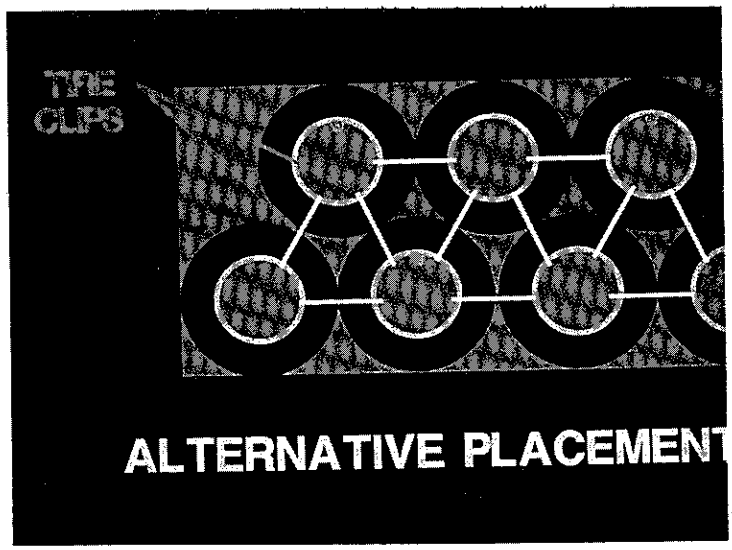


SLIDE 77 - The truck tires can be placed in two configurations. The first configuration is a straight or square placement. Note that four tire clips are used to tie the four tires together.



SLIDE 78 - The second configuration is a staggered or triangular placement, in which three tire clips tie three tires together.

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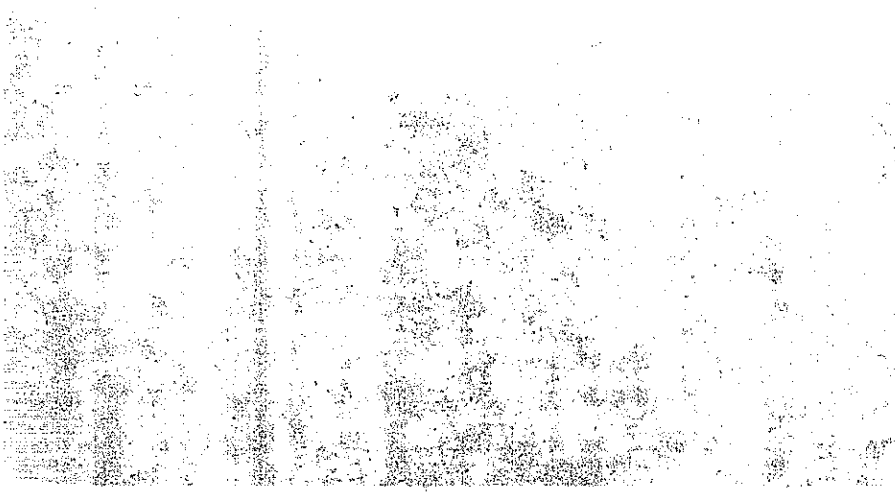

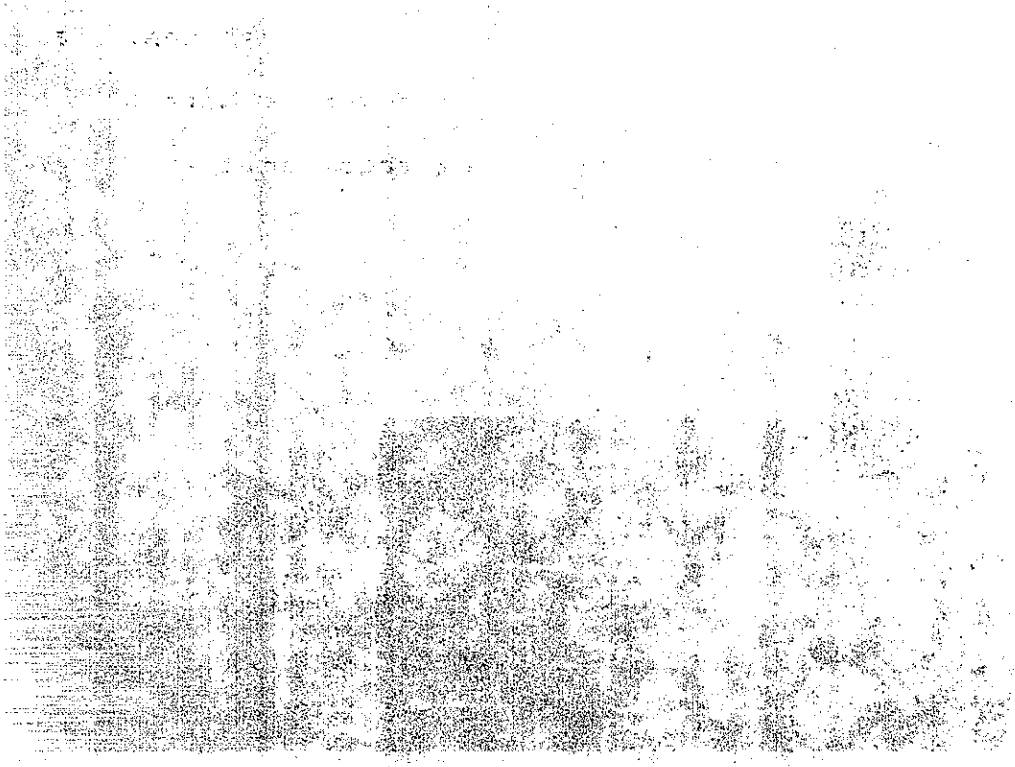

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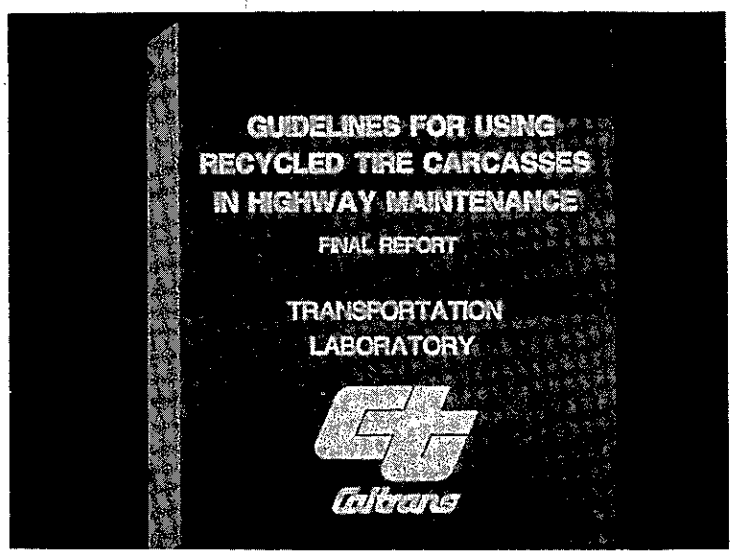

SLIDE 79 - The research report from which this implementation package was prepared is entitled " GUIDELINES FOR USING RECYCLED TIRE CARCASSES IN HIGHWAY MAINTENANCE ". If you need a copy,write or call the Caltrans- Office Of Transportation laboratory at the address and/or phone number given in the brochure.

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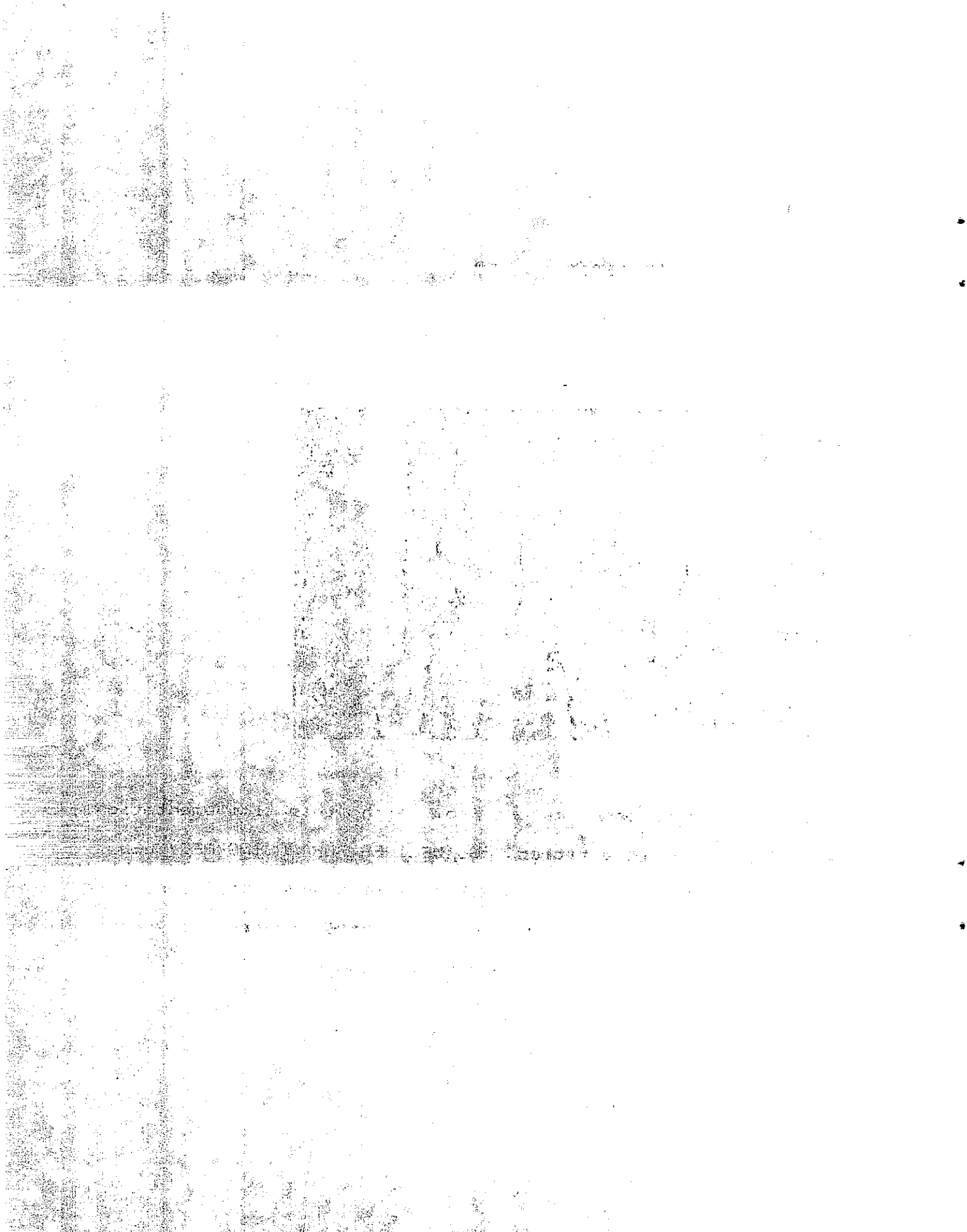

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SLIDE 80 - For furthur information about this implementation package, please contact the Office Of Transportation Laboratory. The procedures explained in this presentation are not to be considered permanent solutions to mitigation of erosion. These procedures are meant to be used by highway personnel as short term solutions pending a more permanent project. In some cases these methods will be the only possible and practical solution.

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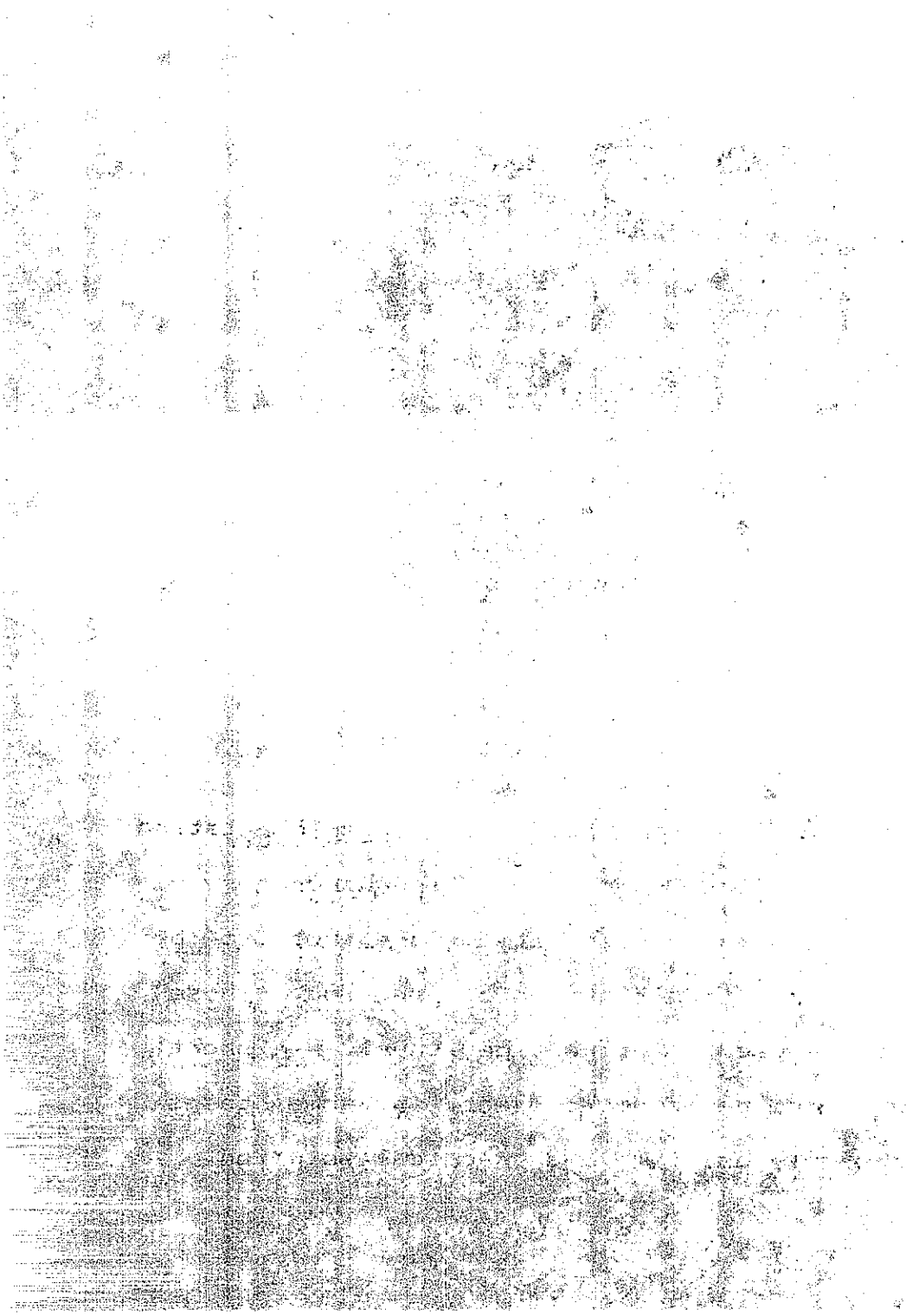

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USE OF DISCARDED TIRES IN HIGHWAY MAINTENANCE

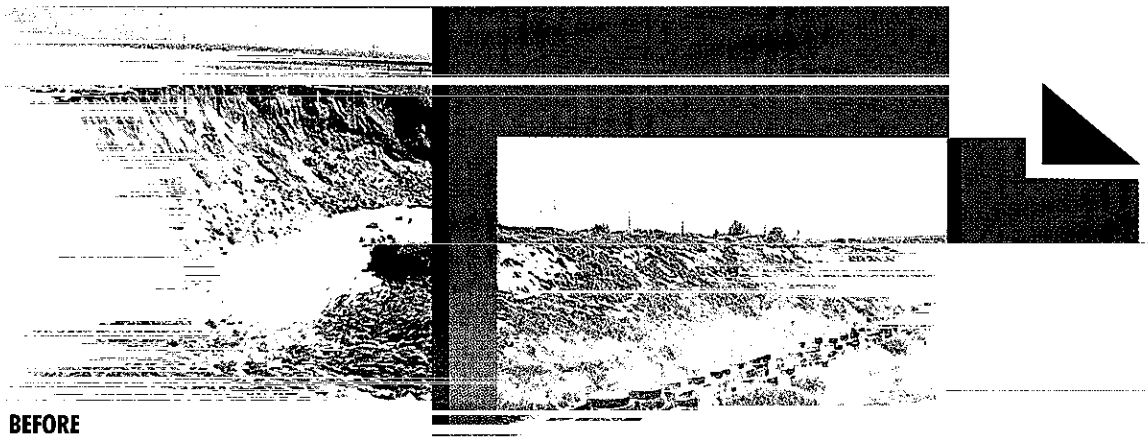
TRANSLAB DESIGN INFORMATION

BENEFITS:

- **SALVAGED MATERIALS**
  May be obtained from maintenance operations.
- **DISCARDED TIRES**
  Can be obtained from various sources.
- **EQUIPMENT**
  No special equipment necessary.
- **PERSONNEL**
  Work performed by maintenance personnel.
- **COST**
  More economical than many alternative materials.

BEFORE

AFTER



BEFORE

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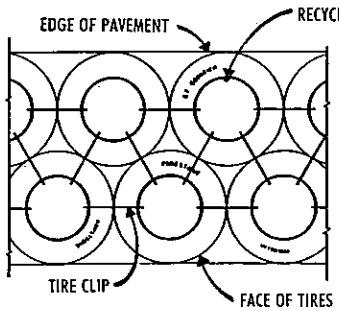
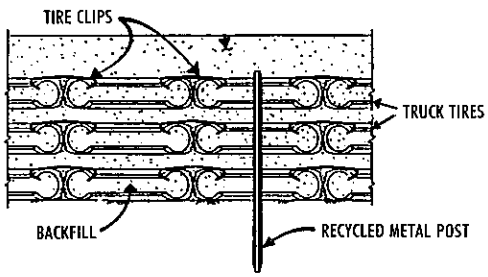
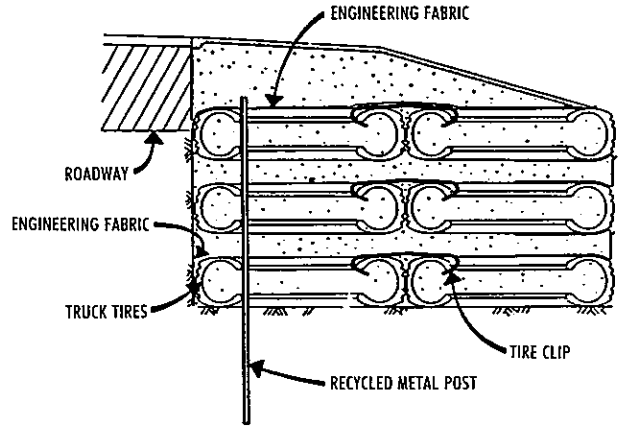
SHOULDER REINFORCEMENT



PLAN VIEW



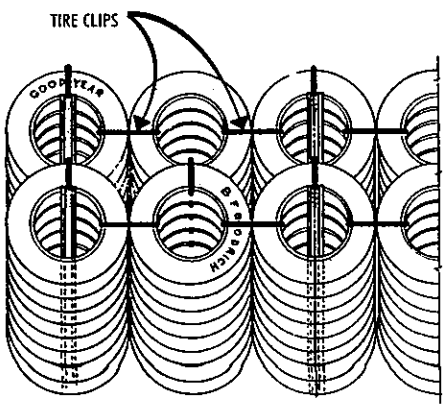
ELEVATION VIEW



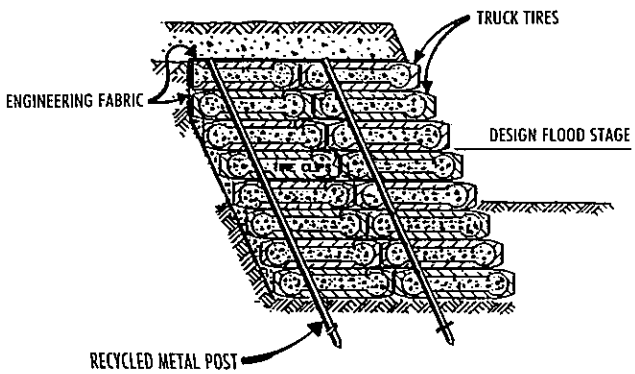
TYPICAL SECTION

Shoulder erosion along a narrow highway can be mitigated. By using salvaged post anchors and discarded tires, shoulders can be restored thus making the highway safe for travel.

CHANNEL SLOPE PROTECTION



PLAN VIEW



TYPICAL SECTION

Severe erosion and slope failure can occur along drainage channels. These slopes can be restored by the use of discarded tires.

An implementation package consisting of a slide presentation, and a design information package is available for interested persons. The slide presentation is also available in a video cassette. The implementation package is designed to help maintenance personnel use discarded tires and other salvaged materials in their work.

For further information, contact:
OFFICE OF TRANSPORTATION LABORATORY,
RESEARCH AND ENVIRO-CHEMICAL SERVICES BRANCH
(916) 739-2417 or write to
TRANSPORTATION LABORATORY
5900 Folsom Blvd.
Sacramento, CA 95819

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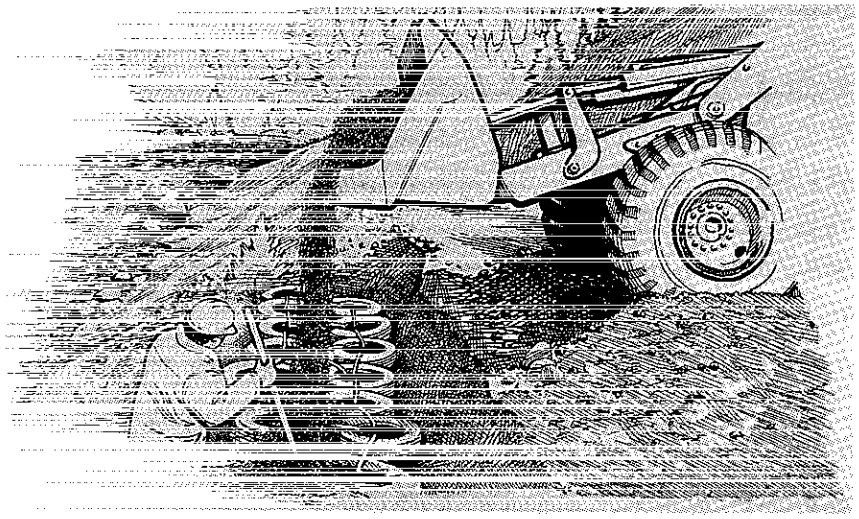
USE OF DISCARDED TIRES IN HIGHWAY MAINTENANCE

TRANSLAB DESIGN INFORMATION BROCHURE NO. TL/REC/1/88



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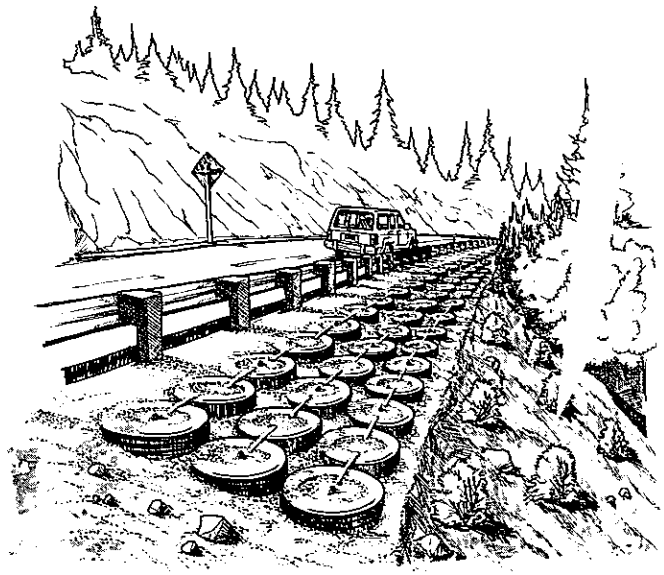
BACKGROUND

The high cost of new construction materials coupled with waste material disposal problems has focused attention on recycling waste products for use on transportation projects. One such waste product is the discarded tire, which has several uses: for shoulder reinforcement on highway slopes, for channel slope protection, or as a barrier to mechanically control blowing sand in low rainfall areas until vegetative windbreaks become established. In this brochure the interception of blowsand using discarded [illegible] was found to be expensive. For further [illegible] Transportation Research Report "Guidelines For [illegible] Carcasses In Highway Maintenance" FHWA/CA/[illegible] Transportation Laboratory in Sacramento has done [illegible] in this area with the following objectives:

- Develop engineering guidelines for the use of discarded truck tires and recycled materials as a mechanical means of stabilizing highway shoulder erosion problem.
- Determine if discarded truck tires and recycled materials would be feasible for low velocity drainage channel slope protection.



DESCRIPTION OF SITE

The process investigated was the mechanical stabilization of the shoulders utilizing discarded truck tires. The selected project site was on Route 32 Tehama County at Deer Creek. At this site, shoulders were eroded by rainfall, snowmelt, and overtopping of embankments. Installation of discarded tires was done by District 2 (Redding) maintenance personnel under the direction of the Transportation Laboratory.

RESEARCH FINDINGS

- Tires remained stable and maintained their integrity.
- Economical solution to an increasing problem occurring on many low volume, narrow mountain highways throughout California.
- Shoulder reinforcement provides a safer highway by development of a wider traveled way.

RESEARCH RECOMMENDATION:

It is economical to use discarded truck tires in shoulder reinforcement.

The use of discarded tires for SHOULDER REINFORCEMENT is considerably more economical than many alternative materials.

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SHOULDER REINFORCEMENT

In 1988 Dollars Per Lineal Foot For a 5' High Wall

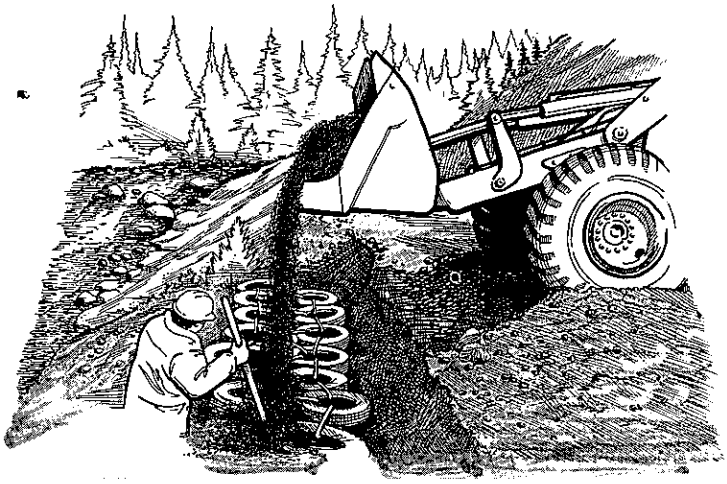
Discarded tire wall*	80.00
Gabion wall	165.00
Concrete crib wall	230.00
Reinforced concrete wall	325.00

*Suitable excavated material is assumed as backfill.

Note: (1) The expected life of a shoulder reinforcement project can be 5 to 10 years.
(2) In the case of shoulder reinforcement, the use of discarded tires should be considered an immediate but interim solution, whereas others are of a more permanent nature.

CONSIDERATIONS:

- **SITE APPLICABILITY:** Tires should be placed on lower slopes and in locations where they are not visible to the traveling public.
- **AESTHETICS:** Painting the tires to blend with the surrounding terrain will improve the aesthetics of the installations.
- **FEASIBILITY:** Determine if a discarded tire wall was the most satisfactory solution for the problem.
- **COST COMPARISON:** Is the cost of discarded tire walls less than the cost of the next possible solution such as gabion wall?



CONSTRUCTION PROCEDURES AND PRACTICES:

The attached drawing sheet "SHOULDER STABILIZATION WITH RECYCLED TIRES" summarizes the construction procedures and practices. At the eroded shoulder, a bench should be cut and sloped slightly towards the traveled way. The width of the cut should be the width of the truck tire mat plus a minimum of six inches. Engineering fabric should be placed behind, under and over the tires to prevent soil from eroding. The tires should be placed in parallel rows and backfilled with imported permeable material. The tires should be connected using clips which are fabricated from ½ inch steel reinforcing bar. A 12 inch layer of permeable material should be placed on top of the first layer of tires. Then the second layer of tires should be placed and backfilled. Salvaged metal posts if available should be driven through the hole a minimum of every other tire in the inside row. The top of the post should be driven flush with the top of the last layer of tires. To provide an unpaved shoulder, an 18 inch layer of native soil should be placed on top of the tires and compacted. Woody plants could then be planted on the slope below the tire installations to accelerate the reestablishment of vegetation. Alternative recommended method of placement of engineering fabric and soil containment between mats is also shown on the drawing sheet.

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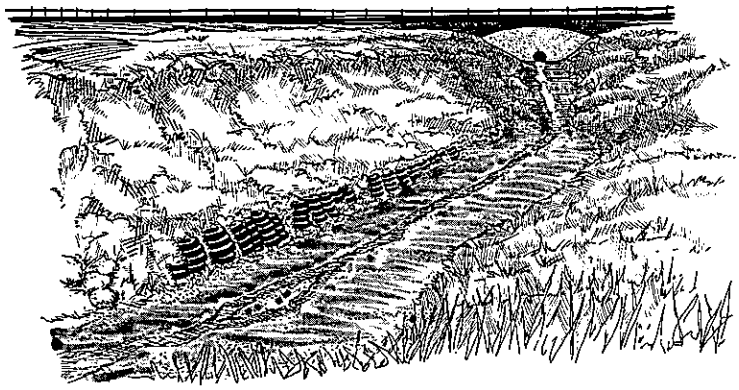
CHANNEL SLOP



DESCRIPTION OF SITE

District 6 (Fresno) maintenance forces installed discarded truck tires to provide channel bank protection at the Lassen Avenue Interchange on I-5 in Fresno County. The channel bank in this area had severely eroded up to the adjacent private property. It was very successful but erosion of slopes due to low velocity drainage continued to occur beyond the stabilized site. An additional section of this channel was studied as part of this research project.

RESEARCH FINDINGS

- Tires remained stable in low velocity sheet flow drainage.
- Immediate and economical solutions.
- Excellent stands of vegetation grew and effectively stabilized the upper slope.

RESEARCH RECOMMENDATION:

It is economical to use discarded truck tires in channel slope protection under low velocity flow drainage. The use of discarded tires for CHANNEL SLOPE PROTECTION is considerably more economical than many alternative materials.

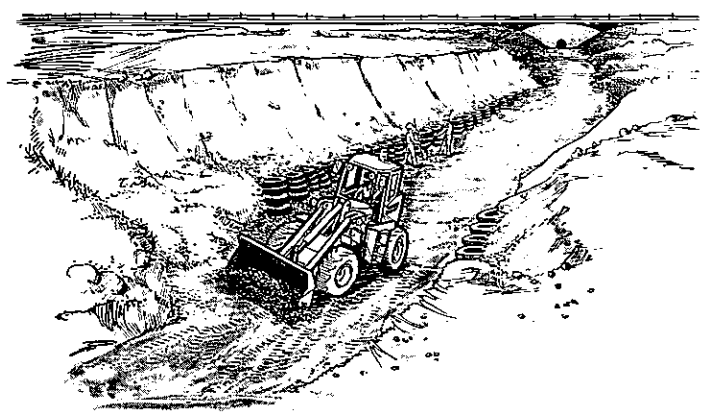
In 1988 Dollars Per Lineal Foot For a 5' High Wall

Discarded tire*	50.00-80.00
Rock slope protection	125.00
Broken concrete slope protection	150.00
Gabion wall	165.00
Reinforced concrete	325.00

*Suitable excavated material is assumed as backfill.

CONSIDERATIONS:

- **SITE APPLICABILITY:** Tires should be placed in locations of low visibility from traveling public.
- **AESTHETICS:** Tires can be successfully covered by the natural sloughing of the soil combined with the growth of native grasses.
- **FEASIBILITY:** Determine if discarded tires are the most satisfactory solution for the problem.
- **COST COMPARISON:** Is the cost of discarded tires for channel slope protection less than the cost of other mitigation measures such as gabion walls?
- **HYDRAULIC ANALYSIS:** Hydraulic analysis should be conducted prior to considering any application to a channel problem.



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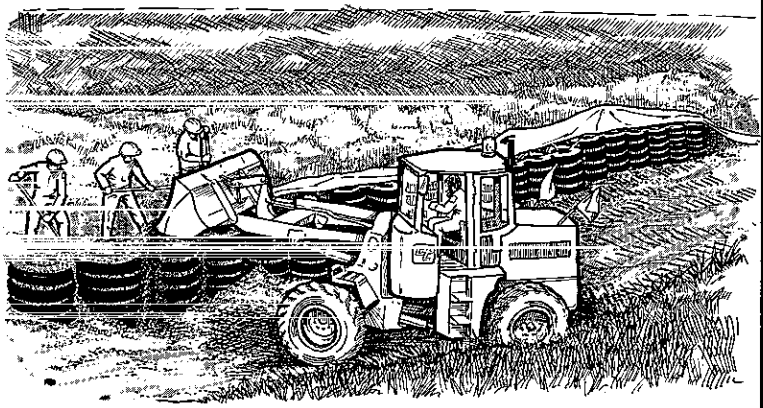
OTECTION

CONSTRUCTION PROCEDURES AND PRACTICES:

The attached drawing sheet "CHANNEL SLOPE PROTECTION WITH RECYCLED TIRES" summarizes the construction procedures and practices. At the eroded channel slope, a foundation of three tires in depth should be dug in order to provide a stable footing. The channel banks should be excavated and sloped to a minimum batter of one in twenty to ensure the stability of the tire wall. Engineering fabric should be placed under and behind the tires. The tires should be backfilled with the excavated material and compacted by ponding and jetting, and using a vibratory compactor. Salvaged metal posts should then be driven through the center hole a minimum of every other tire. The area above the tire units should then be revegetated.



SPECIFICATIONS

This brochure including the two drawing sheets are the guidelines for the use of discarded tires for controlling erosion of embankments and controlling erosion on channel banks. These guidelines are plans which will allow designers to develop discarded tire projects. They will also provide maintenance personnel with an immediate solution for an erosion problem until more permanent measures can be undertaken.

For further information, contact
OFFICE OF TRANSPORTATION
LABORATORY RESEARCH AND
ENVIRO-CHEMICAL SERVICES BRANCH
(916) 739-2417 or (ATSS) 497-2417
or write to
TRANSPORTATION LABORATORY
5900 Folsom Blvd.
Sacramento, CA 95819

Caltrans

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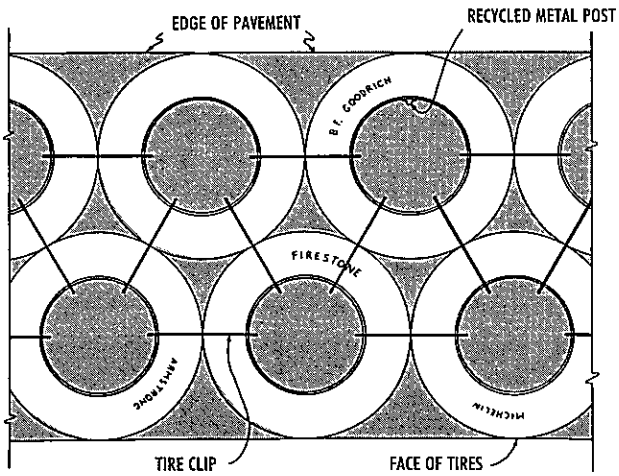
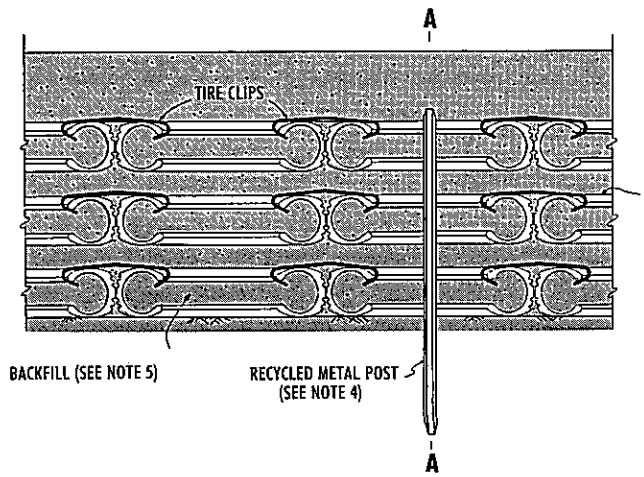
SPECIFICATIONS

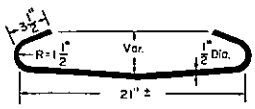
SHOULDER STABILIZATION
WITH RECYCLED TIRES



PLAN VIEW

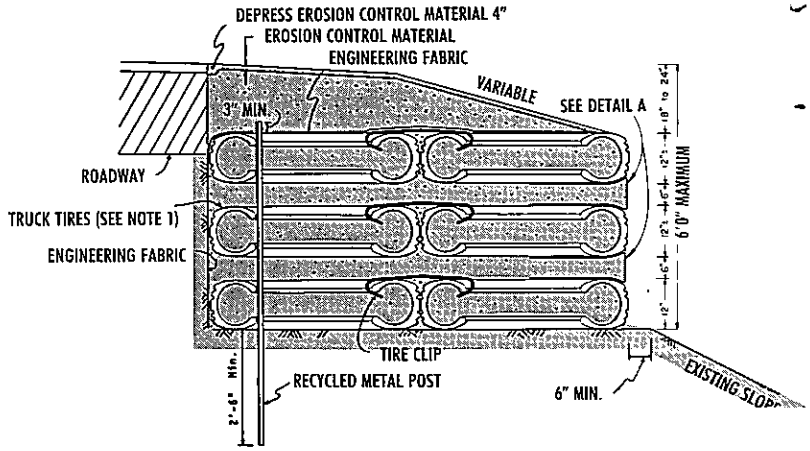


ELEVATION VIEW

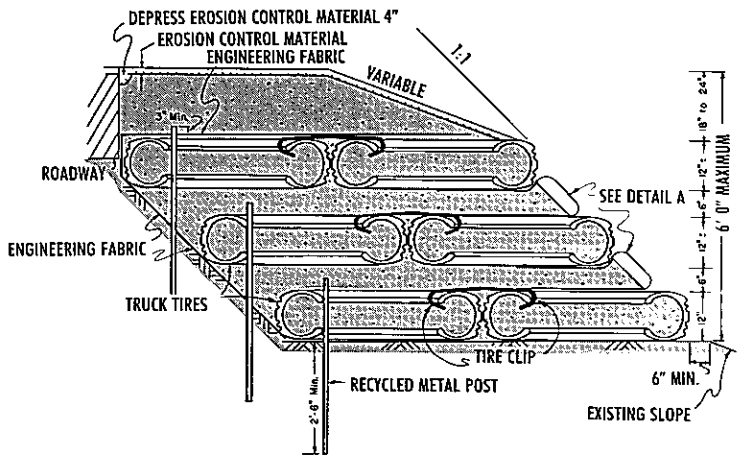


This is not a standard design. Dimensions and Details should be modified as required.

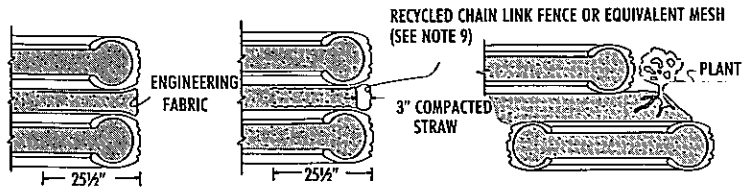
STEEL TRUCK TIRE CLIP
(See Note 2)



TYPICAL SECTION A-A



TYPICAL SECTION A-A (ALTERNATE)



ALTERNATE 1 **ALTERNATE 2** **ALTERNATE 3**

DETAIL A

The "Notes" on the following page are also applicable to this page.

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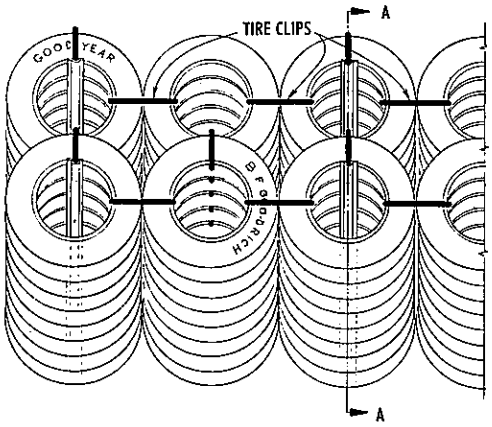
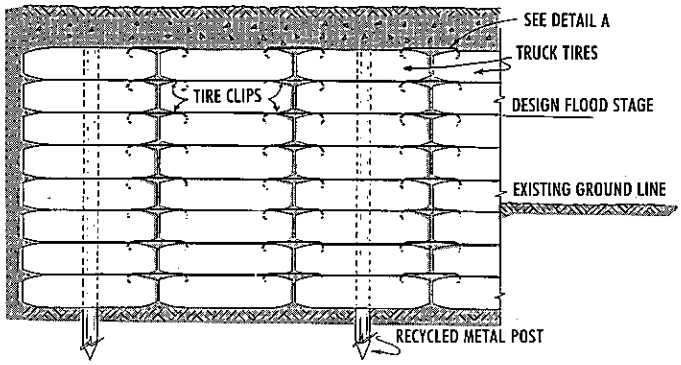
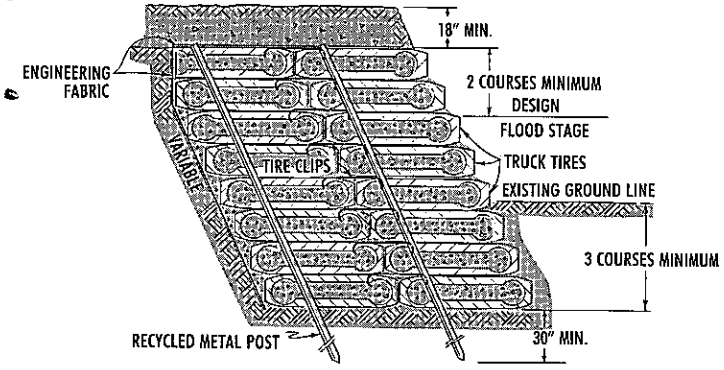
CHANNEL SLOPE PROTECTION
WITH RECYCLED TIRES



PLAN VIEW



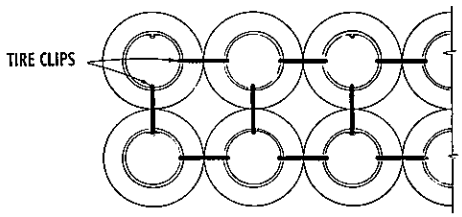
ELEVATION VIEW



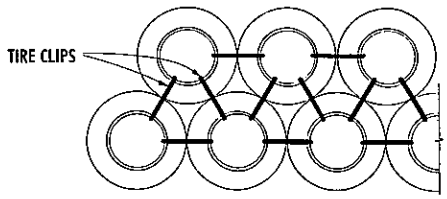
TYPICAL SECTION A-A

Notes:

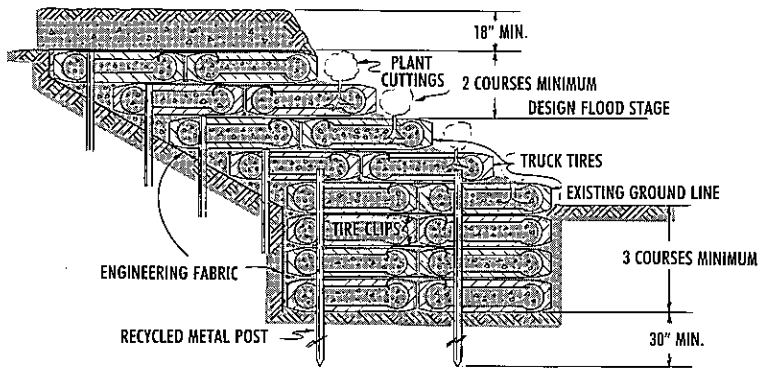
1. Scrap tires will be in such condition as they will retain original manufactured shape when stacked.
2. Steel tire clip is to be made of "cold rolled" ½" diameter steel. All measurements, except bend radius, are to center of bar, bend radius is inside diameter.
3. All posts shall be recycled metal posts in good condition.
4. Post shall be secured tightly against bend on inner row of tires, placed at a minimum of every other tire and at ends of tire mats.
5. Excavated material may be accepted for backfill provided it will be readily consolidated with the use of hand held vibratory compactors.
6. Ponding and jetting may be permitted if it will not damage foundation material, will not develop hydrostatic pressure on the tire unit, and if the backfill material is free-draining.
7. Sidewalls of tires should be spread during backfilling operations to facilitate adequate compaction.
8. Salvaged materials shall be state furnished, if available.
9. Ends of mesh shall be lapped 6" and secured with hog rings or 14-gauge wire.
10. Tires shall be used on lower slopes and in locations not visible to the motorist.
11. Painting the tires to blend with the surrounding terrain will improve the aesthetics of the installations.



PLACEMENT
FIRST COURSE IN TRENCH



ALTERNATIVE PLACEMENT



TYPICAL SECTION A-A (ALTERNATE)

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