B. Maskal

MT. ST. HELENS ASH CLEANUP

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After 123 years of quiet slumber, Mt. St. Helens began to awaken on March 20, 1980 with a tremor of Magnitude 4 on the Richter scale. This signaled the beginning of a series of events which would challenge public works agencies across the states of Washington, Idaho, Montana and Oregon. For the following 59 days the people of the Northwest waited uneasily for a historical event to occur in their backyard.

At 8:32 A.M. on Sunday, May 18, Mt. St. Helens erupted with a direct laterial explosion to the north, removing the entire north face and upper 1,300 feet of the 9,600 foot mountain. The plume of this eruption rose to over 10 miles high and carried 4.6 billion tons of ash in a north-easterly direction. By early evening, one continuous airborne mass of volcanic ash stretched from the mountain in southwest Washington into Montana and Wyoming. Several billion tons of ash quickly returned to the ground surface like snow, coating the landscape with dusty, gray pumice.

The city of Portland, Oregon, just 45 miles to the south and with a metropolitan population of 1.2 million people, was spared this disastrous fallout. The northeastern Washington cities of Yakima, Spokane, Ritzville, Moses Lake and others were not so fortunate. The city of Yakima, only 80 miles downwind from the mountain, was engulfed in total darkness for two days. When the proverbial dust cleared, Yakima was blanketed with over one-half inch of volcanic ash which had the consistency of beach sand. Particle size analysis indicated that the Yakima samples consisted of 80% fine sand and 20% powder (less than 100 microns) while samples from subsequent eruptions consisted of

92% powder and 8% fine sand. Atomic analysis of the Yakima ash indicated the following: Silicone 60%, Aluminum 16%, Calcium 5%, Iron 6%, Sodium 4%, Zr 8% and trace amounts of Ba, Ce, Mn, Mg, Sr, Zn, Sb.

Within 24 hours, the city of Yakima sent out a "Mayday" to larger Northwest city and county public works agencies for assistance. Three days later crews from the city of Portland and a number of other public agencies and private contractors arrived in Yakima and began to test a variety of clean-up procedures to determine the most effective and efficient methods. It was quickly apparent that before municipal type street sweepers could begin work, the bulk material had to be removed by road graders and snow plows. A wide variety of front end loaders, supported by a massive fleet of haul trucks, were employed to remove the ash mounds created by the snow plows and graders. However, belt loading equipment definitely had the advantage over bucket loaders where ash was windrowed and sufficient numbers of haul trucks were available. Street sweepers could then handle the remaining 1/8 inch of material left on the street by the previous operation. During all operations, large volumes of water were necessary to make the ash workable and minimize dust.

On May 25, the Sunday following the first major eruption, Mt. St. Helens erupted again. This time, the areas to the south and west of the mountain received ash fall. Depths were minimal and the material consisted mainly of the finer ash fraction. Some of the equipment and personnel sent by the City of Portland to Yakima were recalled. However, rainfall, supplemented by street flushing equipment, proved adequate to handle the problem. A minimal amount of ash material became trapped in the pores of the paved surfaces and would be removed over time by vehicular traffic, surface runoff, and subsequent street sweeping cycles. The city of Portland was once again spared, but not

for long.

At approximately 9:15 PM on Thursday, June 12, Mount St. Helens erupted once more, and prevailing winds carried the ash plume directly at Portland and Northwest Oregon. Within two hours the city and surrounding areas were engulfed in a snowstorm-like fallout of fine volcanic ash. By dawn, Portland was coated with more than 1/16 of an inch of gray powder. The timing of the ash fall was particularly unfortunate, since the Grand Floral Parade, which is the culmination of the two week long annual Rose Festival, was scheduled to begin the following Saturday morning.

The elected City Officials decided that the Rose Festival Parade should not be cancelled and the Bureau of Maintenance had to lay its ash removal plan aside and reorganize to give highest priority to clean the Central Business District (CBD) and the parade route. John Lang, PE, our Public Works Adminstrator, arranged to supplement the Maintenance Bureau forces with personnel and equipment from the Parks Bureau, Water Bureau, Fire Bureau, and private contractors. All resources were directed to cleaning the parade route, the assembly and disband areas, and the CBD. Even Mother Nature lent a hand by supplying over one inch of rainfall within the next 24 hours.

The method of removal involved creating ash trapping dams with sandbags to protect the storm drainage system and then using fire hoses from hydrants and power street flushers to move the ash into the catchment areas. The trapped ash material was then hand loaded into dump trucks for removal. By 9:30 A.M. on Saturday, the ash had been cleared from the parade route and thousands of spectators awaited the beginning of the parade. The festivities ended successfully that afternoon as the city dried out from the one inch

rainfall received Friday.

But the end of the rain proved to be a mixed blessing, as the city became engulfed in clouds of gray, airborne dust as traffic and ambient winds lifted the now dry ash into the atmosphere. For the next four days the city was choked with airborne ash. With the Oregon Department of Environmental Quality air monitoring equipment reporting as high as 4000 micrograms/cubic meter of suspended particulates in the vicinity of downtown freeways, Portland was on the verge of a full air pollution emergency which could result in the suspension of transportation and related economic activity throughout the region.

The Public Works Department continued working through the weekend, utilizing crews in 12 hour shifts for continuous, 24 hour/day operations. By Monday, the street cleaning operation, supplemented with outside contractors, consisted of 24 sweepers, 24 power flushers, and over 400 people working two 12-hour shifts per day.

For the first week, emphasis was placed on cleaning the 354 mile arterial/collector system. In following weeks, efforts were directed to the 1070 miles of residential streets. The city was subdivided into 244 work areas, each containing approximately 3-5 road miles. Experience showed that only about 5 road miles could be accomplished by one crew during one work shift. Long and short term schedules were developed and updated daily in order to coordinate with crews posting "No Parking" signs and towing of vehicles in advance of the sweeper crews.

The basic crew was composed of two street sweepers, two power flushers and supporting hand crews. All crews were assisted by

additional street flushers as they became available. Hand crews preceeded the sweepers and removed the ash piles placed in the streets by residents and businesses.

By July 11, the Bureau had completed a first pass through the entire city. The other maintenance functions of the bureau, (street repair and paving, sewer construction and cleaning, structural repair, traffic and concrete repair), which had been deferred during the emergency ash cleanup, were resumed, and the majority of contractors were released. Responsibility for the ash removal operation was returned to the street cleaning section.

Due to the small particle size of the ash, the street sweeping equipment was only about 50% effective on the first pass. The street cleaning section began a second pass operation which lasted another 6½ weeks. However, even the second cycle failed to totally remove the ash. The actions of traffic and runoff continued to cleanse the pores of the pavement and deposit the ash along the curb. Given time, the ash would mix with normal debris loadings and eventually be removed by future sweeping passes.

The second pass operation was completed at the end of August, 1980. Over $1.1 million had been expended to return the city to its original state of cleanliness. During the most intensive period of the eleven week cleanup operation, expenditures exceeded $40,000 per day. Upon closure of the temporary landfill, it was determined that more than 7,000 cubic yards of volcanic ash had been collected and buried.

Throughout the entire time frame of the cleanup operation, several different methods and equipment types were tested. Two positive suction vacuums and two types of regenerative vacuums were

examined. The positive suction vacuums were not entirely successful since neither machine had fine particle separators. Under dry conditions, a large portion of the fine ash was able to escape with the air exhausted by the blower system. The regenerative machines produced a considerable amount of dust from the pick up head each time the assembly encountered an irregularity in the pavement surface. Addition of too much water created an ash slurry which was extremely difficult for any sweeping unit to remove. The thin coating of slurry that remained after sweeping soon dried and became re-entrained into the atmosphere.

Backflushing after sweeping was the only method which met with some success. Very high water pressure and slow travel speeds of the street flushers created an ash solution that could be propelled into the gutter. However, due to the high specific gravity of the ash, settlement occured quickly, leaving measurable deposits in the gutter line. The ash fraction that did remain suspended was carried to the storm inlets and eventually reached the waste water treatment facility.

Some detergent solutions were also used to reduce the surface tention of the spray water from both sweepers and flushers. In most circumstances, there was no need for this "wet water" effect since the ash readily absorbed any water applied. However, there was some benefit gained by using the detergents in the positive suction vacuum water systems. Here, the wet water was able to penetrate the dry ash during transport from the pavement to the hopper of the vacuum unit and particulate emissions from the blower were reduced.

Since the initial eruption in May, we have revised our operation plans several times. Our contracted weather service maintains a daily vigilance on the upper wind patterns, while the USGS Volcano Information Center continuously monitors the seismic activity of the mountain. We look forward to future activity of Mount St. Helens with great apprehension, but we are prepared to deal with her if necessary.

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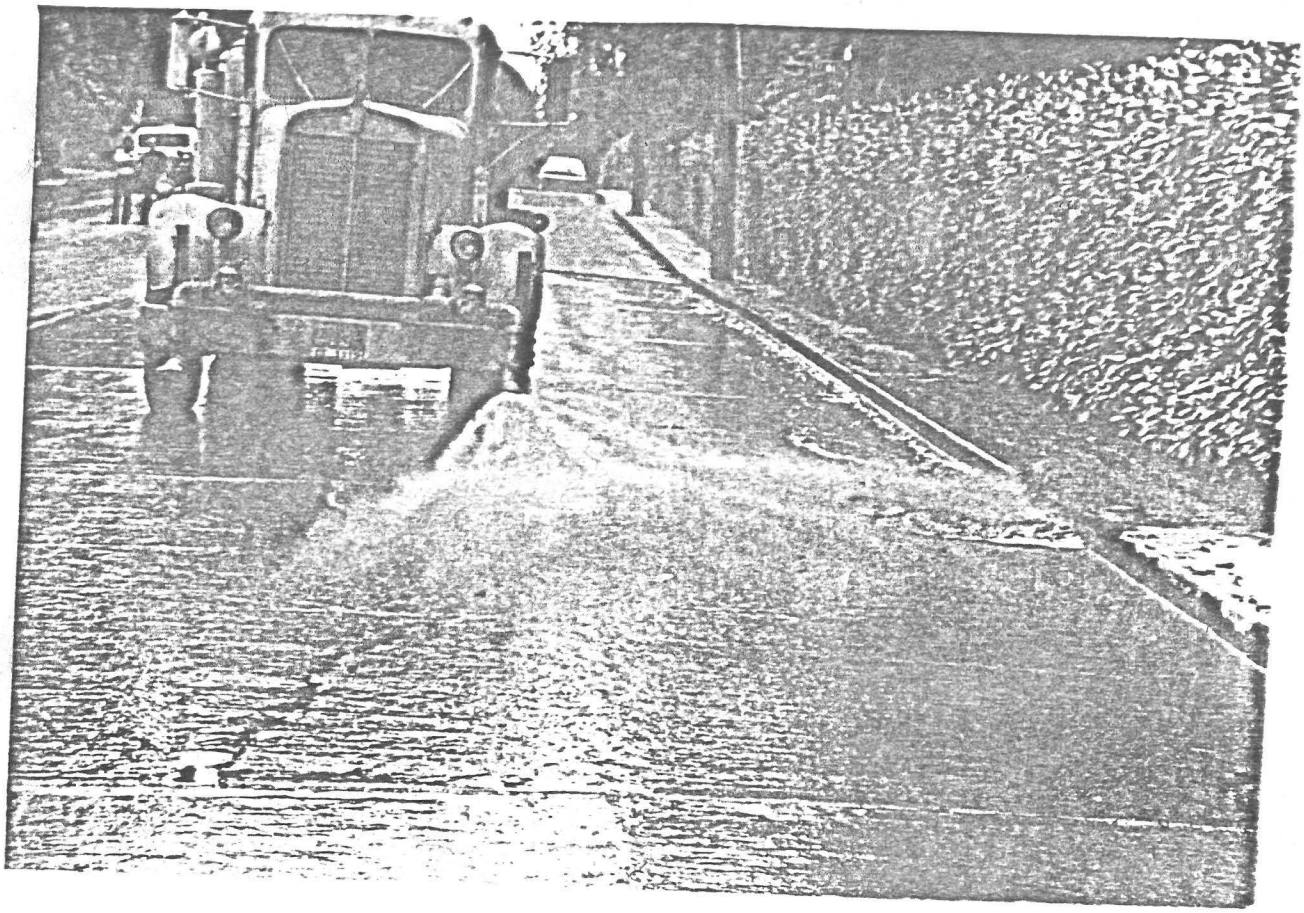
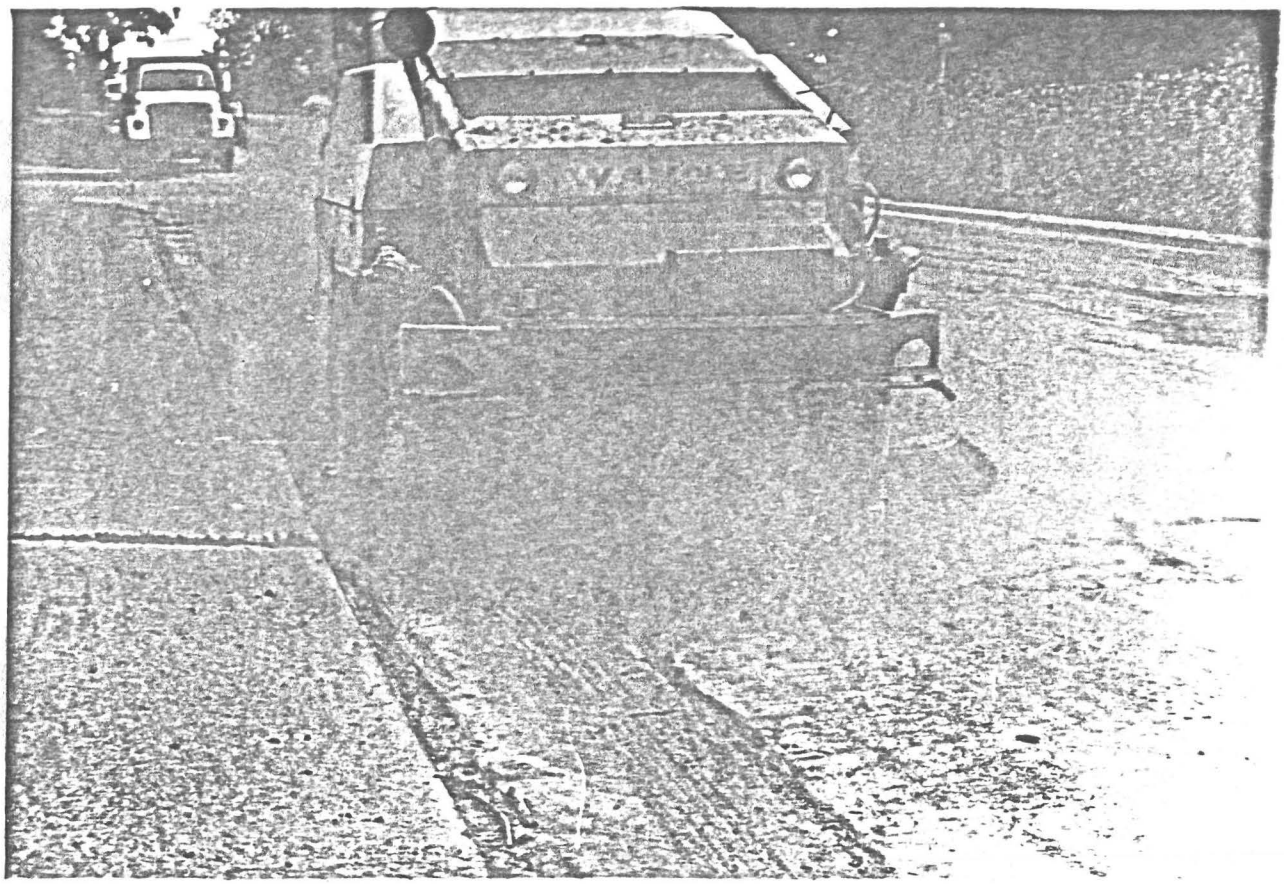


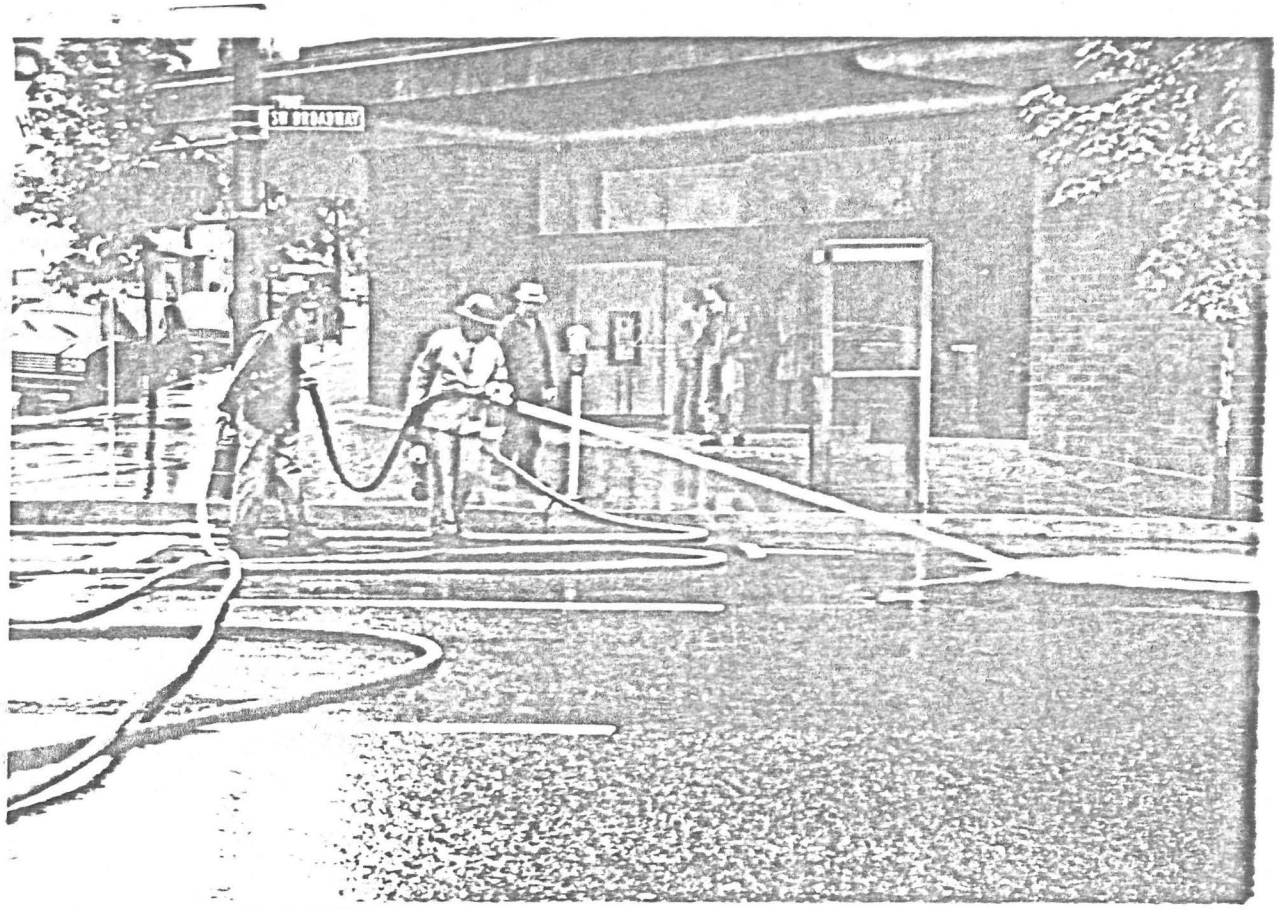
PORTLAND, OREGON

SUCCESSIVE PASSES WITH STREET FLUSHERS PUSHED THE ASH MATERIAL INTO THE CURB LANE FOR TEMPORARY STORAGE.



PORTLAND, OREGON

MECHANICAL STREET SWEEPER ATTEMPTS TO COLLECT THE ASH MATERIAL FROM THE CURB LANE.

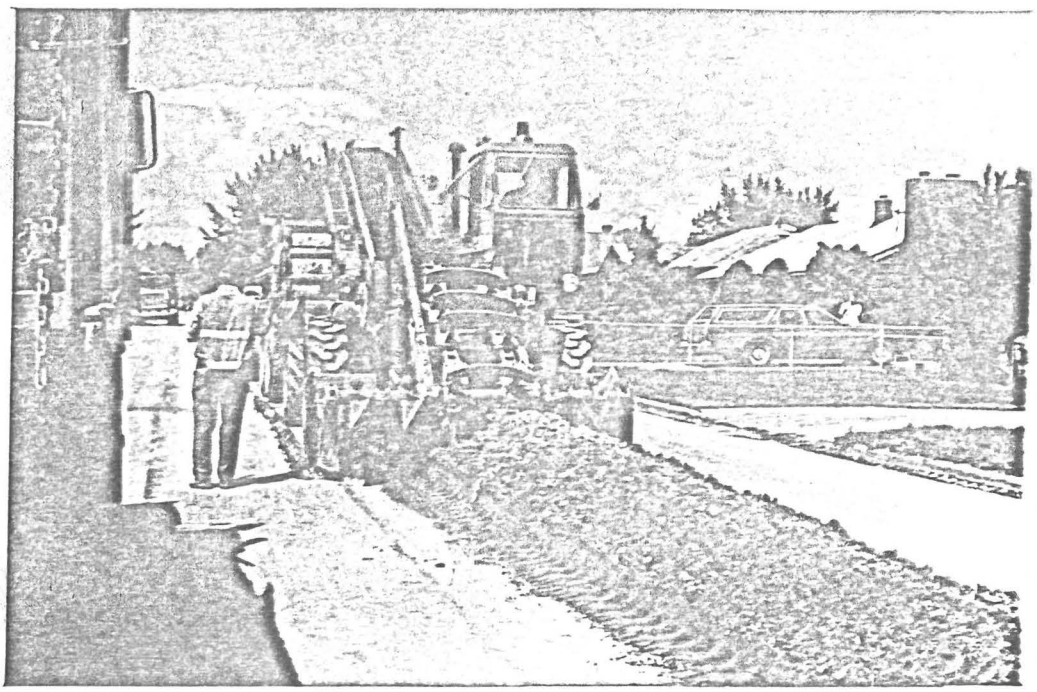


PORTLAND, OREGON JUNE 13, 1980

WITHIN 8 HOURS OF THE ASHFALL, HOSE CREWS WERE FLUSHING THE CBD AND PARADE ROUTE.

PORTLAND, OREGON

BEFORE SWEEPING CREWS ARRIVED, RAINFALL, WIND AND HOSE FLUSHING WITH GARDEN HOSES BY RESIDENTS MOVED THE ASH INTO THE GUTTER AREA.

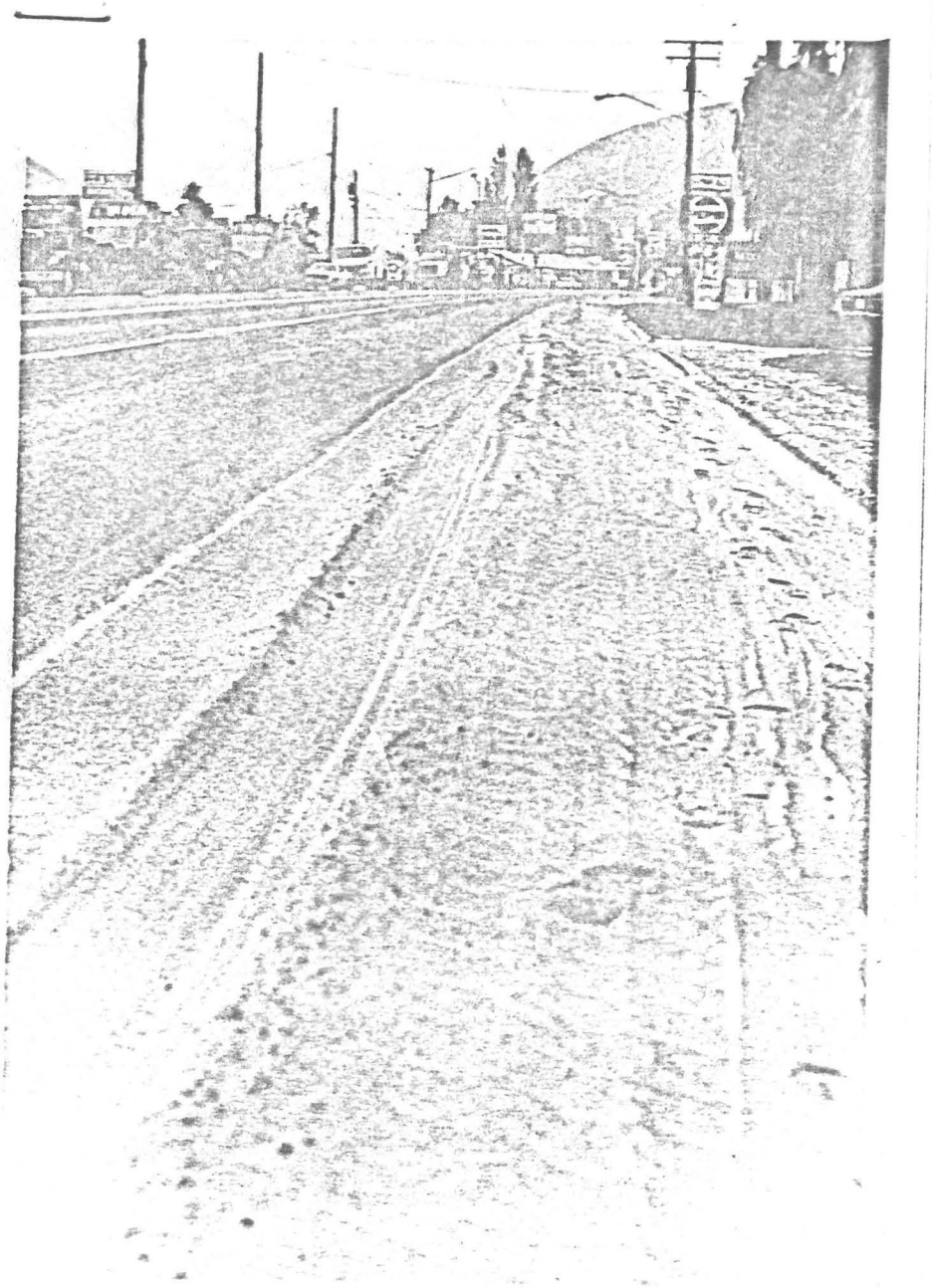


YAKIMA, WASHINGTON

BELT LOADING MACHINES WERE EMPLOYED TO REMOVE THE WINDROWS OF ASH BEFORE SWEEPING.

MAY 28, 1980 YAKIMA, WASHINGTON

SNOW PLOW TRUCKS WERE USED TO REMOVE THE BULK OF THE VOLCANIC ASH BEFORE STREET SWEEPING BEGAN.



MAY 21, 1980 YAKIMA, WASHINGTON

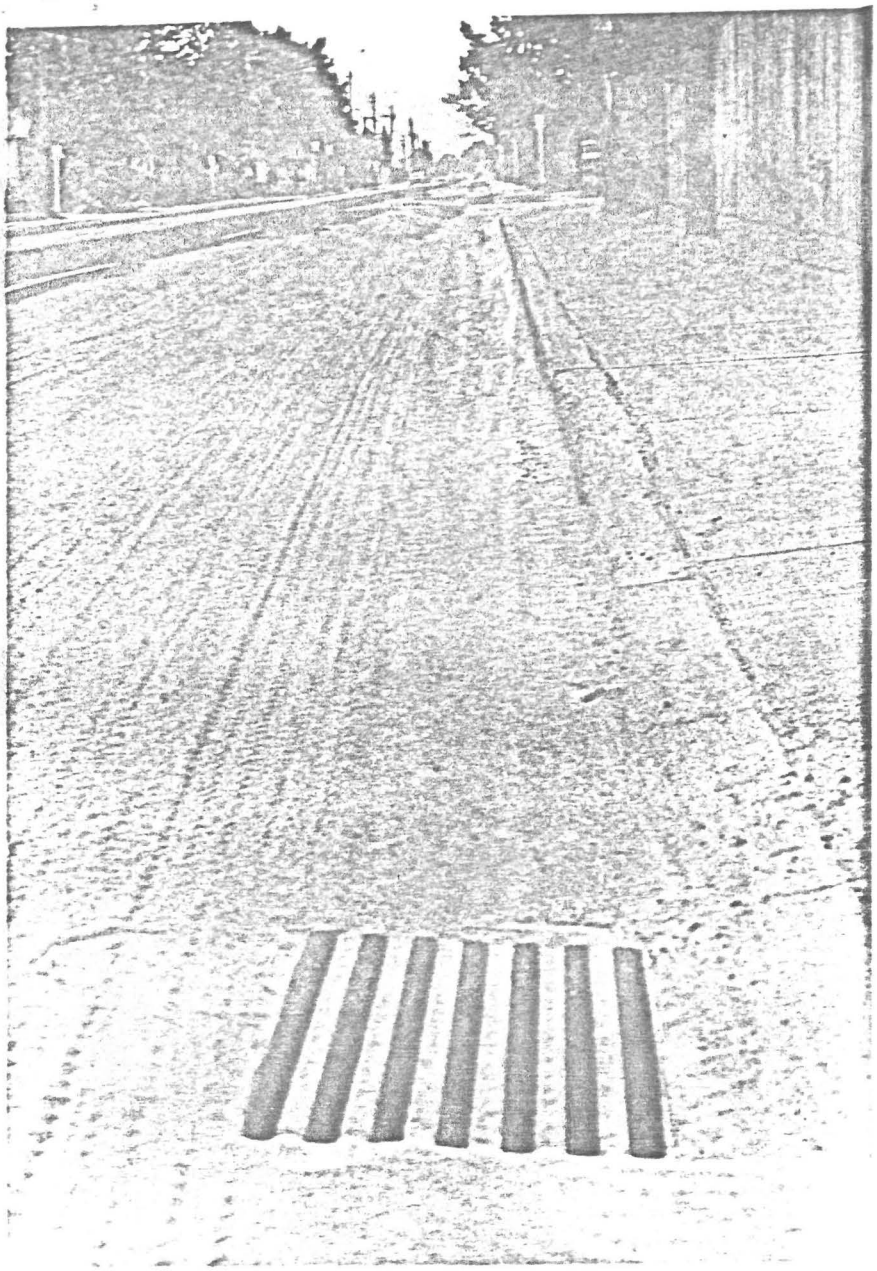
TRAFFIC, WIND AND WATER HAS MOVED THE ASH MATERIAL INTO A 3 INCH DEEP LAYER IN THE CURB LANE.

Neg - 8A/B

YAKIMA, WASHINGTON

TYPICAL ARTERIAL STREET BEFORE ASH REMOVAL CREWS ARRIVED. INDIVIDUAL CREWS WERE REMOVING OVER 1,000 CY PER SHIFT.

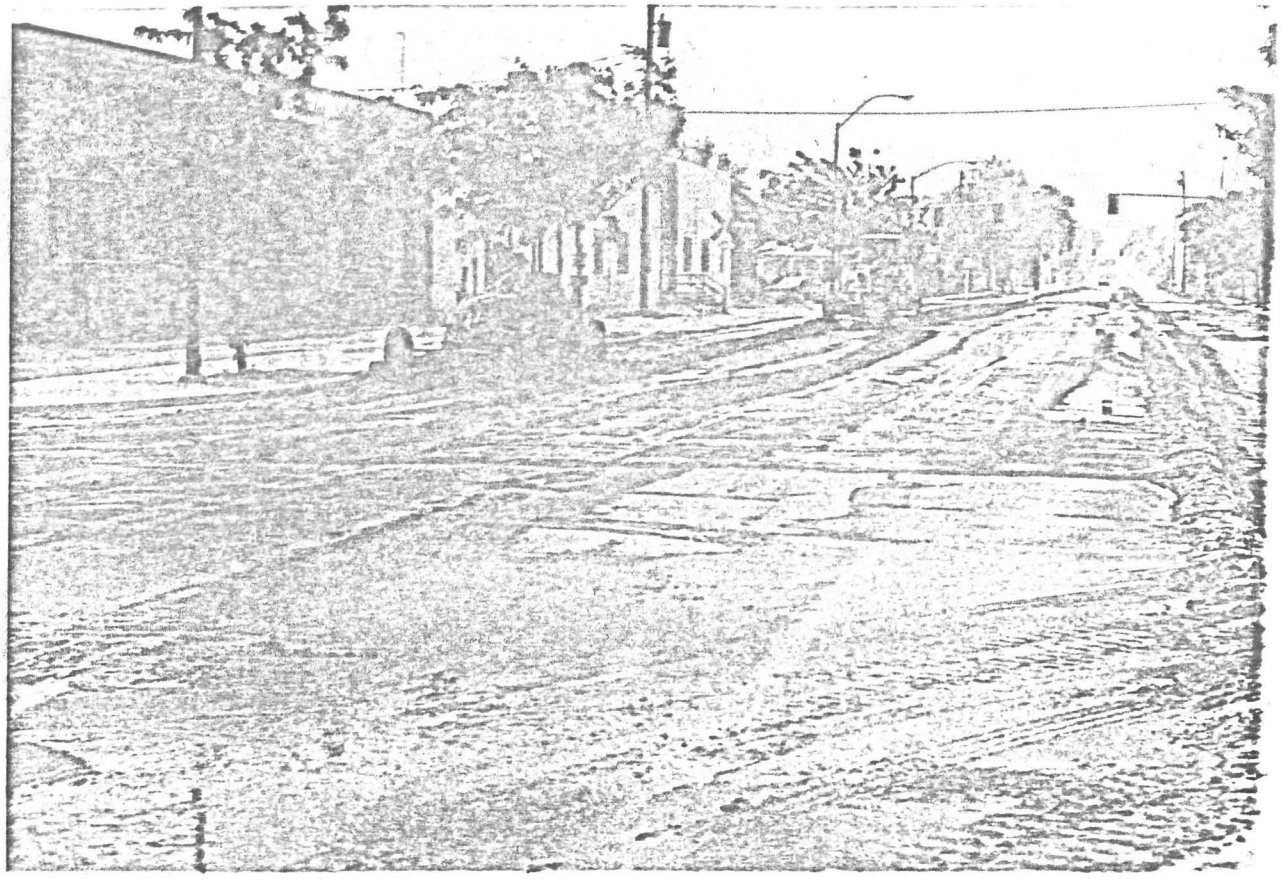
Negative
19



YAKIMA, WASHINGTON

CATCH BASINS WOULD QUICKLY FILL WITH ASH DEBRIS TRANSPORTED BY RUNOFF.

Negative
#20



YAKIMA, WASHINGTON

TWO BLADES WORKING TOGETHER FORM A WINDROW FOR THE BELT LOADER.

Negative #27