

OFFICE MEMORANDUM

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MICHIGAN

STATE HIGHWAY DEPARTMENT

JOHN C. MACKIE, COMMISSIONER

February 22, 1963

To: E. A. Finney, Director
Research Laboratory Division

From: M. H. Janson and A. J. Permoda

Subject: Air Pollutants from Gypsum Plants at the I 96 Grand River Bridge
(B03 of 41029E, C1). Research Project R-62 G-112(1).
Report No. R-413.

At a meeting held on October 9, 1962, to discuss the status of the Smoke and Industrial Refuse Investigation, G. J. McCarthy requested the Research Laboratory Division to investigate air pollutants from Grand Rapids Gypsum Co. in Southwest Grand Rapids near the I 96 bridge over the Grand River. It was suspected that accumulations of dusts from nearby plaster manufacturers could produce slippery road conditions, especially when the surface was wet. Another concern was that plaster dust, consisting of forms of hydrated calcium sulfate, might have a longterm destructive effect on roadway or structural concrete because of the physical and chemical action of the dust's sulfate content.

In investigating this matter Research Laboratory personnel made the following inspections and tests in the area, which is diagrammed in Fig. 1:

1. On November 23, 1962, W. L. Frederick and M. H. Janson visited the area and found grading operations in progress on the I 96 roadbed, with some bridge piers in place. The bridge appeared about equidistant from the plants of the U. S. Gypsum and the Grand Rapids Gypsum Co., both north of the river and west of I 96. Neither plant was operating, but it appeared that most of dust had exhausted from four stacks of calcining building of Grand Rapids Gypsum Co. (Fig. 2). A sample of dust collected from a ledge of this building indicated by infrared analysis a composition of calcium sulfate with some calcium carbonate. Away from the building a small accumulation of white dust was evident, but insufficient dust had accumulated on nearby trees (at right in Fig. 2) to permit sampling. Dust was not readily noticeable across the I 96 right-of-way to the east and south of the plant, or on the trees west of the four stacks (Fig. 3).

2. On December 19, 1962, M. G. Brown and A. J. Permoda visited the area and found grading operations in progress on roadbed, girders being placed on river piers, and pouring of the pier near the river on south. Both gypsum plants were in operation. A workman at Grand Rapids Gypsum Co. stated that the buildings

(mostly of brick) were about 50 years old. The access road to plant from Butterworth Dr. was of bituminous surface over a concrete base, with the latter protruding at a curve. The visible concrete appeared worn, but not disintegrated; its age was not determined. The apron in front of the building in Fig. 1 was also of concrete. This also appeared worn, through a covering of dust and snow slush, but otherwise apparently sound; its age was not known. There was a slight accumulation of dust, greatest near the plant, but no significant amount of dust on the I 96 roadbed about 500 ft away. Steam from drying and de-hydrating operations at the plants was being exhausted in varying amounts, which at greatest discharge formed clouds that billowed toward the I 96 roadbed.

3. In addition, field skidding tests were made on November 27, 1962, in several areas along Butterworth Dr. near the gypsum plants to measure any possible effect that plaster dust from the plants might have had on the traction properties on road surfaces in the area. Table 1 contains averaged coefficients for four areas on Butterworth Dr. and one area on the access road into the plant. Three tests were run at 20 mph in each direction for each area, with the results averaged and corrected to a corresponding value at 40 mph. Fairly heavy deposits of plaster dust were noted in Areas 3 and 5 adjacent to the gypsum plants. A light deposit of plaster dust was noted in Area 2. The tests showed that the plaster dust deposits were not of a nature to change the surface coefficients to any significant extent on the pavement surfaces tested, all of which were of bituminous construction. The access road to the plant measured highest in terms of friction qualities. All four of the other areas averaged about 0.40 coefficient, which is fairly good for a surface in use for several years.

Summary

Inspections and tests conducted in the subject area in Fall 1962 showed:

1. No accelerated deterioration of the limited amount of old concrete roadway present in vicinity.
2. Sporadic discharges of steam and dusts from two gypsum plants that at highest volume and with northwest winds may reduce visibility on adjoining I 96 roadway.
3. Insufficient dust accumulation to affect area-roadway skid resistance when the Grand Rapids Gypsum Co. plant was operating on a single shift, reduced from three-shift summer operations.

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Conclusions

1. Area roadway and structure concrete will not require special protection against sulfate attack from plaster dusts.
2. Area roadway may require special signing warning of possibility of reduced visibility, should sporadic discharges of steam and dusts from adjoining gypsum plants be found to affect visibility when blown across roadway.
3. Skid resistance of the roadway in the critical area will not be significantly reduced, at least in the Fall-Winter period when the gypsum plants reduce their operations. However, in summer during continuous operation of the plants, dust may present a problem. Skid tests will be made in the future at appropriate intervals, to determine the seriousness of the situation.
4. It is recommended that pavement and the structure within the critical area be given careful supervision during construction, to insure a uniform, rough textured, sand-paper finish by burlap drag or other suitable methods.

OFFICE OF TESTING AND RESEARCH

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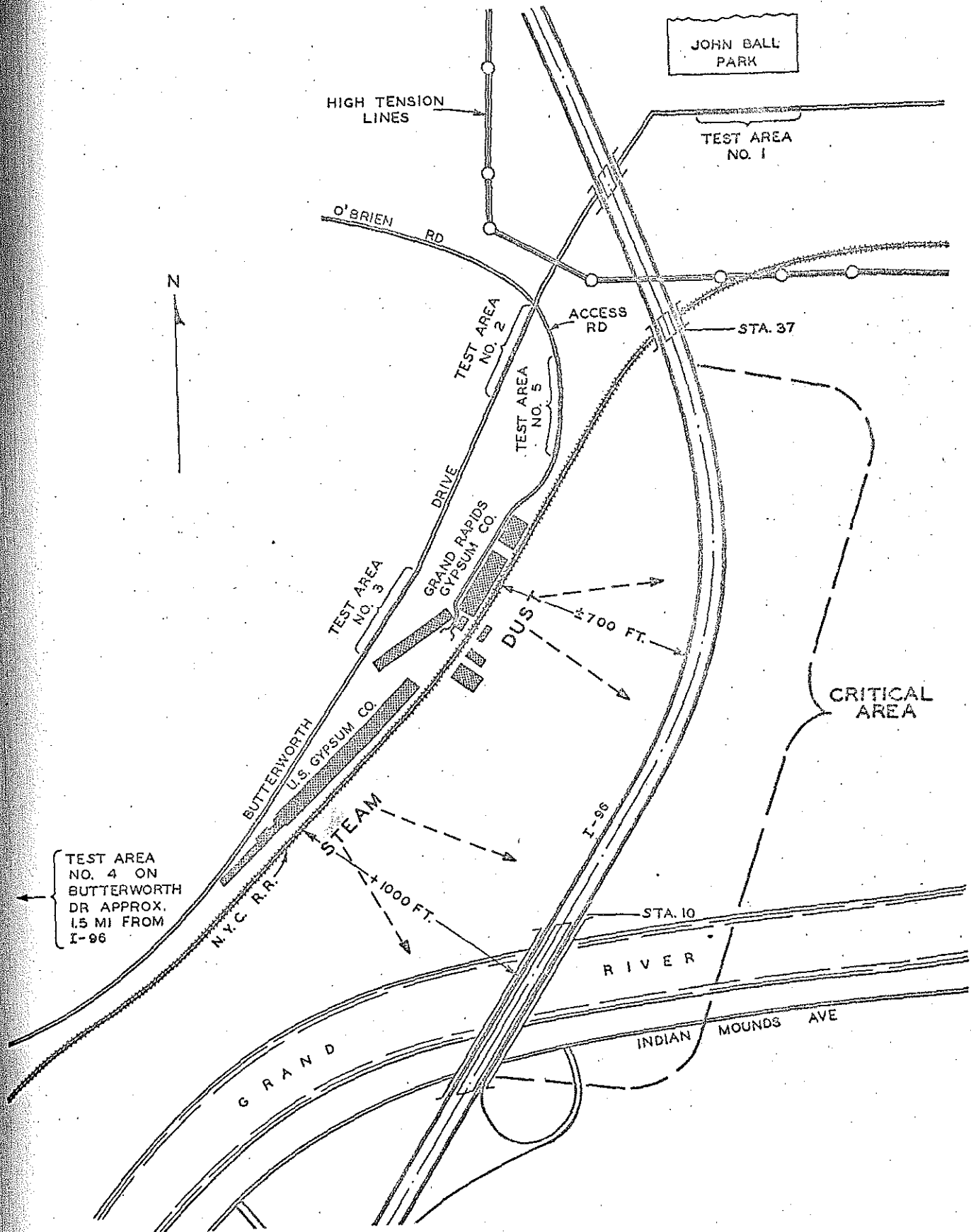


Figure 1. Schematic diagram showing I 96 bridge site, gypsum plants, skid test sites, and critical area.



Figure 2. Four stacks on calcining building of Grand Rapids Gypsum Co.



Figure 3. Area southwest of calcining building near I 96 grading operations.

TABLE 1
SUMMARY OF SKID TEST RESULTS

Test Area	Location	Wet Sliding Coefficient of Friction, 40 mph**		
		Westbound	Eastbound	Average
1	Butterworth Dr. * near John Ball Park, approximately 0.2 mi east of I 96 (no plaster dust)	0.41	0.41	0.41
2	Butterworth Dr west from O'Brien Rd, 0.1 to 0.2 mi west of I 96 (light plaster dust)	0.41	0.42	0.42
3	Butterworth Dr at plaster plant, approximately 0.2 mi northwest of I 96 over Grand River (heavy plaster dust)	0.41	0.42	0.42
4	Butterworth Dr east from Maynard Dr, approximately 1.5 mi west of I 96 over Grand River (no plaster dust)	0.39	0.38	0.39
5	Access road into plaster plant (heavy plaster dust)	0.46	0.49	0.48

* Butterworth has bituminous surface about 10 years old, fairly lightly traveled. Significant portion of its traffic composed of local commercial vehicles serving area plants.

** Each value is the average of three tests at 20 mph, corrected to 40 mph.