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PREVIEW

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PREVIEW

CONTROL AND PRACTICES OF
LAND FILLING IN EL PASO

By

RONALD HUGH PITTS

Bachelor of Science in Civil Engineering
The University of Texas at El Paso
1974

Submitted to the faculty of the Graduate School of
The University of Texas at El Paso
in partial fulfillment of the
requirements for the degree of
MASTER OF SCIENCE IN ENGINEERING

May, 1975

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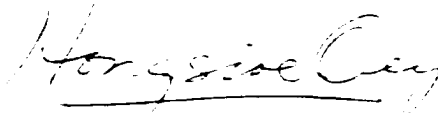
Title of Study: CONTROL AND PRACTICES OF LAND FILLING IN
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Pages in Study:

Major Field: CIVIL ENGINEERING

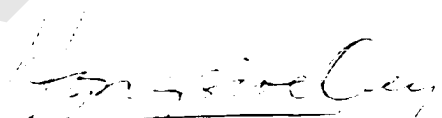
Scope and method of Study: The purpose of this study is to investigate the controls and practices associated with the placement of land fill in El Paso. It is felt by answering the questions of the public associated with land filling that both the public and those professionally involved in its use and control will become more aware of the specific problems associated with its use. The method of study involved research, interviewing and explanation of the recommended designs and practical uses and city controls associated with land filling.

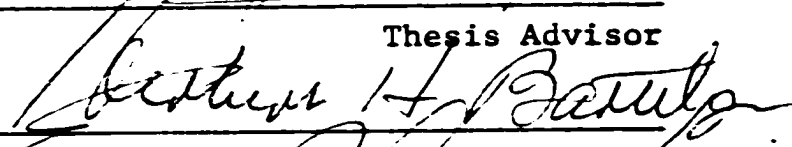
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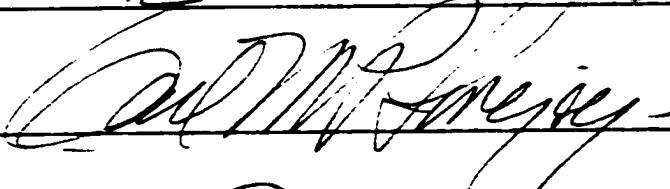


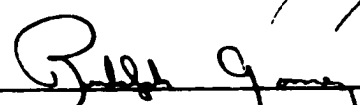
CONTROL AND PRACTICES OF
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Chapter I

INTRODUCTION

Two years ago in a discussion between an engineer and a geologist with regards to engineering practice and land development through the use of land fill, attention was drawn to the construction of a major structure on what was then called a "garbage heap". The participants in the discussion raised the question of what the city and common engineering practices are with respect to the use of land fill in land development. This question was raised due to what seemed the apparent lack of control in the engineering of the land fill upon which the structure being discussed was placed. The dramatic rate of differential settlement, which the building owners have noted, was pointed to as evidence indicating the lack of control of the fill materials. Mention was made of the fact that legal steps were being taken which were intended to place the blame on the firm responsible for the error. The discussion ended with many questions unanswered and general engineering ability under deep suspicion.

Over the period of this study, similar conversations have been witnessed many times. In most cases the same questions were asked and normally left unanswered. These questions are:

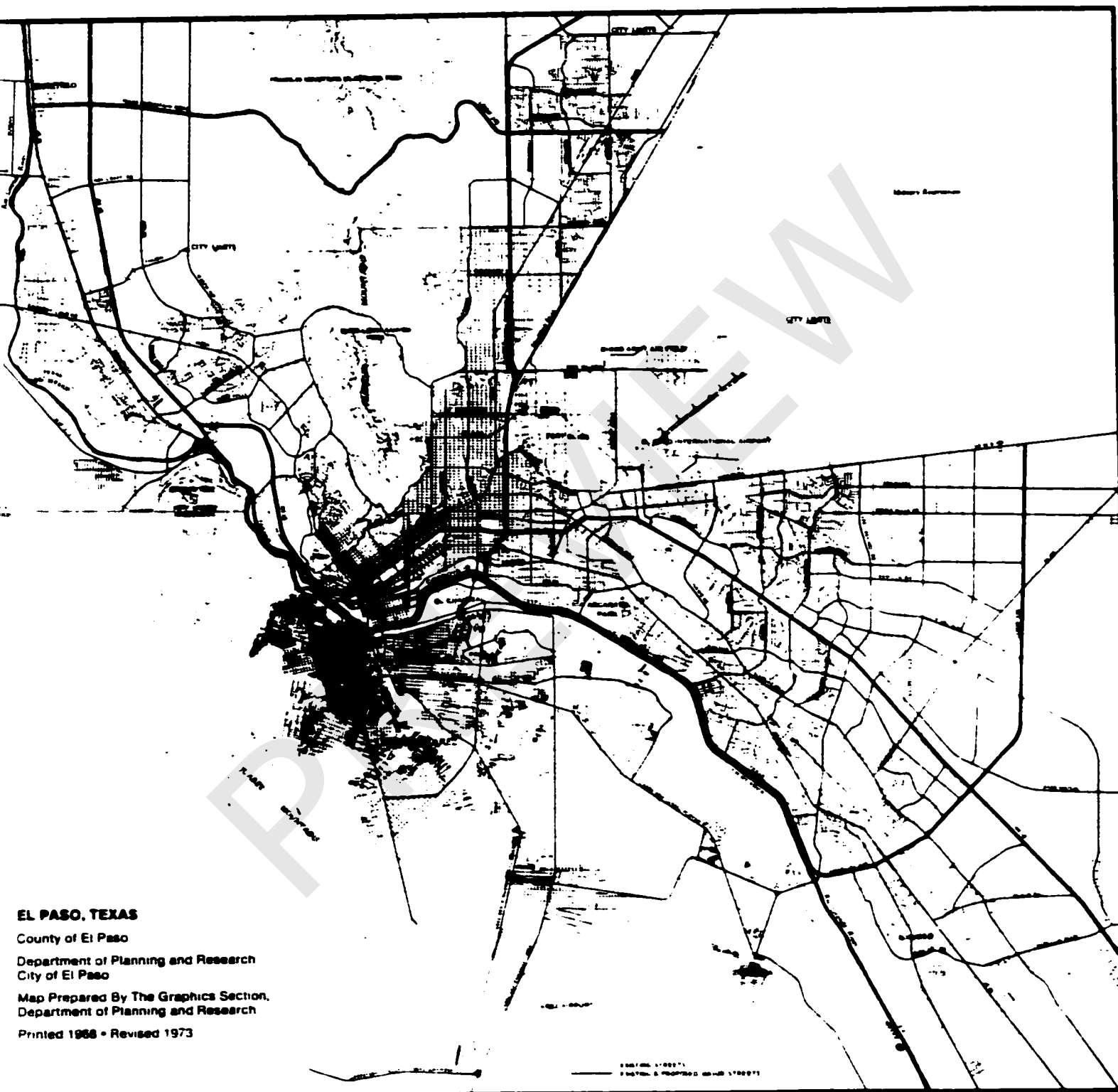
1. What are both the recommended engineering design methods with respect to land filling in the El Paso area and the actual methods being employed?
2. What are the city methods of handling land filling both through legal procedures and general practices?
3. Where is there a lapse between city and engineering practice which would allow failures of "engineered" land fills to occur?
4. What revision in both city and engineering practice should be made to more tightly control the quality of land fill in the city?

This thesis will be addressed to the response to these questions. It is not intended to condemn engineering or city practice, but to indicate points of weakness in present methods and suggest programs for their correction.

Settlement due to land fill failures occur often in the city of El Paso. Land fill may be defined as material which is used to raise a plot of land for use in land development. Because these failures affect the security of owners of structures and result in monetary hardships, the public as has been shown, is continually questioning the ethics of land developers, home builders, engineers and city controlling agencies. Each time a new case appears, the public demands to know and punish the persons responsible for the error. In the end, the public tends to condemn all officials involved, labeling them as all dishonest and losing confidence in their pro-

professional capabilities. The immediacy of this investigation is born out of the need to answer the public's questions and to set their solutions clearly before the people in order to correct the public image of contracting and engineering ethics. If this is not done, it is the feeling of the author that consumer protection agencies both private and governmental will try to provide the answers for these questions. The detrimental effect of this would be that the public would gain the impression that the professionals are incapable or unwilling to solve the problems among themselves. This would in turn lead to the public demands for more stringent regulation of professional land development and engineering practices and legislative controls to protect the public from what the public would feel to be undue damages. The importance of this thesis will lie in the fact that professionals will be able to answer the public questions and will show that professionals are actively involved in solving these problems honestly and openly. From these open and honest solutions, confidence in professional ability will be restored and the need for additional consumer protection averted.

The El Paso metropolitan area, as seen in figure No. 1, provided the area in which the questions being asked were investigated. The solutions to these same questions would then logically apply only to this area. Application of these solutions to other areas would need to be considered separately in terms of the conditions of each case similarity to the



THE EL PASO METROPOLITAN AREA

Figure 1.

conditions which will be mentioned later in this discussion. In-depth studies of methods of identifying land fill failures and structural design criteria for protection against such failures will not be found herein. Also, a quantitative study of the quality of all land fill materials in El Paso was not undertaken because of both the exceedingly high cost and amount of time such a complete study would have required. Because of this, only specific separated investigations will be discussed which will indicate the general qualities of the more detrimental fill materials.

In the investigation of this problem, personal interviewing was a major tool. After studying background information from various standard texts, interviewing was used to identify standard engineering techniques and standards which are now being followed. Through these same interviews, sites of land fill failures were identified and discussed. Also, the interview of El Paso engineers and developers provided first hand knowledge of the relationship that the professionals felt themselves to be in with respect to city policies and controlling agencies. Substantive studies next were performed on the information gained through the interviews. Wherever information could be supported by further investigation, additional investigations were conducted. Next, the city engineers and personnel were interviewed in order to determine city policies and their affect on the control of land filling. Again the interview provided first hand knowledge

of the relationship this time between the city and local professional land developers and engineers. Additional sites of land fill failures and ordinance violations were identified and later investigated. During the process of interviewing, city records on the volume of officially recognized land fill were obtained. It must be realized that the city at present does not require all fills to be listed with the city. This will be discussed in greater detail later in this study. After interviewing and studying standard engineering design methods, additional information was found to be needed in terms of contractual agreements with others involved in land development. This additional information was obtained through personal contact and official documents which were used for contractual agreements.

The approach which will be followed in developing the research material which led to the answering of the public's questions will be:

1. The background material relating conditions which have a direct bearing on the quality of land fills, their placement and the control of that placement will be discussed.
2. Past and present engineering practices will be shown with respect to land filling.
3. City methods of dealing with land filling and actual practices relating to land fill will be discussed.
4. The areas in which both city and engineering practice

fail to control land filling will be brought out.

5. Lastly, suggestions as to the corrections of these breeches in control will be set forth.

No specific research was found from material earlier than 1972 which bore on the actual failure of land fill control, its results and solutions. Technical papers and codes dealing with the recommended design methods of land filling were the nearest materials which were located bearing on this problem. Again, no data was found dealing with specific recommendations for identifying the lapses in control, their effects on the public, and their solutions.

CHAPTER II

GEOGRAPHY

Before the actual problem of land filling can be discussed and solutions set forth, factors which influence their placement must be understood. These factors which include climate, the geology of the region and man's intervention in the natural pattern through his development, will be discussed in this chapter.

CLIMATE

The climate of the El Paso area is generally termed as semiarid. The average precipitation for the metropolitan area is approximately 7.89 inches and the temperature varies from the highest of 109° and the lowest of - 10° F (U.S. Department of Commerce, 1961). Climatological data has been recorded in El Paso for 96 years. A table showing annual precipitation and its deviation from the average can be found in Appendix I. From this data and records of precipitation duration, frequency tables and curves may be computed. These tables in turn bear directly upon the design of land fills and restrict to some extent their placement. Table 1 shows the frequency data for a period of time of one day if the precipitation lasts a certain number of minutes or hours. The table not only gives the frequency of this occurring but also shows its expected

TABLE 1.1
RAINFALL FREQUENCY

Frequency Years	Duration						
	30 Min.	1 hr.	2 hr.	3 hr.	6 hr.	12 hr.	24 hr.
1	.5"	.6"	.7"	.7"	.8"	.8"	1.1"
2	.6"	.8"	.9"	.9"	1.3"	1.3"	1.3"
5	.9"	1.2" *	1.2"	1.3"	1.6"	1.6"	2.0"
10	1.1"	1.4"	1.5"	1.6"	1.8"	2.1"	2.6"
25	1.2"	1.6"	2.0"	2.0"	2.5"	2.6"	3.1"
50	1.4"	1.8"	2.4"	2.4"	2.7"	2.9"	3.4"
100	1.7"	2.0"	2.5"	2.5"	2.9"	3.3"	3.6"

* EXAMPLE: A rainfall with a duration of one hour which occurs with a frequency of once in five years will have a magnitude of 1.2 inches.

(U.S. Department of Commerce, 1969)

magnitude.

Another feature of the El Paso climate is its lack of humidity. It is because of this that the moisture content during land fill placement is difficult to control. The temperature plays an important role in the determination of humidity at a certain time as does the wind velocity. As can be seen from the data in Appendix I, the temperature range and velocity of the wind can vary greatly causing long periods of low humidity. This lack of moisture content, high winds and high temperature causes, during the spring months, large dust storms which obscure visibility and strip the soil of its thin layer of silt and clay (Cooke Doorkamp, 1974). As a further result of these conditions the infiltration value of the soil is known to decrease further, contributing again to low moisture content in most El Paso soils. Illustration of this process may be seen in Figure 2.1.

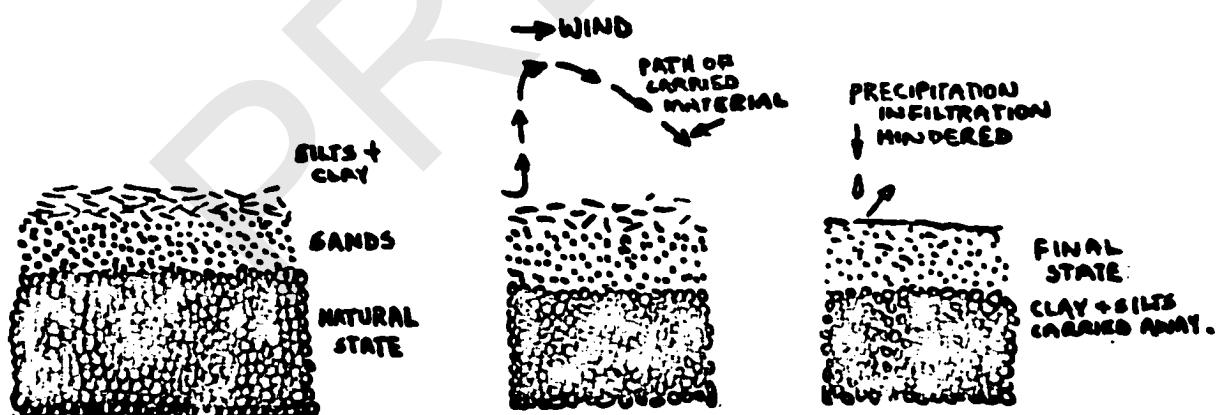


FIGURE 2.1

From the data in Appendix I, weathering can be seen to have a