CITY OF CAMBRIDGE

PLANNING & DEVELOPMENT DEPARTMENT

City Hall Annex - Inman & Broadway - Cambridge, Mass. 02139

(617) 876-6800
EXTENSION 344

CAMBRIDGE CITY DUMP SITE

Summary of Report by Haley & Aldrich, Inc. on Subsurface Conditions

History

For many years the site was mined for clay to make pottery and bricks. In 1946 the City acquired the site and began to dump refuse into the excavation. Clay mining continued over portions of the site until 1953, and refuse dumping continued until March 1971.

Subsurface Materials

The entire dump site consists of the following layers of material listed from the surface down:

1. Artificial fill - heterogeneous mixture of refuse and building rubble in a silty matrix of sand, including paper products, textiles, brick, glass, tin cans, garbage, rubber tires, wood, metal, etc. Varies in thickness up to about 27 feet depending upon the depth of clay excavation of any one location.

2. Marine deposits - stiff gray silty clay, stratified with thin fine sand and silt layers and varying in thickness from zero to about 30 feet. This is the clay material that was mined and is reported to have been originally about 50 feet in depth.

3. Glacial till deposits - stiff clay with some gravel and fragments of bedrock, and layers and pockets of silty sand with some gravel and boulders, all deposited during the last great continental glaciation. Varies in thickness from 2-1/2 to 23-1/2 feet.

4. Bedrock - so-called Cambridge Argillite, a gray-colored rock, fractured and often weathered at the top to a clay-like consistency.

Characteristics of Refuse Fill Relative to Site Development

1. Bearing capacity - The bearing capacity of refuse varies from 500

to 800 pounds per square foot, depending upon the age of fill, bearing depth, method of fill placement, and subsequent compaction of the fill. These limits of capacity and the fact that they vary over small areas restricts the reliable support of structures on refuse to the smallest buildings of limited floor area. All other structures must be supported on end bearing pipe piles carried down to solid material, such as bedrock or dense till, below the refuse.

2. Settlement - Settlement of refuse over time occurs through compression under its own weight or external loading, reduction in volume from decomposition of organic material, and the movement of fine material into voids in the refuse. Settlement varies in extent and time over small areas and can amount to ultimately 10 or 15% or more of the original refuse thickness. About 50% of total refuse settlement under its own weight should occur by the end of the second year and 90% by the end of the fifth year after placement. Attempts to increase the rate of settlement through mechanical compaction or preloading with earth have been only partly successful. These settlement characteristics of fill confirm the necessity of piles for most structures and require that facilities placed on the fill such as light poles and paved areas have extra deep layers of foundation material placed under them and be designed to allow later adjustments in vertical alignment necessitated by differential settlement.

3. Corrosion and deterioration - Decomposing organic material in refuse can corrode unprotected steel, galvanized pipe, and concrete. Where such material cannot be kept from contact with the refuse it should be protected by either an epoxy coating or by extra thickness.

4. Methane gas - Decomposing organic material produces carbon dioxide and methane gases. Methane is hazardous because it can form explosive mixtures with air at concentrations between 5% and 15% by volume. These concentrations must be prevented either by neutralizing the gas with nitrogen or ventilating under the structures placed on refuse to allow the gas to freely escape

5. Rodents, vectors, and odors - At least two feet of silty sand soil cover over refuse and chemical spraying wherever the cover is disturbed will minimize the nuisances of rodents, vectors, and odors customarily present at refuse dumps.

6. Underground fires - Fires in combustible refuse can burn or smolder below the surface for long periods of time affecting the settlement of the refuse and increasing the hazard of methane gas explosions. Known underground fires should be excavated, and extinguished prior to any development of the site, and as discovered subsequently.

Recommended Actions to Prepare the Dump for Development

1. Establish a master plan for location of uses and structures on the site.

2. Shape and cover the present surface to provide for adequate drainage, rodent, vector, and odor control, and a developable topography related to the master plan. Larger excavation equipment than required at a normal site will be necessary.

3. Establish a program to monitor refuse settlement and methane gas production.

4. Surcharge building, pavement and playfield areas with earth fill to reduce later settlement and remove from building area wherever possible large surface obstructions such as concrete masses, tree stumps, and auto bodies, that would hinder pile driving.

5. Do not develop the site until the monitoring of settlement indicates that settlement has stabilized. This will not be for at least two or three years.

Building and Site Development Considerations

1. Make the most economical use of the required piles by generally building high. Minimize building area covering to reduce the cost of methane control.

2. Provide a methane gas control system under each building or complex of buildings.

3. Collect roof and surface drainage for disposal into existing drainage system on the site perimeter.

4. Use ramps to buildings rather than stairs to make easier adjustments to ground settlement.

5. Avoid placing pavement immediately adjacent to structures to minimize visual effects of ground settlement. Provide buffer zones of shrubbery.

6. Protect all piles from corrosion.

7. Support the ground floor of all buildings with piling as well as the bearing walls.

8. Provide a maintenance program to regrade areas and repave pavements that settle and to maintain proper drainage.

9. Use portable watering systems for landscaped areas rather than in-ground systems.

10. Any light poles, grandstands, and other structures that are not to be supported by piles must be provided with extra long bolt connections at the base to adjust for differential settlement.

11. Provide extra thick base courses under paved areas to minimize settlement, and use a temporary paving, such as oiled fine gravel, until paved area settlements have stabilized.

12. Use bituminous, rather than Portland cement, concrete for final paving. It is more flexible.

13. Increase the pavement slope beyond normal grades for drainage and increase the number of catch basins and compensate for differential settlement construct catch basins and piping to settle with the ground.

14. Group together all major utilities and support by piles.

Premium Costs for Developing on the Dump

The following figures represent the approximate additional costs of developing on a refuse dump site compared to a "normal" site.

1. Soil cover where necessary over whole site: $150,000-$175,000.

2. Methane treatment: $1-$3 per square foot of building area.

3. Building piles: from $2.85 per square foot for a one-story building to $1.90 per square foot for a 20-story building.

4. Paving: $3-$4 per square yard.

5. Utilities: $200 per linear foot

Refuse Dump Development Precedents

Refuse dumps all over the world have been subsequently developed, usually for non-building uses such as parks, playgrounds, parking areas and airport runways. But, because of the scarcity of land in urban areas, the number of building developments on dump sites have increased in recent years. Local examples are the University of Massachusetts-Boston Campus in Dorchester and the AVCO building in Everett. There are plans in Watertown for construction of an enclosed ice skating rink on an old landfill site.

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Prepared by Richard A. Lockhart

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