

A Comparative Study of the Geographic Sites of Spencer and Bloomington, Indiana

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Spencer and Bloomington, Indiana, have many things in common. Each is a county seat of adjacent counties of approximately the same size. Both cities are located in the southern part of the state where settlement occurred first, and therefore their sites were selected at an early date. The site of Spencer was selected in 1815 and the site of Bloomington in 1816. Located only 18 miles apart they are in an area with humid continental climate having long summers and generally adequate precipitation, and both were originally surrounded by a broad-leaf, deciduous forest. As discovered later, they were located in an area without mineral fuels but in which stone would become an important commercial non-metallic mineral. Each city was originally settled by people who came from the same general area of eastern United States. During the first decades they served as trading centers for the early pioneers who were busy clearing the land and utilizing the virgin resources. During this time, the growth of the two villages was similar.

Of course there were and remain differences in their geographic sites. The contrast between their physical sites and the influence these have had on settlement and current problems stands out in bold relief. An understanding of the physical geographic site of any city is a prerequisite to geographic engineering. And it is interesting to note that in nearly every way the sites differ that the more favorable condition exists in Spencer, the smaller settlement.

Surface Configuration

Description. Spencer is located on a terrace which is part of a valley fill of the West Fork of the White River. The terrace at Spencer is approximately 30 feet above the average river level. Except for a few residences and commercial enterprises located on the valley slope to the north, the local relief is less than 20 feet.

In contrast, Bloomington sits astride a ridge which extends in a general east-west direction. This ridge which crests at Eleventh Street is a part of the water divide which separates the watersheds of the East and West Fork of the White River. Consequently the surface water which falls on the north slope of the ridge drains north by means of Griffy Creek and Butcher Creek to the Bean Blossom Creek and the West Fork of the White. Surface water falling on the south side of the ridge flows through several intermittent streams called branches into Clear Creek at the south edge of the city limits and hence into the East Fork of the White. Intermittent streams have cut back into the ridge from both sides creating a rolling topography. Although the city is small (there were 2,351 acres in the city in December, 1951), the topography is locally diversified.

Cultural Relationships. Spencer's rectangular street pattern is only broken in a few minor places, not by landforms but by the orientation of state highways. The thoroughfares are broad and adequate and appear

spacious for a town of its size. The only major traffic bottleneck is an old bridge which connects the trade territory south of the river with Spencer on the north.

The residential and other parts of the city may be monotonously level, but no one pays taxes for the construction of storm sewers, and storm water problems are few. Storm water drains to the river unhampered except by a railroad bed.

Although Bloomington has a roughly rectangular street pattern, it is superimposed on an uneven topography of ridges, ravines and rolling slopes. The areas enclosed by the major and secondary streets form squares and rectangles of varying sizes and arrangements. There are more short and dead-end streets. At present there are only two continuously oriented thoroughfares through the city, namely Walnut Street and Third Street, and the latter has two off-set jogs in it. Cultural features such as the University grounds, railroad properties and vacant land interrupt the otherwise rectangular street pattern.

Bloomington's streets appear and are in many places narrow and crowded. They have jogs, bends, and dips which handicap a smooth traffic flow and contribute to accidents. There are many traffic bottlenecks; blind vision spots; steep slopes which become icy in winter; and dips which flood during heavy downpours of rain.

Basement garages are a ubiquitous feature of the better residential areas and commonly associated with the better houses except those of ranch type construction. By orienting houses properly on sloping lots, basement garages are easily accessible and of rather low construction cost.

The rolling topography provides opportunities for building houses and commercial buildings to fit the slope. Some of the commercial buildings on the south side of the square have been constructed in response to the slope, but to date slope has had little influence on the architecture of the houses other than basement rooms and garages with ground level entrances.

Two outstanding examples of fitting house construction to sloping land can be found in Bloomington. One is a ranch-type house built on three levels to hug a southwest facing slope. The V-shape structure of the house fits a flat-iron shaped lot. The house hugs the topography so closely that a small earth dike had to be constructed up-slope from the house to divert the run-off from ponding in the apex of the V. The other house is located on the side of a south facing slope. It was constructed so deep into the side of the slope that the top of the house extends less than six feet above the up-slope side. The basement garage of this house is at street level. The house nearly flanks the sidewalk and one climbs a flight of stairs to enter it.

The rolling topography and steep grades influence rapid run-off (the engineering office gives the highest elevation at 820 feet and the lowest elevation in the southern part of the city as 720 feet) and thereby increasing the drainage problems. Only a very minor part of the city is served by underground storm sewers. Many blocks of streets are not flanked by any drainage ditch and many more have only a ditch on one side. Drainage areas along streets, whether gutters lined with cement or stone or open ditches, often become clogged with trash especially where culverts exist.

Clogged or too small culverts divert the water into and across the crushed stone and macadam streets washing away material and saturating the stone with water. Later with freezing and thawing and heavy traffic, "chug" holes develop and the streets deteriorate rapidly.

Also, the rolling topography plus a tight subsoil causes a high percentage of run-off. Heavy thunderstorms with large run-offs damage residential property and create disagreeable conditions. New houses constructed on too low a foundation, often with their longest dimension crosswise to the slope, dam the run-off until the water level rises sufficiently to run through the house. After this happens diversionary dikes and walls are made up-slope or power machinery is used to scoop out an amphitheatre-like area so the immediate upslope level is lower than the foundation.

The ridge site of Bloomington with the diverging down-grade slopes presents an expensive dilemma in constructing a sewage system. From the standpoint of gravity flow the divide stretching east-west along Eleventh Street cuts the city in two. Sewers draining downhill on the north side lead to a pumping station where it is necessary to put the material under pressure and hoist it to the top of the ridge so it can flow down the south side of the ridge to the city's sewage disposal plant two miles south and west of the city limits. Fortunately the drop from the highest point in the city to the sewage disposal plant is about 160 feet in a distance of few miles. The cost of pumping the sewage and repairing pressure mains is considerable and although residential expansion has taken place to the north, sewage main construction here has been limited. In a two-year period the primary pressure mains on the north slope had to be partially excavated and repaired twenty-three times. These mains were originally laid on bedrock.

Bedrock

Description. To date the underlying bedrock has not been a handicap to Spencer's growth. The bedrock lies approximately 100 feet beneath the surface of most of the city.

In contrast, Bloomington is located on a ridge, the core of which contains three types of limestone. The uneven and differential weathering of these limestones accounts for the diversity of the local topography. Large ravines with widening valley floors develop in the brittle and massive limestone called the Harrodsburg, while in the soft, massive Salem limestone gently undulating slopes develop. The greatest number of sinkholes are associated with the hard, dense, cherty St. Louis limestone, but these features may also appear in the other types.

Cultural Relationships. The possibility of striking bedrock is one of the primary construction hazards in Bloomington. Before or after buying a lot and prior to construction, the owner does or should make test borings to ascertain the depth of the underlying rock. Grids with mesh of various sizes are used with tests being made at the intersections. Some grid squares contain a yard and others four or nine square yards. The wider the test holes are spaced, the greater the danger of missing rock. Moreover, if construction of the test hole is stopped as soon as rock is reached,

there is no way of knowing whether one has reached the general surface of the underlying bedrock or only a residual boulder or the top of a rock point projecting up into the subsoil. Moreover, it is possible to take a rather large number of borings and by accident miss rather large lenses or several projecting points. It is also both exasperating and expensive to locate a place on your lot for a basement and, after constructing a nice basement, find that a ledge of rock separates the basement from the water and sewer mains.

In spite of careful test borings the risk of hitting bedrock, where not expected, is so great and so expensive that contracts are so drawn that the contractor is not financially responsible for additional costs. Today the estimated price for removal of a cubic yard of rock ranges from 15 to 25 dollars depending in part upon the nature of the limestone and its state of decay.

The discovery of bedrock after excavation begins sometimes influences a change in construction plans. A full basement may be reduced to half and in other cases plans for a basement are discarded. In the latter case the careful replanning of the house structure may be necessary. Unless new blueprints are drawn, makeshift changes reduce the utility, aesthetic and monetary value of the structure. Sometimes the site of the house on the lot must be changed thus disturbing the balance between the two. Other times the foundation of the house is raised creating a grading problem and causing the house to have a perched appearance. If the foundation is too high above the street level there is an additional problem and cost of constructing retaining walls, steep earth banks, or terraces, or a combination of these.

Retaining walls along one or more sides of city lots are a ubiquitous feature in Bloomington's landscape. Fortunately stone is locally available and often walls add beauty to the property. On the other hand, because many of the walls have not been constructed properly allowing for drainage, they are in a bad state of repair. Unless drainage is provided, heads of water build up behind. Good cement plus good construction are important, otherwise walls are moved by "heads of water" and alternating freezing and thawing. After heavy spring rains, walls may be seen bulging out of line or partially collapsed.

City administrators as well as individuals have construction headaches.

The underlying bedrock of Bloomington helps explain the city's limited sewer main system; the high cost of constructing and maintaining mains; and the dissatisfaction of some people on the sewer lines. Because of the high cost of excavating rock, in some places city sewers were laid as shallow as a foot and a half below the street surface. Consequently, locally there are mains at a higher level than the basements or sanitary systems they are expected to service. Some houses have small, enclosed catchment basins in their basements equipped with an electric pump. This pumps the sewage up to the city sewer main.

The city has an additional cost of laying sewer mains on a "cushion of gravel." All rock transmits shock in varying degrees and since blasting is common in Bloomington, sewers formerly laid on bedrock are often

broken and need repair. Today and in recent years city sewer contracts state that "an additional four inches of rock must be excavated and the space filled with crushed stone or gravel" which acts as a shock absorber. Here is an additional cost.

An additional physical handicap to sewer construction is the deep ravines on the side of the major ridge. Shallow installment of a sewer main on both sides of the ravine at a proper grade would cause the main to be exposed and even suspended at the bottom. Few sewer mains of this type have been constructed.

Sinkholes leading to cracks and caverns in the underlying bedrock have influenced several types of human response during the history of Bloomington. In the early days wells and springs were common. There were wells on the city square and basement springs helped preserve perishables. During water shortages in the city system, they provided water for household use and business purposes. Today most of the ground water in the mantle rock and the underground rock channels is foul smelling and contaminated. Some sinkholes are used as cesspools or septic tank outlets and some are partially occupied by outside toilets. If a sinkhole is used as an outlet, not so many feet of laterals need be constructed in the septic field.

With the bedrock so close to the surface, the city has a dual system of sanitary and storm sewers which means that two pipes are laid side by side. Such a system helps reduce the amount of vertical excavation that would otherwise be necessary, but increases the amount of horizontal.

The outcropping or shallow buried bedrock presents numerous problems to one who wishes to install poles, gas mains, water mains, or underground telephone lines or build driveways and streets. This element of the environment presents a constant headache of economic worries.

In contrast with Bloomington, the bedrock problems of Spencer are minor.

Mantle Rock

Description. In contrast with the friable, well-drained alluvial and glacio-fluvial sediments underlying Spencer, in Bloomington the mantle rock resulting from the weathering of limestone is primarily clay which is sticky or stiff and plastic when wet and compact and hard when dry. Originally the subsoil was covered with a few inches (about six or less) of friable loams. Today the subsoil is at the surface either because the top soil washed away during cultivation or because it was covered up by excavated subsoil and "fill dirt." These clayey subsoils vary in depth from nothing where the rock outcrops to 10 feet or more under natural conditions.

Cultural Relationships. The tight subsoil surface of Bloomington contributes to problems of storm water drainage, sewage disposal, droughty appearance of the residential areas, street construction, clouds of dust in dry periods, and reddish mud in wet periods.

In proportion to the amount of precipitation, drainage facilities must be larger because of the high per cent of run-off. At present the underground storm sewers and above ground drainage ditches are inadequate. Cost of construction and the maintenance of the existing artificial drain-

age is high. Street and drainage ditches have not been constructed to take complete advantage of the intermittent stream pattern on the sides of the ridge.

The light, compact, plastic subsoils with their low absorption qualities are a handicap to the construction and efficient operation of septic tank fields and create storm water problems. The clay trenches really tend to hold the water and retard its movement downward or horizontally. Wet or dry the clay is difficult to dig and the tile is seldom laid at the proper depth. Lacking a knowledge of septic field operation, some land-owners remove part of the cover by grading or bury the fields with "fill" clay.

In addition to the clay, other physical conditions placing rigid limitations on the proper construction and functioning of septic fields are heavy thunderstorms, uneven topography and soil erosion. Alternate freezing and thawing followed by heavy thunderstorms remove much top earth. After heavy rains disagreeable odors are common. Many fields are so flooded and water-soaked after an inch of rain that two common sights prevail. One is the man with his truck to empty the septic tank until the fields can drain again and the other is "weeping"; wet spots indicating "septic tank trouble." In winter a blanket of snow following a thunderstorm quickly has its tell-tale brown stains and melted spots indicating where the warm water from fields is seeping or running to the surface, a process locally called "weeping." Unfortunately the speed of seeping is accelerated during heavy rains and the material is carried down slope to the neighbors. Basement wet weather "springs" are common after these rains, and odor as well as dyes have substantiated that a neighbor's septic tank is the source of some basement water flows.

Contrast this Bloomington situation with Martinsville or Spencer or many other Indiana towns and cities where septic tank fields may be constructed in friable silts, sands, loams, and gravels.

Nice sod lawns or gardens are rare. The greatest natural limitation to good lawns and gardens is the dryness of the earth. Water tables fall rapidly or are absent in many yards because of the underlying limestone or the overlying blanket of excavated clay. Soon after an inch of rain in summer, the earth cracks open. It is doubtful if 20 per cent of the falling rain enters the ground in many yards. Where less than 10 inches of the 44 inch annual rainfall enters the ground, desert-like conditions prevail unless water is added.

Both artificially added water and rain evaporate quickly, run off or through. The surface material is low in vegetable matter or humus, and long slopes and terraces contribute to lowering the water table. Water is comparatively expensive in Bloomington and many water their yards lightly or not at all. Some who can afford large water bills and let their sprinklers run all night are not aware that much of the water runs through mantle rock fissures down to the fractured limestone below and into the great network of cracks and caverns in the bedrocks. Fortunately the tree roots enter these cracks and rock channels and are not so subject to the droughty conditions.

Numerous freezes and thaws also damage good lawn grasses especially if the grass has been weakened by a dry summer and fall.

In part because of the uneven relief, the clayey mantle rock and the underlying bedrock, street construction costs are high. Miles of city streets both graded and ungraded are either of earth or crushed stone. Clouds of dust bedevil the housewives during the dry periods. In some places applications of oil help hold down the dust but contribute to the development of "chug holes" and "washboard" surfaces. Most new blocks present fill and rock removal problems.

In contrast with Bloomington, in Spencer ditches can be constructed easily by hand and machine. In this town three separate parallel sanitary systems lead to the river. Since no one main must carry the complete load, smaller pipes are used. Buildings costs of city facilities are lower. Spencer's growth is encouraged by its good mantle rock and soil.

Waterbodies

One of the biggest contrasts between the sites of Spencer and Bloomington is the fact that the former is located on the edge of one of the largest rivers in the state whereas Bloomington is located far from a large river or natural lake and is on topography, bedrock and mantle rock, which excludes the possibility of constructing a lake nearby that would provide the necessary water.

After a history of reoccurring water shortages dating back to the 1890's, the city of Bloomington completed construction of a 1,600-acre reservoir lake in 1953. When full, the reservoir holds 5.5 billion gallons of water. But this lake had to be built about 10 miles northeast of the city limits and partially in adjacent Brown County. The water from the new Bean Blossom Lake still must flow through the old Bean Blossom creek channel to reach Griffey Lake reservoir, the former primary source of Bloomington's water.

An abundant water supply has brought a chain of reactions all of which cannot be considered in this paper. Blueprints have been drawn for an expansion in the water system. On October 16, 1953, Mayor Emmett Kelly stated that "engineers of Consoer-Townsend began sounding water main routes for stone today, in order to find the best routes for the lines and to get a more accurate engineering cost estimate." On October 28, 1953, the City Council passed an ordinance "hiking water rates from a minimum of \$1.50 a month to \$2.25."

A sewage disposal plant built in 1934 is now too small and plans have been drawn for enlarging both the disposal plant and the sewer mains.

The water and sewer service in Bloomington have cost the people millions of dollars and the total costs continue to rise.

In contrast Spencer takes its water from wells constructed in the Valley fill and empties its untreated sewage into the river. Water and sewer costs remain low.

Favorable Site for Pioneer Village

Viewed in retrospect many people raise the question, "Why did the original settlers select such an unfavorable physical site for Bloomington?"

When occupied in 1816 the physical site had many characteristics favoring its selection and the people of that day did not visualize the technology and needs of our times.

One hundred and thirty-five years ago a well-drained site was an important criteria in selecting a spot for village development. At that time the millions of acres of swamp land in Ohio, Indiana and Illinois had not been drained. Water tables were high and mud was a handicap to those who walked, rode or drove cattle or horse-drawn vehicles. A high, well-drained area had less mud and the people believed that disease was not so common there. Much pioneer illness and many deaths were attributed to disease such as malaria and ague resulting from swamps.

Other favorable factors were the timber, stone and water. The ridge was wooded and the rolling nature of the land offered many good residential sites. Building stone for foundations, steps, wells and cisterns was available and easily tooled. Springs of pure water and the other natural water courses provided an adequate water supply for both man and animals. When these became inadequate, wells and cisterns were constructed. At that time the water table was high and the ground water uncontaminated. Meadows furnished grazing grounds for animals. The village of Bloomington did not suffer from water shortages and the first city water works consisting of a small lake and pump was not constructed until 1894.

Unfavorable Site for City in Twentieth Century

As the population in Bloomington grew and the pioneer village changed into a modern, Twentieth Century city, limitations in the physical site became more and more real, apparent and costly. However, in spite of these limitations, the city continues to grow because of other favorable geographic factors which cannot be treated within the limits of this paper but will be presented later. Bloomington's population in 1950 was 28,163 and Spencer's 2,386.