MATERIALS INVENTORY SECTION

GENERAL INFORMATION

Permian and Upper Pennsylvanian limestones make up a major part of the construction materials resources in Riley County. Siliceous sand and gravel can be produced from Pleistocene terraces in the Kansas and Big Blue River floodplains, but it is much more economical to produce such material from Recent Alluvium along the Kansas and Big Blue Rivers. A small amount of locally derived limestone gravel, which can be used for light type surfacing, can be found in some of the small streams.

There is also a limited amount of dune sand and a prospective site in glacial material of sand and gravel.

Construction materials types, their uses, and availability are tabulated in figure 7. Test results from a limited amount of sampling and testing are presented in figure 18 (page 25).
<table>
<thead>
<tr>
<th>TYPE material and geologic source</th>
<th>USE</th>
<th>Page</th>
<th>AVAILABILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LIMESTONE</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tarkio Limestone Member</td>
<td>Concrete and bituminous aggregate light type surfacing.</td>
<td>16</td>
<td>Moderate source in eastern Riley County. Plates IX &amp; XII.</td>
</tr>
<tr>
<td>Cottonwood Limestone Member</td>
<td>Concrete aggregate, light type surfacing, building stone.</td>
<td>17</td>
<td>Moderate source in eastern and southern part of the county. Plates VIII, IX, XI &amp; XII.</td>
</tr>
<tr>
<td>Havensville Shale Member &quot;Reef&quot;</td>
<td>Light type surfacing.</td>
<td>18</td>
<td>Very limited source in southeastern corner of the county. Plate XII.</td>
</tr>
<tr>
<td>Florence Limestone Member</td>
<td>Light type surfacing.</td>
<td>19</td>
<td>Moderate source in eastern and southern part of Riley County. All plates except IX &amp; XII.</td>
</tr>
<tr>
<td>Port Riley Limestone Member &quot;Rimrock&quot;</td>
<td>Concrete aggregate light type surfacing, riprap, agricultural line.</td>
<td>20</td>
<td>Moderate source central part of county. Plates XI &amp; XII.</td>
</tr>
<tr>
<td>Towanda Limestone Member</td>
<td>Concrete and bituminous aggregate, light type surfacing.</td>
<td>22</td>
<td>Moderate source northwestern part of Riley County. All plates except IX &amp; XII.</td>
</tr>
<tr>
<td><strong>SAND AND GRAVEL</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glacial Drift</td>
<td>Light type surfacing.</td>
<td>22</td>
<td>Very limited source in northeastern corner. Plate II.</td>
</tr>
<tr>
<td>Terrace Deposits (Buck Creek and Newman)</td>
<td>Construction aggregate, light type surfacing.</td>
<td>23</td>
<td>Moderate source in stream and river valleys. Plates VIII, IX, XI &amp; XII.</td>
</tr>
<tr>
<td>Dune Sand</td>
<td>Used as sweetener or mortar sand.</td>
<td>23</td>
<td>Very limited source in Kansas River valley. Plate XI.</td>
</tr>
<tr>
<td>Quaternary Alluvium</td>
<td>Concrete and bituminous aggregate and light type surfacing.</td>
<td>24</td>
<td>Good source in Kansas and Big Blue River valleys. Plates VI, VIII, IX, &amp; XI.</td>
</tr>
</tbody>
</table>

Figure 7. Tabulation of the construction material's types and their availability in Riley County.
DESCRIPTION OF CONSTRUCTION MATERIALS

Limestone
Zeundale Limestone Formation

The Zeundale Limestone Formation is composed of two limestone members and one shale member. These members are, in ascending order, the Tarkin Limestone, Wamego Shale, and Maple Hill Limestone.

Tarkin Limestone Member

The Tarkin is a gray-orange to brownish gray, hard, dense, fossiliferous limestone that weathers to a rusty brown. It is composed of two thick limestones separated by a thin shale having a thickness of 0.2 feet (6.1 cm). The shale is olive grey, silty, and calcareous. Each limestone bed is approximately 6 feet (1.8 m) thick. Very large fusuloids, Fruticities ventricosus, stand out on the weathered surface and give it a "rasp-like" appearance. It is easily recognized by its bold outcrop.

Figure 8. Exposure of Tarkin Limestone Member in the NW 1, sec. 27, T10S, R9E. (Stereogram)

Quality test data on samples of the Tarkin from open sites indicate the material will meet all current highway specifications for construction aggregate. The Tarkin Member outcrops in the area shown on plates IX and XII.
Beattie Limestone Formation

The Beattie Limestone Formation is composed of three members which are, in ascending order, the Cottonwood Limestone, Florena Shale, and Morrill Limestone.

Cottonwood Limestone Member

The Cottonwood Member consists of a single, massive limestone layer, with a uniform thickness of 6 feet (1.8 m) throughout the area. This limestone is gray, weathers almost white, and contains a great number of fossilized coral. In this area the Cottonwood appears flinty but nodules of partly silicified material weather more slowly and give it the flinty appearance (Jewett, 1941).

Figure 9. Exposure of Cottonwood Limestone Member in the SE 1, sec. 33, T95S, R7E. (Stereogram)

Many springs issue from the base of this limestone. A resultant bush-line forms at the base of the unit and can be seen for many miles.

Limestone from the Cottonwood Member is the most satisfactory for use as building stone in Riley County. However, only a small amount is currently being quarried for this purpose, but large quantities have been used in the past. Cottonwood Limestone has been produced in large quantities in and near Manhattan. The buildings on the campus of Kansas State University at Manhattan are constructed almost entirely of limestone from this unit.

Quality test data on samples of the Cottonwood from open sites indicate the material will meet specifications for concrete aggregate as well as light type surfacing material and riprap. It may meet specifications for bituminous aggregate when taken from select outcrops. However, tests should be run on any potential quarry sites.
Figure 10. Cottonwood Limestone escarpment showing bush-line. (Sterogram)

The outcrop pattern of the Cottonwood Limestone is shown on plates VI, VII, IX, XI and XII.

Wreford Limestone Formation

The Wreford Limestone is composed of two limestone members and one shale member. These members are, in ascending order, the Threemile Limestone, Havensville Shale, and Schroyer Limestone. The Wreford Limestone has an approximate thickness of 40 feet (12.1m) in Riley County.

Havensville Limestone Member

The Havensville Shale Member is a gray-green, calcareous, argillaceous, fossiliferous shale. Several limestone zones of variable thickness occur throughout the member. Locally the lower portion has undergone a change in lithology due to a change in depositional environment. This resulted in a bioherm or reef-like mass of rock commonly referred to as the "Havensville Reef". This change can be observed along I-70 in the E8, sec. 39, T11S, R9E. The approximate thickness of the bioherm at this location is 10 feet (3m). During the time of this study there were no active "Havensville Reef" quarries. Quality test data on samples of the "Havensville Reef" from open sites indicate the material will not meet current Kansas Department of Transportation specifications for construction aggregate. The Havensville Limestone was not mapped for this report; however, a sampled open materials site is located on plate XII.
Figure 11. "Kearneysville Reef" exposed in backslope along I-70, E1, sec. 28, T11S, R9E. (Stereogram)

Barneston Limestone Formation

The Barneston Limestone is composed of two limestone members and one shale member. These members are, in ascending order, Florence Limestone, Oketo Shale, and Fort Riley Limestone. The total thickness of the formation in Riley County is in excess of 64 feet (19.5m).

Florence Limestone Member

The Florence Limestone is a light-gray, thin-bedded to massive unit that weatheres to a light tan in color. The total thickness of this member is 15 to 30 feet (4.6 to 9.1m). The Florence is a very distinct bed due to the large amount of steel-gray chert embedded within the limestone. The chert consists of very irregular nodules, which are arranged in layers 1 to 6 inches (2.5 to 15.2 cm) thick. Nonfissility limestone layers are approximately 9 inches (22.9 cm) thick and represent about 15% of the member. There are commonly two shale partings in the upper 10 feet (3m) and one shale parting in the lower 5 feet (1.5m). This member is easily recognized by its outcrop expression, and the abundance of chert it contains.

This material will not meet the Kansas Department of Transportation specifications for use either in concrete or bituminous construction. The only active quarry is located on the Fort Riley Military Reservation where it is being used for light type surfacing.

The Florence Limestone was not mapped. However, the top of the Florence is located approximately 9 feet (2.7m) below the Fort Riley "rimrock" which was mapped on all plates except IX and XII.
Figure 12. Florence Limestone in backslope along US-24, SW1, sec 22, T9S, R7E. (Stereogram)

*Fort Riley Limestone Member*

Figure 13. Exposure of *Fort Riley Limestone Member* in the SE1, sec 21, T9S, R7E. (Stereogram)
The Fort Riley Limestone is a soft, fine textured, gray limestone which weathers to a light tan color. A massive bed of limestone termed the "rimrock" zone, occurs near the base of the unit. The "rimrock", which may be as much as 6 feet (1.8m) thick, was used extensively in earlier years for building stone. Total thickness of this member is approximately 26 feet (7.9m). Bedding and joint planes in the thinner-bedded and more argillaceous strata below the "rimrock" carry a moderate amount of ground water and many springs issue from this zone.

Figure 14. "Rimrock" escarpment in SI, sec. 32, T6S, R4E. (Stereogram)

Material from the Fort Riley, other than the "rimrock", is of low quality and probably not suitable for use in concrete or bituminous construction. It is undesirable for use as a light type surfacing material due to its soil nature. Although some material from this source has been used for light type surfacing, its major use today is for agricultural lime. Quality test data on samples of the "rimrock" from select open pits indicate that it will meet specifications for concrete aggregate as well as light type surfacing. The U.S. Army Corps of Engineers used the "rimrock" in the Tuttle Creek Reservoir area on dikes and fills subject to periodic water action above conservation level. However, tests should be run on material from any potential quarry after. The "rimrock" was mapped on all plates b to IV and XII.

Doyie Shale Formation

The Doyie Shale Formation is composed of two shale members and one limestone member. These members are, in ascending order, Holmesville Shale, Towanda Limestone, and Gage Shale.
**Towanda Limestone Member**

The Towanda Member is a yellow to tan-brown massive, dense, hard, unfossiliferous limestone that weathers to form small blocks and plates. Limonite stains and nodules are abundant on weathered surfaces. It may contain one or more lensing shale parting. The thickness throughout the area ranges from 19 to 23 feet (5.8 to 7.0m).

![Figure 15. Towanda Limestone Member exposed in the face of a quarry in the SE1/4, sec. 11, T98S, R4W. (Stereogram)](image)

- Quality test data on samples of the Towanda Limestone from open sites indicate the material will meet all current KDOT specifications for construction aggregate.

- The Towanda Limestone outcrops in the areas shown on plates I, II, III, IV, V, VI, VII and X.

**Sand and Gravel**

**Glacial Drift**

Glacial drift is the term used here to include all material deposited directly or indirectly by glacial ice. In Marshall County, which is located just north of Riley County, the composition of Kansan Till is mostly silt and clay. However, some localized areas contain deposits of sand and gravel. The location of scattered sand and gravel deposits is of concern since material of this type may be used for light type surfacing. A glacial deposit of sand and gravel with clay and silt binder was
noted on aerial photographs and in the backslope of a county road (SE 2 sec. 2, T6S, R7E, plate III). The extent and thickness of this deposit will have to be determined by drilling. This area has been included as a prospective site for light type surfacing material on Plate II.

Figure 16: Glacial drift exposed in a backslope on the side SE 1, sec. 2, T6S, R7E. (Stereogram)

Terrace Deposits

Terrace deposits of Quaternary age are present in major stream valleys in Riley County. Two were mapped, the Buck Creek Terrace of Illinoian age and the Newman Terrace of Wisconsinan age (plates VIII, IX, XI and XII). The upper + 40 feet (12.2 m) of each terrace is composed of varying combinations of fine sand, silt, and clay. Granular material is found at depth, but has not been produced from this source in the county due to the relatively thick overburden. The Buck Creek Terrace is + 95 feet (29 m) thick and the Newman Terrace is + 70 feet (21.3 m) thick in Riley County.

Pleistocene terraces may assume a greater economic importance as a source of sand and gravel in coming years due to increasing environmental regulation of dredging operations in stream channels.

Terrace deposits have been mapped on plates VIII, IX, XI, and XII.

Dune Sand

Sand dunes of Recent age are found southwest of Manhattan in the valley of the Kansas River (plates VIII and XII). Dunes are comprised of mineral particles of sand size that have been deposited by the wind. They are tan-gray in color, exhibit hummocky topography, and are typically crossbedded. At the time of this study they
were well covered with vegetation. Their thickness varies from a feather edge to approximately 25 feet (7.6m). The dune sand can generally be used as mortar sand. However, tests should be run on this material before use from any location.

Quaternary Alluvium

The alluvium of the Kansas and Big Blue Rivers is an excellent source of large quantities of granular material. This material consists of fine sand to coarse gravel composed dominantly of quartz, feldspar, chert, calcite, and limestone fragments. It is produced through pumping operations because of the relatively high water table in these valleys. During production oversized chert and limestone are screened out and discarded because of their deleterious nature. The alluvium has an approximate thickness of 100 feet (30.5m) in Riley County. Sand and gravel, obtained from Kansas and Big Blue River alluvium, will meet current KDOT specifications for all types of construction aggregate. However, when chert from these deposits are used with cement, the cement is susceptible to expansion, cracking and distress. To alleviate these problems prescribed amounts of sweetener such as limestone, sandstone, or specified sand and gravel must be added to meet KDOT standard specifications.

The alluvium has been mapped on plates VIII, IX, X, XI, and XII.

Figure 17. Sand pumping operation in the Blue River.
<table>
<thead>
<tr>
<th>Source of Material: Alluvium (G1)</th>
<th>Site Data Form No.</th>
<th>Material Type</th>
<th>Date of Test</th>
<th>3/4</th>
<th>3/8</th>
<th>4</th>
<th>8</th>
<th>16</th>
<th>30</th>
<th>50</th>
<th>100</th>
<th>Wash 200</th>
<th>G.F.</th>
<th>% Gr.</th>
<th>Sp. Gr.</th>
<th>Sp. Gr. Dry</th>
<th>% Wear</th>
<th>% Soundness</th>
<th>% Absorption</th>
<th>Source of Data Sci Lab. No.</th>
<th>Type of Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sg7</td>
<td>2-62</td>
<td>Fine Sand</td>
<td>3-7</td>
<td>17</td>
<td>35</td>
<td>55</td>
<td>79</td>
<td>94</td>
<td>99</td>
<td>0.25</td>
<td>2.61</td>
<td>3.90</td>
<td>116.18</td>
<td>35.8</td>
<td>0.97</td>
<td>0.5</td>
<td>18973</td>
<td>Crushed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sg21</td>
<td>2-66</td>
<td>Fine Sand</td>
<td>3-6</td>
<td>2.59</td>
<td>2.61</td>
<td>3.90</td>
<td>116.18</td>
<td>35.8</td>
<td>0.97</td>
<td>0.5</td>
<td>18973</td>
<td>Crushed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sg27</td>
<td>3-1-57</td>
<td>Sand &amp; Gravel</td>
<td>3-63</td>
<td>2.59</td>
<td>2.61</td>
<td>3.90</td>
<td>116.18</td>
<td>35.8</td>
<td>0.97</td>
<td>0.5</td>
<td>18973</td>
<td>Crushed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sg29</td>
<td>2-6</td>
<td>Sand &amp; Gravel</td>
<td>3-4-59</td>
<td>2.59</td>
<td>2.61</td>
<td>3.90</td>
<td>116.18</td>
<td>35.8</td>
<td>0.97</td>
<td>0.5</td>
<td>18973</td>
<td>Crushed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sg33</td>
<td>2-61</td>
<td>Sand &amp; Gravel</td>
<td>3-4-59</td>
<td>2.59</td>
<td>2.61</td>
<td>3.90</td>
<td>116.18</td>
<td>35.8</td>
<td>0.97</td>
<td>0.5</td>
<td>18973</td>
<td>Crushed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sg35</td>
<td>2-61</td>
<td>Sand &amp; Gravel</td>
<td>3-4-59</td>
<td>2.59</td>
<td>2.61</td>
<td>3.90</td>
<td>116.18</td>
<td>35.8</td>
<td>0.97</td>
<td>0.5</td>
<td>18973</td>
<td>Crushed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sg52</td>
<td>3-4-59</td>
<td>Limestone Gravel</td>
<td>48</td>
<td>80</td>
<td>93</td>
<td>96</td>
<td>2.45</td>
<td>3.90</td>
<td>116.18</td>
<td>35.8</td>
<td>0.97</td>
<td>0.5</td>
<td>18973</td>
<td>Crushed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source of Material: Doyle Shale Formation (Trended Limestone Member) Pit

| Source of Material: Doyle Shale Formation (Trended Limestone Member) Pit |
|-----------------------------|------------------|--------------|-------------|-----|-----|---|---|----|----|----|----|--------|------|------|--------|--------------|--------|-------------|--------------|------------------|---------------|
| Source of Material: Doyle Shale Formation (Trended Limestone Member) Pit |
|-----------------------------|------------------|--------------|-------------|-----|-----|---|---|----|----|----|----|--------|------|------|--------|--------------|--------|-------------|--------------|------------------|---------------|
| Source of Material: Martha Shale Formation (Fort Riley Limestone Member) Pit |
|-----------------------------|------------------|--------------|-------------|-----|-----|---|---|----|----|----|----|--------|------|------|--------|--------------|--------|-------------|--------------|------------------|---------------|
| Source of Material: Martha Shale Formation (Fort Riley Limestone Member) Pit |
|-----------------------------|------------------|--------------|-------------|-----|-----|---|---|----|----|----|----|--------|------|------|--------|--------------|--------|-------------|--------------|------------------|---------------|
| Source of Material: Martha Shale Formation (Fort Riley Limestone Member) Pit |
|-----------------------------|------------------|--------------|-------------|-----|-----|---|---|----|----|----|----|--------|------|------|--------|--------------|--------|-------------|--------------|------------------|---------------|

Source of Material: Wreath Shale Formation (Havensville Shale Member) Pn

| Source of Material: Wreath Shale Formation (Havensville Shale Member) Pn |
|-----------------------------|------------------|--------------|-------------|-----|-----|---|---|----|----|----|----|--------|------|------|--------|--------------|--------|-------------|--------------|------------------|---------------|
| Source of Material: Wreath Shale Formation (Havensville Shale Member) Pn |
|-----------------------------|------------------|--------------|-------------|-----|-----|---|---|----|----|----|----|--------|------|------|--------|--------------|--------|-------------|--------------|------------------|---------------|
| Source of Material: Wreath Shale Formation (Havensville Shale Member) Pn |
|-----------------------------|------------------|--------------|-------------|-----|-----|---|---|----|----|----|----|--------|------|------|--------|--------------|--------|-------------|--------------|------------------|---------------|

Source of Material: Debo Shale Formation (Cottonwood Limestone Member) PnC

| Source of Material: Debo Shale Formation (Cottonwood Limestone Member) PnC |
|-----------------------------|------------------|--------------|-------------|-----|-----|---|---|----|----|----|----|--------|------|------|--------|--------------|--------|-------------|--------------|------------------|---------------|
| Source of Material: Debo Shale Formation (Cottonwood Limestone Member) PnC |
|-----------------------------|------------------|--------------|-------------|-----|-----|---|---|----|----|----|----|--------|------|------|--------|--------------|--------|-------------|--------------|------------------|---------------|
| Source of Material: Debo Shale Formation (Cottonwood Limestone Member) PnC |
|-----------------------------|------------------|--------------|-------------|-----|-----|---|---|----|----|----|----|--------|------|------|--------|--------------|--------|-------------|--------------|------------------|---------------|

Source of Material: Grenola Shale Formation (Hwy 13 Limestone Member) Pn

| Source of Material: Grenola Shale Formation (Hwy 13 Limestone Member) Pn |
|-----------------------------|------------------|--------------|-------------|-----|-----|---|---|----|----|----|----|--------|------|------|--------|--------------|--------|-------------|--------------|------------------|---------------|
| Source of Material: Grenola Shale Formation (Hwy 13 Limestone Member) Pn |
|-----------------------------|------------------|--------------|-------------|-----|-----|---|---|----|----|----|----|--------|------|------|--------|--------------|--------|-------------|--------------|------------------|---------------|
| Source of Material: Grenola Shale Formation (Hwy 13 Limestone Member) Pn |
|-----------------------------|------------------|--------------|-------------|-----|-----|---|---|----|----|----|----|--------|------|------|--------|--------------|--------|-------------|--------------|------------------|---------------|

Source of Material: Zeardale Shale Formation (Tarkio Limestone Member) PnZ

| Source of Material: Zeardale Shale Formation (Tarkio Limestone Member) PnZ |
|-----------------------------|------------------|--------------|-------------|-----|-----|---|---|----|----|----|----|--------|------|------|--------|--------------|--------|-------------|--------------|------------------|---------------|
| Source of Material: Zeardale Shale Formation (Tarkio Limestone Member) PnZ |
|-----------------------------|------------------|--------------|-------------|-----|-----|---|---|----|----|----|----|--------|------|------|--------|--------------|--------|-------------|--------------|------------------|---------------|
| Source of Material: Zeardale Shale Formation (Tarkio Limestone Member) PnZ |
|-----------------------------|------------------|--------------|-------------|-----|-----|---|---|----|----|----|----|--------|------|------|--------|--------------|--------|-------------|--------------|------------------|---------------|

Figure 18. Results of test completed on samples of material from the various geologic source beds in Riley County.
RILEY COUNTY MATERIALS MAP INDEX

On the following pages are the twelve plates covering Riley County as shown below.

Note: The individual site data forms follow plate XII.
Legend

MATERIALS SITE DESIGNATIONS

Open Materials Sites; Sampled
Open Materials Sites; Not Sampled
Prospective Materials Sites; Not Sampled

Material Type

Estimated Quantity
+ indicates more than 25,000 cubic yards
- indicates less than 20,000 cubic yards

Reference to site number of following data forms
Geological Age and Unit

SG Sand Gravel
FS Fine Sand
LS Limestone

GEOLOGY

Allouvium
Dune Sand
Waconia Tanneke
Buck Creek Terrace
Kampan Glacial Drift

Towarda LS, Mnr
Fort Riley LS, Mnr
Cottonwood LS, Mnr
Parky LS, Mnr
Igneous Rock (Kimberlind

Geologic Unit Exposed
Geologic Unit Not Exposed

MILES

KILOMETERS
LEGEND
MATERIALS SITE DESIGNATIONS

- Open Materials Sites; Sampled
- Open Materials Sites; Not Sampled
- Prospective Materials Site; Not Sampled

Material Type
Estimated Quantity
- indicates more than 20,000 cubic yards
- indicates less than 20,000 cubic yards
Reference to site number of following data forms
Geological Age and Unit

GEOLGY

Albipan

Duck Tang

Wisconsinian Terrace

Rusk Creek Terrace

Kansas Glacial Phase

FORT KNOX

FORT MILLER

CONSIDERED

TURKSTOWN

IGNeous Rock (Kimberlite)

MILES
KILOMETERS

1 0 1 2 3 4 5

Geologic Unit Exposed
Geologic Unit Not Exposed