A method of covering an area with a compressible material, such as asphalt, to a desired elevation using a machine that deposits a layer of the compressible material of controlled thickness on a foundation surface, and then using a compacting machine to compact the compressible material to the desired elevation, includes the steps of determining the elevation of the foundation surface over the area, and determining the difference between the elevation of the foundation surface and the desired elevation over the area. A layer of the compressible material is deposited over the area. The layer has an upper surface that varies in elevation over the area, with the layer upper surface being higher in the areas having a lower foundation elevation and lower in the areas having a higher foundation elevation. The layer is sufficiently thick to allow for compression of the layer of compressible material over the area to the desired elevation. The layer of compressible material is compressed during one or more compression operations such that the upper surface of the layer after compression is uniformly at the desired elevation over the area.
METHOD OF COVERING AN AREA WITH A LAYER OF COMPRESSIBLE MATERIAL

CROSS-REFERENCE TO RELATED APPLICATION

[0001] Not applicable.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0002] Not applicable.

BACKGROUND OF THE INVENTION

[0003] Asphalt paving is widely used for roadbeds, parking lots, and other surfaces where a relatively smooth, durable surface is needed. Typically, the contour of a foundation surface, such as a roadbed, is prepared with a motor grader or other machine. A mat of hot asphalt concrete, commonly and hereinafter referred to as asphalt, is laid over the foundation surface with an asphalt paving machine that slowly moves over the area. After the mat of hot asphalt is deposited on the roadbed, a roller or other compression machine compresses the asphalt and produces a relatively smooth finish on the top surface of the asphalt layer. Not only does compressing the asphalt mat finish the top surface of the asphalt layer, it also compresses the roadbed and forces the irregularities of the roadbed into the asphalt. Additionally, compressing the asphalt presses together the mineral aggregate particles in the asphalt mixture to enhance the structural integrity of the final asphalt layer.

[0004] Typically it is desired that the asphalt paving operation produce a predefined upper surface elevation contour over the paved area. The foundation on which the asphalt is to be laid may be a layer of crushed rock or other material, or in some cases an appropriately graded earth roadbed. Such surfaces typically have irregularities, and commonly it is desired that these irregularities not be reflected in the final top surface of the asphalt layer. In the past it has been common to deposit an asphalt mat having a uniform pre-compression thickness. The thickness of the mat is chosen so that when the mat is subsequently compressed, the high spots of the mat are at or near the desired elevations. The thin portions of the compressed mat are then filled in with additional asphalt material and the compression step repeated. It will be appreciated, however, that making multiple passes with an asphalt paving machine and a compacting roller over portions of the area to be paved is time consuming and expensive. It is seen that there is a need for a method of depositing asphalt or other compressible material in which only a single deposit step, and a reduced number of compression steps are needed to achieve the desired elevation level for the upper surface of the compressed asphalt or compressible material layer.

SUMMARY OF THE INVENTION

[0005] This need is met by a method of paving an area with asphalt to a desired elevation using an asphalt paving machine that deposits a mat of asphalt of a controlled thickness on a foundation surface, and then using a compacting machine to compact the asphalt to the desired elevation. The method includes the steps of determining the elevation of the foundation surface over the area, and determining the difference between the elevation of the foundation surface and the desired elevation over the area. A mat of asphalt is deposited over the area. The mat has a thickness that varies over the area, with the mat being thicker in the areas having a lower foundation elevation and thinner in the areas having a higher foundation elevation, such that the mat is sufficiently thick to allow for compression of the mat over the area to the desired elevation. The mat of asphalt is compressed during one or more compression operations such that the upper surface of the mat has the desired elevation over the area.

[0006] The step of determining the elevation of the foundation surface over the area may comprise the steps of scanning the contour of the foundation surface over the area, and storing the results of the scanning operation. The step of scanning the contour of the foundation surface over the area may include the step of using a GNSS survey device to determine the elevation of the foundation at a plurality of points spaced over the area. The step of scanning the contour of the foundation surface over the area may include the step of using a laser scanning device to determine the elevation of the foundation at a plurality of points spaced over the area. The step of scanning the contour of the foundation surface over the area may include the step of scanning the foundation from a scanner mounted on the asphalt paving machine to determine the elevation of the foundation at a plurality of points spaced over the area. The mat of asphalt is deposited on the asphalt paving machine while the asphalt paving machine is depositing an asphalt mat of varying thickness. The step of scanning the contour of the foundation surface over the area may include the step of scanning the foundation from a vehicle that travels ahead of the asphalt paving machine to determine the elevation of the foundation surface at a plurality of points spaced over the area.

[0007] The step of depositing a mat of asphalt over the area may comprise the step of depositing a mat which has a thickness that is substantially 1.25 times the difference between the desired elevation and the elevation of the foundation surface at each of a plurality of points spaced over the area. The step of depositing a mat of asphalt over the area may comprise the step of depositing a mat which has a thickness that is substantially a constant K times the difference between the desired elevation and the elevation of the foundation surface at each of a plurality of points spaced over the area. The method may further comprise the steps of determining the elevation of the upper surface of the mat after compression, and adjusting the value of K to compensate for determined offset from the desired elevation of the upper surface over the area. The step of determining the elevation of the upper surface of the mat after compression may include the step of measuring the elevation of the upper surface of the mat after compression with a laser scanner directed to the surface behind the compacting machine. The step of adjusting the value of K to compensate for determined offset from the desired elevation of the upper surface over the area may comprise the step of computing an adjusted value for K as the ratio of the thickness of the uncompressed asphalt mat deposited on the foundation surface to the thickness of the compressed asphalt mat. The method may further comprise the step of determining the thickness of the compressed asphalt mat by subtracting the elevation of the foundation surface at a point in the area from the elevation of the upper surface of the mat after compression at the same point in the area.

[0008] A method of covering an area with a compressible material to a desired elevation using a machine that deposits a layer of the compressible material of controlled thickness on a foundation surface, and then using a compacting machine to compact the compressible material to the desired
elevation, comprises the steps of determining the elevation of the foundation surface over the area, and determining the difference between the elevation of the foundation surface and the desired elevation over the area. A layer of compressible material is deposited over the area. The layer has an upper surface that varies in elevation over the area, with the layer upper surface being higher in the areas having a lower foundation elevation and lower in the areas having a higher foundation elevation. The layer is sufficiently thick to allow for compression of the layer of compressible material over the area to the desired elevation. The layer of compressible material is compressed during one or more compression operations such that the upper surface of the layer after compression has the desired elevation over the area.

[0009] The step of determining the elevation of the foundation surface over the area may comprise the step of scanning the contour of the foundation surface over the area, and storing the results of the scanning operation. The step scanning the contour of the foundation surface over the area may include the step of using a laser scanning device to determine the elevation of the foundation at a plurality of points spaced over the area. The step scanning the contour of the foundation surface over the area may include the step of using a GNSS survey device to determine the elevation of the foundation at a plurality of points spaced over the area. The step of scanning the contour of the foundation surface over the area may include the step of scanning the foundation surface from a scanner mounted on the machine that deposits a layer of the compressible material to determine the elevation of the foundation at a plurality of points spaced over the area. The step of depositing a layer of compressible material over the area may comprise the step of depositing a layer which has a thickness that is substantially 1.25 times the difference between the desired elevation and the elevation of the foundation surface at each of a plurality of points spaced over the area. The step of depositing a layer of compressible material over the area may comprise the step of depositing a layer which has a thickness that is substantially a constant K times the difference between the desired elevation and the elevation of the foundation surface at each of a plurality of points spaced over the area. The method may further comprise the steps of determining the elevation of the upper surface of the layer after compression, and adjusting the value of K to compensate for any offset from the desired elevation of the upper surface over the area. The step of determining the elevation of the upper surface of the layer after compression may include the step of measuring the elevation of the upper surface of the layer after compression with a laser scanner directed to the surface behind the compacting machine. The step of adjusting the value of K to compensate for any offset from the desired elevation of the upper surface over the area may comprise the step of computing an adjusted value for K as the ratio of the thickness of the uncompressed compressible material layer to the thickness of the compressed compressible material layer. The method may further comprise the step of determining the thickness of the compressed compressible material layer by subtracting the elevation of the foundation surface at a point in the area from the elevation of the upper surface of the layer after compression at the same point in the area.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIG. 1A is a diagrammatic longitudinal sectional view of an area, such as a road bed, showing a foundation surface over which compressible material has been laid to a desired grade or elevation;

[0012] FIG. 1B is a diagrammatic sectional view, similar to FIG. 1A, showing the compaction and fill levels achieved in multiple paving steps;

[0013] FIG. 1C is a diagrammatic sectional view, similar to FIG. 1B, showing compaction levels;

[0014] FIG. 1D is a diagrammatic sectional view, similar to FIG. 1C, useful in explaining the method of the present invention;

[0015] FIG. 1E is a diagrammatic sectional view, similar to FIG. 1D, useful in explaining the manner in which the volume of the asphalt dispensed and applied is controlled; and

[0016] FIG. 2 is a diagrammatic view of an asphalt paving system.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0017] FIG. 1A illustrates a road 10 that has been paved with asphalt 12 to a desired grade 14 along its top surface 15. FIG. 1A is taken along a vertical plane that extends longitudinally along the center of the road 10 and thus illustrates elevation variations that occur along the length of the road. The asphalt 12 has been paved over a foundation 16 defining a foundation surface 18. The top surface 15 of the asphalt 12 is shown essentially flat even though the surface 18 of the foundation 16 varies significantly. To achieve this, the thickness of the asphalt mat 12 varies significantly along the road 10. Several points should be noted. First, although a short segment of the road, such as that shown in FIG. 1A, may be horizontal, the inclination of the road will vary along its length. Second, although the description here defines control of the paving operation along the length of the road, a control across the width of the road is also utilized and described, below.

[0018] FIG. 1B shows a road 10 in section, in a view similar to that of FIG. 1A, and is useful in understanding the prior art paving process. Corresponding elements have been given the same reference numerals in all of the drawings. FIG. 1B illustrates the process of paving a road in which an asphalt mat or layer of uniform thickness 20 is deposited on the upper surface 18 of foundation 16. After the asphalt mat 12 is deposited, it is compacted to a thickness 22. It will be noted that a surface 14 results from compression that is below the desired grade 15. At this point, additional layers of asphalt are deposited on the surface 14 in the lower elevation areas and compacted. At least one additional layer of asphalt is then applied over the entire area and compacted to bring the multiple layers of asphalt up to the desired elevation 15. In FIG. 1C, a paving process similar to that of FIG. 1B is shown. In the process of FIG. 1B, the initial layer of asphalt applied to the foundation brings the pre-compact elevation of the asphalt mat up to the desired grade. Once the mat is compacted, all portions of the surface 14 are below the desired grade. In the FIG. 1C paving process, on the other hand, the asphalt mat 12 has a pre-compression thickness 20 that is sufficient to result
in the highest portions of the compressed mat 12 achieving the desired elevation. In both cases, however, the compressed mat 12 has portions that have a below grade top surface, and that must be filled in with additional asphalt in additional steps.

FIG. 1D illustrates a method by which the appropriate amount of asphalt can be deposited as a mat having a thickness 20 that varies over the surface of the roadbed. In order to pave an area with asphalt to a desired elevation using an asphalt paving machine that deposits a mat of asphalt of a controlled thickness on the foundation surface, and then use a compacting machine to compact the asphalt to the desired elevation, the existing elevation of the foundation surface level 18 of the foundation 16 must be determined over the area to be paved. The difference $\Delta h_{G,F}$ may be determined by use of the foundation surface 18 and the desired elevation $h_{G}$ over the area is determined. A mat 12 is deposited over the area. The mat 12 has a thickness 20 that varies over the area, with the mat being thicker in the areas having a lower foundation elevation and thinner in the areas having a higher foundation elevation. The mat thickness is selected such that it is sufficiently thick to allow for compression of the mat over the area to the desired elevation in one or more compression operations. It has been found that by depositing a mat with a thickness that is approximately 25% greater than would be the case with an incompressible mat, the mat can be compressed in a single compression operation, or in a reduced number of compression operations, such that the upper surface 14 of the mat is uniformly at the desired elevation 15 over the area. In other words, the method contemplates the deposition of an asphalt mat that has a thickness adjusted to be approximately 1.25 $h_{G,F}$.

[0020] The step of determining the elevation of the foundation surface 18 over the area may comprise the steps of scanning the contour of the foundation surface 14 over the area, and storing the results of the scanning operation. The mapped surface contour can then be used later in developing the appropriate thickness for the mat of asphalt before the mat is applied. The step of scanning the contour of the foundation surface 18 over the area may include the step of using a laser scanning device 40 (FIG. 2) to determine the elevation of the mat at a plurality of points spaced over the area. This data may be stored in memory 41. The step of scanning the contour of the foundation surface over the area may include the step of using a GNSS survey device, such as receiver 42, to determine the elevation of the mat at a plurality of points spaced over the area. It will be appreciated that the elevation of the mat is determined by use of the GNSS receiver with the elevation of the foundation surface with respect to the machine 43 determined with the scanner 40. The GNSS receiver then permits the elevation of the mat to be referenced to a coordinate system that matches the grade plans for the road. It will be further appreciated that the elevation of the foundation surface may be determined by other known survey techniques. The step of scanning the contour of the foundation surface 18 over the area to be paved may include the step of scanning the foundation from a scanner 40 that is mounted on the asphalt paving machine 43 to determine the elevation of the foundation 18 at a plurality of points spaced over the area ahead of the asphalt paving machine, while the asphalt paving machine is depositing an asphalt mat of varying thickness. Alternatively, the scanner 40 may be mounted on a vehicle that travels ahead of the asphalt paving machine.

[0021] FIG. 1D illustrates depositing a mat of asphalt 12 over the area which has a thickness 20 that varies over the area, with the mat being thicker in the areas having a lower foundation elevation with respect to desired grade elevation and thinner in the areas having a higher foundation elevation with respect to desired grade elevation. It has been determined that depositing a mat 12 which has a thickness 20 that is substantially 1.25 times the difference between the desired elevation 15 and the elevation of the foundation surface 16 at each of a plurality of points spaced over the area compensates for compression of the mat. It will be noted that at each of the points $x_i$, the overfill is approximately 25% of the fill height to the desired grade. In other words, $h_{G,F} = 1.25 \Delta h_{G,F}$ for each value of $x_i$. It will be appreciated, however, that the overfill of 25% is an approximation that may need to be altered depending on the particular makeup of the asphalt material being used, on its temperature, and on other factors. It may, therefore, be necessary to adjust the amount of overfill to compensate for such variations. It is contemplated that a mat which has a thickness that is substantially a constant $K$ times the difference between the desired elevation and the elevation of the foundation surface at each of a plurality of points spaced over the area may be deposited. If the factors that determine the percentage of overfill should change during a paving operation, it may be desirable to change the constant $K$ also during the paving operation. This may be accomplished by determining the elevation of the upper surface 14 of the mat 12 after compression, and adjusting the value of $K$ to compensate for the offset from the desired elevation of the upper surface over the area. The step of determining the elevation of the upper surface 14 of the mat 12 after compression may include the step of measuring the elevation of the upper surface of the mat after compression with a laser scanner 44 directed to the surface of the mat behind the compaction machine. More specifically, the output from the laser scanner 14 and the output from a GNSS receiver 46 are used to determine the elevation of the surface 14 at specific points behind the compaction machine 48. The step of adjusting the value of $K$ to compensate for determined offset from the desired elevation of the upper surface over the area comprises the step of computing an adjusted value for $K$ as the ratio of the thickness of the uncompacted asphalt mat deposited on the foundation surface to the thickness of the compressed asphalt mat. The thickness of the compressed asphalt mat is determined by subtracting the elevation of the foundation surface at a point in the area, as measured by sensor 40, from the elevation of the upper surface of the mat after compression at the same point in the area.

It will be appreciated that although the paving methods described above in the context of asphalt concrete paving, these methods may be used in conjunction with applying and compressing a layer of any type, and then compacting the compressible material. It will be further appreciated that although these methods are described in the context of changing the amount of overfill along the length of a roadway as the roadway is being paved to compensate for variations in the elevation of the foundation in the direction of the roadway, this same method may also be used to adjust the level of overfill across the width of the roadway to compensate for variations in the elevation of the foundation across the roadway. In order to make such an adjustment, of course, it is necessary that the asphalt paving machine have a screed arrangement that controls variations in the elevation of the deposited asphalt across the direction of machine travel.
FIG. 1E illustrates the manner in which the volume of the asphalt material being dispensed along the roadbed or other area is determined. The dispersed differential volume of the asphalt at a differential point \( x \) along the roadway is:

\[
\text{Volume} = \frac{(W - \text{Width})}{(H_{\text{base}} - H_{\text{base} + x})} \times (\Delta x)(1.25)
\]

[0024] The paving machine therefore determines the volume of asphalt that is to be deposited on the foundation surface as the paving machine moves along foundation surface 18. This volume of material is ejected from the paver 43 and the elevation of the asphalt behind the paver 43 is determined by a screed 47 following the paving machine 43. The asphalt is deposited by a dispensing unit 48 in the disperser under control of control unit 50.

[0025] It will be appreciated that the present system determines the true height of the base foundation of the roadbed that is to be filled in with asphalt, and that this elevation measurement is taken so that it is in the same coordinate system as the desired road model. It will be appreciated that the system of FIG. 2 measures the actual level of compaction and then takes this into account in dispensing the asphalt so that the compaction process produces a compacted asphalt service at the desired level in a single operation without adding additional layers of asphalt and with a reduced number of compaction cycles.

[0026] Other aspects, objects, and advantages of the embodiments can be obtained from a study of the drawings, the disclosure, and the appended claims.

What is claimed is:

1. A method of paving an area with asphalt to a desired elevation using an asphalt paving machine that deposits a mat of asphalt of a controlled thickness on a foundation surface, and then using a compacting machine to compact the asphalt to the desired elevation, comprising the steps of:
   - determining the elevation of the foundation surface over the area,
   - determining the difference between the elevation of the foundation surface and the desired elevation over the area,
   - depositing a mat of asphalt over the area, said mat having a thickness that varies over the area, with the mat being thicker in the areas having a lower foundation elevation and thinner in the areas having a higher foundation elevation, said mat being sufficiently thick to allow for compression of said mat over said area to said desired elevation, said mat having a thickness that is substantially a constant \( K \) times the difference between the desired elevation and the elevation of said foundation surface at each of a plurality of points spaced over said area,
   - compressing said mat of asphalt during one or more compression operations such that the upper surface of said mat is uniformly at said desired elevation over said area,
   - determining the elevation of the upper surface of said mat after compression, and
   - adjusting the value of \( K \) to compensate for determined offset from the desired elevation of the upper surface over said area.

2. The method of paving an area with asphalt to a desired elevation using an asphalt paving machine that deposits a mat of asphalt of a controlled thickness on a foundation surface, and then using a compacting machine to compact the asphalt to the desired elevation according to claim 1, in which the step of determining the elevation of the foundation surface over the area comprises the steps of scanning the contour of said foundation surface over said area, and storing the results of the scanning operation.

3. The method of paving an area with asphalt to a desired elevation using an asphalt paving machine that deposits a mat of asphalt of a controlled thickness on a foundation surface, and then using a compacting machine to compact the asphalt to the desired elevation according to claim 2, in which the step of scanning the contour of said foundation surface over said area includes the step of using a laser scanning device to determine the elevation of said foundation at a plurality of points spaced over said area.

4. The method of paving an area with asphalt to a desired elevation using an asphalt paving machine that deposits a mat of asphalt of a controlled thickness on a foundation surface, and then using a compacting machine to compact the asphalt to the desired elevation according to claim 2, in which the step of scanning the contour of said foundation surface over said area includes the step of using a GNSS survey device to determine the elevation of said foundation at a plurality of points spaced over said area.

5. The method of paving an area with asphalt to a desired elevation using an asphalt paving machine that deposits a mat of asphalt of a controlled thickness on a foundation surface, and then using a compacting machine to compact the asphalt to the desired elevation according to claim 2, in which the step of scanning the contour of said foundation surface over said area includes the step of using a scanner mounted on said asphalt paving machine to determine the elevation of said foundation at a plurality of points spaced over said area ahead of said asphalt paving machine while said asphalt paving machine is depositing an asphalt mat of varying thickness.

6. The method of paving an area with asphalt to a desired elevation using an asphalt paving machine that deposits a mat of asphalt of a controlled thickness on a foundation surface, and then using a compacting machine to compact the asphalt to the desired elevation according to claim 2, in which the step of scanning the contour of said foundation surface over said area includes the step of scanning said foundation from a scanner mounted on a vehicle that travels ahead of said asphalt paving machine to determine the elevation of said foundation surface at a plurality of points spaced over said area.

7. The method of paving an area with asphalt to a desired elevation using an asphalt paving machine that deposits a mat of asphalt of a controlled thickness on a foundation surface, and then using a compacting machine to compact the asphalt to the desired elevation according to claim 1, in which the step of depositing a mat of asphalt over the area, said mat having a thickness that varies over the area, with the mat being thicker in the areas having a lower foundation elevation and thinner in the areas having a higher foundation elevation, comprises the step of depositing a mat which has a thickness that is substantially 1.25 times the difference between the desired elevation and the elevation of said foundation surface at each of a plurality of points spaced over said area.

8. (canceled)

9. (canceled)

10. The method of paving an area with asphalt to a desired elevation using an asphalt paving machine that deposits a mat of asphalt of a controlled thickness on a foundation surface, and then using a compacting machine to compact the asphalt to the desired elevation according to claim 1, in which the step...
of determining the elevation of the upper surface of said mat after compression includes the step of measuring the elevation of the upper surface of said mat after compression with a laser scanner directed to the surface behind the compacting machine.

11. The method of paving an area with asphalt to a desired elevation using an asphalt paving machine that deposits a mat of asphalt of a controlled thickness on a foundation surface, and then using a compacting machine to compact the asphalt to the desired elevation according to claim 1, in which the step of determining the thickness of the elevated area comprises the step of computing an adjusted value for \( K \) as the ratio of the thickness of the uncompacted asphalt mat deposited on the foundation surface to the thickness of the compacted asphalt mat.

12. The method of paving an area with asphalt to a desired elevation using an asphalt paving machine that deposits a mat of asphalt of a controlled thickness on a foundation surface, and then using a compacting machine to compact the asphalt to the desired elevation according to claim 11, further comprising the step of determining the thickness of the compacted asphalt mat by subtracting the elevation of the foundation surface at a point in the area from the elevation of the upper surface of said mat after compression at the same point in the area.

13. A method of covering an area with a compressible material to a desired elevation using a machine that deposits a layer of the compressible material of controlled thickness on a foundation surface, and then using a compacting machine to compact the compressible material to the desired elevation, comprising the steps of:
   - determining the elevation of the foundation surface over the area,
   - determining the difference between the elevation of the foundation surface and the desired elevation over the area,
   - depositing a layer of compressible material over the area, said layer having an upper surface that varies in elevation over the area, with the layer upper surface being higher in the areas having a lower foundation elevation and lower in the areas having a higher foundation elevation, said layer being sufficiently thick to allow for compression of the compressible material over said area to said desired elevation, said layer having a thickness that is substantially a constant \( K \) times the difference between the desired elevation and the elevation of said foundation surface at each of a plurality of points spaced over said area,
   - compressing said layer of compressible material during one or more compression operations such that the upper surface of said layer after compression is uniformly at said desired elevation over said area,
   - determining the elevation of the upper surface of said layer after compression, and
   - adjusting the value of \( K \) to compensate for any offset from the desired elevation of the upper surface over said area.

14. The method of covering an area with compressible material to a desired elevation using a machine that deposits a layer of controlled thickness on a foundation surface, and then using a compacting machine to compact the compressible material to the desired elevation according to claim 13, in which the step of determining the elevation of the foundation surface over the area comprises the step of scanning the contour of said foundation surface over said area, and storing the results of the scanning operation.

15. The method of covering an area with compressible material to a desired elevation using a machine that deposits a layer of controlled thickness on a foundation surface, and then using a compacting machine to compact the compressible material to the desired elevation according to claim 14, in which the step scanning the contour of said foundation surface over said area includes the step of using a laser scanning device to determine the elevation of said foundation at a plurality of points spaced over said area.

16. The method of covering an area with compressible material to a desired elevation using a machine that deposits a layer of controlled thickness on a foundation surface, and then using a compacting machine to compact the compressible material to the desired elevation according to claim 14, in which the step scanning the contour of said foundation surface over said area includes the step of using a GNSS survey device to determine the elevation of said foundation at a plurality of points spaced over said area.

17. The method of covering an area with compressible material to a desired elevation using a machine that deposits a layer of controlled thickness on a foundation surface, and then using a compacting machine to compact the compressible material to the desired elevation according to claim 14, in which the step scanning the contour of said foundation surface over said area includes the step of using a scanner that deposits a layer of the compressible material to determine the elevation of said foundation at a plurality of points spaced over said area.

18. The method of covering an area with compressible material to a desired elevation using a machine that deposits a layer of controlled thickness on a foundation surface, and then using a compacting machine to compact the compressible material to the desired elevation according to claim 14, in which the step scanning the contour of said foundation surface over said area includes the step of using a scanner that deposits a layer of the compressible material to determine the elevation of said foundation at a plurality of points spaced over said area.

19. The method of covering an area with compressible material to a desired elevation using a machine that deposits a layer of controlled thickness on a foundation surface, and then using a compacting machine to compact the compressible material to the desired elevation according to claim 14, in which the step of depositing a layer of compressible material over the area, said layer having an upper surface that varies in elevation over the area, with the upper surface of the layer being higher in the areas having a lower foundation elevation and lower in the areas having a higher foundation elevation, comprises the step of depositing a layer which has a thickness that is substantially 1.25 times the difference between the desired elevation and the elevation of said foundation surface at each of a plurality of points spaced over said area.

20. (canceled)
21. (canceled)
22. The method of covering an area with compressible material to a desired elevation using a machine that deposits a layer of controlled thickness on a foundation surface, and
then using a compacting machine to compact the compressible material to the desired elevation according to claim 13, in which the step of determining the elevation of the upper surface of said layer after compression includes the step of measuring the elevation of the upper surface of said layer after compression with a laser scanner directed to the surface behind the compacting machine.

23. The method of covering an area with compressible material to a desired elevation using a machine that deposits a layer of controlled thickness on a foundation surface, and then using a compacting machine to compact the compressible material to the desired elevation according to claim 13, in which the step of adjusting the value of K to compensate for any offset from the desired elevation of the upper surface over said area comprises the step of computing an adjusted value for K as the ratio of the thickness of the uncompressed compressible material layer to the thickness of the compressed compressible material layer.

24. The method of covering an area with compressible material to a desired elevation using a machine that deposits a layer of controlled thickness on a foundation surface, and then using a compacting machine to compact the compressible material to the desired elevation according to claim 23, further comprising the step of determining the thickness of the compressed compressible material layer by subtracting the elevation of the foundation surface at a point in the area from the elevation of the upper surface of said layer after compression at the same point in the area.

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