

**SEMI-RIGID PAVEMENT FILLING MATERIAL AND SEMI-RIGID
ASPHALT PAVEMENT**

TECHNICAL FIELD

5 [0001]

The present invention generally relates to a semi-rigid pavement filling material and a semi-rigid asphalt pavement made from the filling material in the field of civil engineering and construction.

10 BACKGROUND ART

[0002]

It is known that semi-rigid pavement has both advantages of asphalt pavement and concrete pavement. The semi-rigid pavement is made by filling with cement milk an open graded asphalt mixture which has a larger
15 amount of air voids than typical dense graded asphalt mixtures. The semi-rigid pavement can provide silence and flexibility like asphalt pavement, as well as durability like concrete pavement. There are some conventional semi-rigid pavement materials having some quick setting properties or including some expansive materials to allow early access to roads. There are
20 also some conventional semi-rigid pavement filling materials including some elastic polymers to have freeze-thaw resistance. See Patent Documents 1 to 6.

CITATION LIST

25 Patent Literature

[0003]

Patent Document 1: Japanese Patent Application Laid-open
Publication No. H11-292579

Patent Document 2: Japanese Patent Application Laid-open
5 Publication No. H11-228205

Patent Document 3: Japanese Patent Application Laid-open
Publication No. 2016-190766

Patent Document 4: Japanese Patent Application Laid-open
Publication No. 2002-226243

10 Patent Document 5: Japanese Patent Application Laid-open
Publication No. 2000-119057

Patent Document 6: Japanese Patent Application Laid-open
Publication No. H10-195300

15 SUMMARY OF INVENTION

Technical Problem

[0004]

The conventional semi-rigid pavement filling materials have some known drawbacks. If the conventional filling material is mixed with water to fill into
20 a pavement, the ingredients of the material cause segregation until the completion of filling, and the strength of the resulted pavement is uneven depending upon the filled portions. The conventional material also causes problems of subsidence due to bleeding or segregation after filling into open-graded asphalt pavement until the material hardens. The conventional
25 material also has problems of generating voids on the pavement surface due

to shrinkage during the hardening process. The subsidence or void requires re-filling the material into the pavement surface and it affects the early access to the road.

5 Solution to Problem

[0005]

The present inventor has studied the problems above, and developed and completed the present invention. An embodiment of the present invention can provide the following aspects.

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[0006]

1. A quick-setting, semi-rigid pavement filling material comprising a binder, the binder including, with the proviso that the total amount of the binder is 100 parts:

15 5 to 30 parts of a rapid hardening agent, the agent comprising an amorphous calcium aluminosilicate compound in which a glass content is 50 % or more, and gypsum;

1 to 5 parts of an ettringite-based or ettringite-lime-based expansive material, wherein a mean grain size is 1 to 20 microns; and

20 1 to 10 parts of acidic silica fume.

[0007]

2. The semi-rigid pavement filling material according to aspect 1, further comprising 1 to 5 %, as solid content, of elastic emulsion and/or
25 elastic latex on the basis of the amount of the binder.

[0008]

3. The semi-rigid pavement filling material according to aspect 1 or 2, wherein a water cement ratio (W/C) is 30 to 40 %, a P-value for cement milk is 10 to 14 seconds, an initial expansion is -0.5 to +1.5 %, and a bleeding ratio is 0.3 % or less.

[0009]

4. A semi-rigid asphalt pavement comprising the semi-rigid pavement filling material according to any one of aspects 1 to 3.

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Advantageous Effects of Invention

[0010]

- An embodiment of the present invention can provide a semi-rigid pavement filling material (hereinafter abbreviated to as "filling material") which has sufficient fluidity and resistance against segregation required for filling to open-graded asphalt. The present filling material also has quick-setting property and initial strength to allow early access to the road. Further, the present filling material can properly control the volume change during the hardening process, and then leave no voids on the pavement surface and need no re-filling processes. A semi-rigid asphalt pavement made from the present filling material can improve the durability.

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DESCRIPTION OF EMBODIMENTS

[0011]

- 25 Although embodiments of the present invention will be explained in detail,

the present invention is not limited to the embodiments. In the present specification, the units "part" and "percentage (%)" are given on mass basis unless otherwise defined. In the present specification, a numerical range includes the upper and lower limits unless otherwise defined.

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[0012]

The cement used in the present embodiment may include various Portland cement such as normal, high-early-strength, ultra-high-early-strength, low heat, and moderate heat Portland cements.

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[0013]

A semi-rigid pavement filling material according to an embodiment of the present invention includes a binder. The binder includes a rapid hardening agent comprising an amorphous calcium aluminosilicate compound and gypsum. The calcium aluminosilicate compound is almost composed of CaO , Al_2O_3 , and SiO_2 and the molar ratio of $\text{CaO}/\text{Al}_2\text{O}_3$ is in the range of 2.3 to 1.5. The content of SiO_2 may preferably be 0.5 to 20 %, more preferably 10 to 15 %. These raw materials generally contain impurities such as MgO , Fe_2O_3 , TiO_2 , K_2O , Na_2O , and V, but they offer no practical problem in the range of 10 % or less. The calcium aluminosilicate compound may preferably contain a large amount of amorphous calcium aluminosilicate to maintain fluidity and develop strength. The glass content may preferably be 50 % or more. The glass content can be measured by, for instance, powder X-ray diffractometry using a constant amount of reference material to quantify the ratio of crystalline and amorphous substances.

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[0014]

The gypsum may include, but not limited to, calcium sulfate anhydrite, calcium sulfate hemihydrate, and sulfate dihydrate. The calcium sulfate anhydrite may be preferred to maintain fluidity and develop strength.

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[0015]

The amorphous calcium aluminosilicate compound and gypsum may preferably have the mean grain size of 1 to 20 microns, more preferably 3 to 10 microns to maintain fluidity and develop strength.

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[0016]

The ratio of the amorphous calcium aluminosilicate compound and gypsum in the rapid hardening agent may vary depending on raw materials such as cement. For instance, 100 parts of the rapid hardening agent may contain 40 to 60 parts of the calcium aluminosilicate compound and 40 to 60 parts of gypsum to develop strength and reduce subsidence or voids.

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[0017]

The amount of the rapid hardening agent may vary depending on the kind of the agent. For instance, 100 parts of the binder may contain 5 to 30 parts, more preferably 10 to 20 parts of the rapid hardening agent. If the amount of the rapid hardening agent is less than 5 parts, the resulted product may lack rapid-hardening or initial expansion property. If the rapid hardening agent is more than 30 parts, the resulted product may have poor durability.

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25 The setting time may preferably be around 1 to 6 hours considering

workability and necessary time to access the road.

[0018]

A binder according to an embodiment may preferably contain an
5 ettringite-based or ettringite-lime-based expansive material (hereinafter
abbreviated to as "expansive material"). The amount of the expansive
material may preferably be 1 to 5 parts in 100 parts of the binder. The
expansive material may be almost composed of free lime (f-CaO), Ye'elimite,
and calcium sulfate anhydrate. Provided that the total amount of free lime,
10 Ye'elimite, and calcium sulfate anhydrate is 100 parts, it may preferably be
a sintered product and/or the mixture of sintered products that contains 10
to 80 parts (more preferably 30 to 70 parts) of free lime, 10 to 45 parts
(more preferably 5 to 20 parts) of Ye'elimite, and 10 to 50 parts (more
preferably 15 to 40 parts) of calcium sulfate anhydrate. The expansive
15 material may preferably include an ettringite-based compound which can
produce ettringite ($3\text{CaO} \cdot \text{Al}_2\text{O}_3 \cdot 3\text{CaSO}_4 \cdot 32\text{H}_2\text{O}$) via a hydration reaction
or an ettringite-lime-based compound which can mainly produce ettringite
and calcium hydroxide $\text{Ca}(\text{OH})_2$. Ye'elimite is a calcium sulfoaluminate
mineral, $\text{Ca}_4(\text{AlO}_2)_6\text{SO}_4$. The expansive material may preferably have the
20 mean grain size of 1 to 20 microns, more preferably 4 to 15 microns. The
expansive material in the binder can prevent bleeding, maintain steady
initial expansion and strength, and improve initial strength and surface
smoothness of the cured product. If the expansive material has the mean
grain size of more than 20 microns, the preferred properties above may be
25 lost. If the expansive material has the mean grain size of less than 1 micron,

grinding the raw material may require too long time and be wasteful although the above properties reach a plateau.

[0019]

- 5 A binder according to an embodiment of the present invention may preferably contain 1 to 10 parts of acidic silica fume (i.e., silica powder having an acidic pH) in 100 parts of the binder. The acidic silica fume may preferably contain zirconium oxide (zirconia) to maintain the fluidity and resistance against segregation of the filling material and to develop strength.
- 10 The amount of zirconium oxide may preferably be 1 to 10 %, more preferably 1 to 5 %. The acidic silica fume may preferably have the BET specific surface area of 3 to 15 m²/g, more preferably 5 to 12 m²/g.

[0020]

- 15 The present filling material according to an embodiment may be used with water so as to the water binder ratio (also called as "water cement ratio" or "W/C ratio" in the present specification) is in the range around 30 to 40 %. If the ratio is less than 30 %, the fluidity may be deteriorated. If the ratio is more than 40 %, the resistance against segregation or the strength may be
- 20 poor.

[0021]

- The fluidity of the filling material can be quantified from the method according to ASTM C939 using P-funnel flowing time (also abbreviated to as
- 25 "P-value"). The P-value may preferably be in the range of 10 to 14 seconds,

more preferably 11 to 13 seconds. If the P-value is less than 10 seconds, the ingredients may cause segregation. If the P-value is more than 14 seconds, the filling material may be difficult to put into an open graded asphalt pavement.

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[0022]

The initial expansion of the filling material can be measured according to section JSCE-F 542 of the concrete standard specifications authored by the Japan Society of Civil Engineers. The present filling material may preferably
10 have the initial expansion in the range of -0.5 % to +1.5 %. If the initial expansion is smaller than -0.5 %, the resulted pavement surface tends to have voids thereon and may have poor durability. If the initial expansion is larger than +1.5 %, the resulted pavement may have poor strength and may provide bad silence and skid resistance properties for cars running thereon.

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[0023]

The present filling material according to an embodiment may preferably have the bleeding ratio of 0.3 % or less, more preferably 0.1 % or less, the most preferably 0 %. The bleeding ratio can be measured according to the
20 JSCE-F 542.

[0024]

In order to determine whether a filling material causes segregation, the compressive strength of a cured product is examined. Specifically, when a
25 filling material is prepared by mixing a binder and water, the first sample is

obtained immediately after the mixing and the second sample is obtained after settling for 15 minutes. The first and second samples are compared in the compressive strength to determine whether the ingredients cause segregation quantitatively. In general, if the compressive strength of the second sample is reduced by 10 % or more with respect to that of the first sample, the sample would occur segregation. In addition, more than 0.3 % of the bleeding ratio or a negative value of the initial expansion can also work as an indication of segregation.

10 [0025]

It is preferred to use the present filling material to prepare pavement (cured product) without voids or spots on the surface. Note that the "spots" means random marks or specks resulted from the production of ettringite by a rapid hardening agent and are frequently shown on the surface of a conventional pavement. The spots are undesired since they spoil the appearance of pavement.

[0026]

In a preferred embodiment, the filling material may further contain elastic emulsion and/or elastic latex to improve the durability of the resulted semi-rigid pavement. The elastic substance may include, for instance, polyacrylic emulsion or polychloroprene latex. The amount of the elastic emulsion and/or elastic latex may preferably be in the range of 1 to 5 % as solid polymer content on the basis of the amount of the binder. If the amount is 1 % or more, the resulted pavement may improve durability. If the

amount is 5 % or less, the fluidity or strength may be improved.

[0027]

The present filling material according to an embodiment may further contain,
5 as long as the material can substantially achieve the goal of the present
invention, one or more of aggregates such as sand and gravel; water
reducing agents or dispersion agents; high-performance water reducing
agents; AE water reducing agents; high-performance AE water reducing
agents; fluidizing agents; defoaming agents; thickeners; corrosion inhibitors;
10 non-freezing agents; shrinkage reducing agents; polymer emulsions and
setting regulators; fly ash; silica fume; clay minerals such as bentonite and
zeolite; and anion exchangers such as hydrotalcite.

EXAMPLES

15 [0028]

The present invention is further illustrated by the following examples.

[0029] Example 1

To prepare a binder, the cement, rapid hardening agent, expansive material,
20 and silica powder as follows were mixed in the ratio shown in Table 1, where
the total amount of the mixture above was defined as 100 parts. The amount
of retarder (not shown in Table 1) was 5 % of the rapid hardening agent and
added in outer percentage. The amounts of the dispersion agent and the
thickener are also shown in outer percentage. The resulted binder (powder)
25 was mixed with water in the W/C ratio illustrated in Table 1 to prepare a

filling material.

[0030]

The every filling materials were subjected to measurements of the P-value,
5 bleeding ratio, initial expansion, setting time, and compressive strength. In
order to evaluate the resistance against segregation, the compressive
strength of each test sample obtained immediately after the mixing with
water was compared with that obtained after settling for 15 minutes in a pail.
The comparison was carried out both at the material age of 1 day (1d) and 28
10 days (28d). The results are shown in Table 1.

[0031] Materials

Cement: ordinary Portland cement (OPC), a commercial product.

Rapid hardening agent **a**: 50 parts of calcium aluminosilicate (the molar ratio
15 of $\text{CaO}/\text{Al}_2\text{O}_3 = 1.9$; SiO_2 content = 0.5 %; glass content = 100 %; the mean
grain size = 4 microns) and 50 parts of calcium sulfate anhydrate (the mean
grain size = 4 microns).

Rapid hardening agent **b**: 50 parts of calcium aluminosilicate (the molar ratio
of $\text{CaO}/\text{Al}_2\text{O}_3 = 1.9$; SiO_2 content = 12 %; glass content = 100 %; the mean
20 grain size = 4 microns) and 50 parts of calcium sulfate anhydrate (the mean
grain size = 4 microns).

Rapid hardening agent **c**: 50 parts of calcium aluminosilicate (the molar ratio
of $\text{CaO}/\text{Al}_2\text{O}_3 = 1.9$; SiO_2 content = 20 %; glass content = 100 %; the mean
grain size = 4 microns) and 50 parts of calcium sulfate anhydrate (the mean
25 grain size = 4 microns).

Rapid hardening agent **d**: 50 parts of calcium aluminosilicate (the molar ratio of $\text{CaO}/\text{Al}_2\text{O}_3 = 1.9$; SiO_2 content = 12 %; glass content = 50 %; the mean grain size = 4 microns) and 50 parts of calcium sulfate anhydrate (the mean grain size = 4 microns).

- 5 Expansive material **A**: ettringite-based; containing 20 parts of f-CaO, 35 parts of Ye'elimite, and 40 parts of calcium sulfate anhydrate; the mean grain size = 8 microns.

Expansive material **B**: ettringite-based; containing 20 parts of f-CaO, 35 parts of Ye'elimite, and 40 parts of calcium sulfate anhydrate; the mean
10 grain size = 25 microns.

Expansive material **C**: ettringite-lime-based; containing 50 parts of f-CaO, 15 parts of Ye'elimite, and 30 parts of calcium sulfate anhydrate; the mean grain size = 8 microns.

Expansive material **D**: lime-based; "Taiheiyo Expan" commercially available
15 from Taiheiyo Material; the mean grain size = 25 microns.

Expansive material **E**: aluminum powder.

Silica powder **A**: silica fume (SF) containing zirconia, commercially available; $\text{SiO}_2 = 95.3\%$, $\text{ZrO}_2 = 2\%$; the BET specific surface area = $8.7 \text{ m}^2/\text{g}$; pH = 2.7

- 20 Silica powder **B**: silica fume (SF), commercially available; $\text{SiO}_2 = 96.3\%$; the BET specific surface area = $10 \text{ m}^2/\text{g}$; pH = 8.0

Dispersion agent: polycarboxylate-based high-performance water reducing agent

Thickener: methyl cellulose, molecular weight = 140,000, commercially
25 available.

Retarder: the mixture of 70 parts of potassium carbonate and 30 parts of citric acid; reagent grade

Water: tap water.

5 [0032] Test protocol

The tests were carried out at 30 degrees C. The applicable standards are as follows.

Fluidity: ASTM C939

Bleeding ratio: JSCE-F 542

10 Initial expansion: JSCE-F 542

Setting time: EN 196-3

Compressive strength: BS EN 12390; the test samples were in the shape of 50 mm cube. The mold was removed at the material age of 1 day, and then the test sample was cured in water. The compressive strength was measured

15 at the material age of 7 days and 28 days.

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[0033]

[Table 1]

No.	powder (%)						water	P value	Bleeding (%)	Initial expansion (%)	Setting time (hr)	Compressive strength (N/mm ²)				Note
	OPC	silica powder	rapid hardening agent	expansive material	dispersion agent (outer %)	thickener (outer %)						1d, immediately after mixing	1d, 15 min after mixing	28d, immediately after mixing	28d, 15 min after mixing	
1-1	82.0	A5.0	a10.0	A3	0.3	-	33.0	11.2	0	0.3	0.5	42.1	42.0	100	98	Example
1-2	82.0	A5.0	b10.0	A3	0.3	-		11.5	0	0.5	2.0	47.0	46.6	106	105	Example
1-3	82.0	A5.0	c10.0	A3	0.3	-		11.2	0	0.2	4.0	38.4	38.1	104	103	Example
1-4	82.0	A5.0	d10.0	A3	0.3	-		12.2	0	-0.1	4.5	32.4	30.1	92	91	Example
1-5	84.0	A5.0	b10.0	A1	0.3	-		11.0	0	0.2	2.5	46.0	45.5	105	103	Example
1-6	80.0	A5.0	b10.0	A5	0.3	-		11.8	0	0.9	1.5	46.5	46.4	105	104	Example
1-7	86.0	A1.0	b10.0	A3	0.3			11.8	0	0.5	2.0	48.6	47.6	103	101	Example
1-8	80.0	A7.0	b10.0	A3	0.4			13.0	0	0.5	1.5	43.3	43.5	112	108	Example
1-9	82.0	A5.0	b10.0	B3	0.5	-		12.0	0	0.4	2.5	42.0	40.0	101	98.1	Example
1-10	82.0	A5.0	b10.0	C3	0.5	-		12.3	+0.3	0.3	3.0	39.1	39.9	97.7	92.5	Example
1-11	82.0	B5.0	b10.0	D3	0.5	-		12.5	+0.6	0.3	3.0	38.0	33.7	90.2	82.3	comparative
1-12	85.0	B5.0	b10.0	0	0.3	0.5		17.0	0	-1.7	3.0	39.5	32.2	93.5	80.7	comparative
1-13	85.0	B5.0	b10.0	F 0.005	0.3	-		12.0	+0.8	0.2	3.0	39.2	31.7	88.8	79.8	comparative
1-14	82.0	A10.0	b5.0	A3	0.4	-	30.0	13.8	0	0.2	2.0	50.0	52.8	125	118	Example
1-15	82.0	B5.0	b10.0	A3	0.4	-	30.0	17.8	0	0.0	2.5	46.0	44.8	101	97.9	comparative
1-16	60.0	A5.0	b30.0	A5	0.1	-	40.0	11.0	0	-0.2	3.0	37.2	36.7	90.4	90.0	Example

[0034]

The example Nos. 1-1 to 1-4 illustrate that the rapid hardening agent composed of amorphous calcium aluminosilicate and gypsum can give the semi-rigid pavement adequate fluidity, setting time, strength, and surface
5 smoothness. The example Nos. 1-5 to 1-10 and 1-16 adopted the combination of an acidic silica fume containing zirconia, a rapid hardening agent composed of amorphous calcium aluminosilicate compound and gypsum, and an ettringite-based expansive material in a certain ratio. The examples had appropriate P-values to prevent bleeding and subsidence.
10 These inventive examples are also advantageous in suppressing the segregation even after the 15-minute settlement. The inventive examples can have stable compressive strength regardless of when the sample is acquired.

15 [0035]

In contrast, the comparative example Nos. 1-11 to 1-13 and 1-15 that used conventional expansive materials or silica powder require a lot of dispersion agents to obtain fluidity, fail to prevent bleeding and subsidence, and has a poor initial strength. The comparative examples also have a problem that the
20 ingredients caused segregation in 15 minutes after the mixing process, and the resulted samples had poor strength. Additionally, comparative example No. 1-15, which was carried out in the small W/C ratio for trying to avoid bleeding or segregation, had bad fluidity compared with example No. 1-14 under a similar condition. The comparative example would be difficult to put
25 into a pavement.

[0036] Example 2

Semi-rigid pavement prepared by the filling material was evaluated. An open graded asphalt pavement was prepared by the following protocol so as to have the formulation in Table 2 and 30 % voids. The aggregate was prepared
5 to have the particle size distribution shown in Table 3. The temperature of the open graded asphalt pavement was confirmed to be 40 degrees C or less, and then the filling material shown in Table 4 was filled to the level of the surface of the pavement to obtain a test pavement. The test pavement was subjected to measurements of compressive strength and bending strength
10 at the material age of 7 days and 28 days. Additionally, polyacrylic-based emulsion or chloroprene latex was added to the binder to prepare a filling material to be evaluated. The amount of the polyacrylic-based emulsion or chloroprene latex was based on the total amount of the binder. The results are shown in Table 4.

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[0037] Materials

Silica stone: a commercial product.

Filler: silica stone powder, a commercial product.

Asphalt: a commercial product.

20 Elastic formulation **A**: "Estobond Acryl" obtained from Denka Construction Solutions Malaysia, solid content = 45 %.

Elastic formulation **B**: nonionic chloroprene latex obtained from Denka Co. Ltd, solid content = 45 %.

The other raw materials were the same as Example 1 above.

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[0038]

[Table 2]

Aggregate	93.0%
Filler	3.0%
Asphalt	4.0%

Formulation of open graded asphalt pavement

5 [0039]

[Table 3]

Sieve (mm)	mesh	Percentage Passing
19		100
13.2		50.0
9.5		40.0
6.3		8.0
2.36		5.0
0.6		4
0.3		0
0.075		0

Particle size distribution of aggregate

[0040] Preparation of open graded asphalt pavement

- 10 The raw materials were heated to 165 degrees C and mixed for 40 seconds. The mixture was put in a mold of 30 cm x 30 cm x 4 cm. The upper surface of the molded material was rolled and pressed well to prepare a test pavement.

[0041] Test protocol

The tests were carried out at 30 degrees C.

Subsidence degree: cut the pavement at the material age of 7 days, and then measured the subsidence depth from the pavement surface.

- 5 Compressive strength: Open graded asphalt was put in a steel mold of 100 mm x 100 mm x 100 mm, and then the filling material was filled to prepare a test sample. The sample was withdrawn from the mold at the material age of 1 day and cured in water. The compressive strength was measured at the material age of 7 days and 28 days.
- 10 Bending strength: according to BS EN 12390, the sample was cut into 40 mm x 40 mm x 160 mm at the material age of 1 day and cured in water. The bending strength was measured at the material age of 28 days.

Appearance of the cured surface: The sample was judged by sight whether the surface had spots or voids.

[0042]

[Table 4]

No.	powder (%)					water powder x (%)	elastic formulation (%)	Subsidence (mm)	Compressive strength (N/mm ²)		Bending strength (N/mm ²) 28d	Surface cracks or voids	Note
	OPC	silica powder	rapid hardening agent	expansive material	dispersion agent (outer %)				7d	28d			
2-1	82.0	A5.0	b10.0	A3.0	0.5	33	0	0	8.3	11.2	3.6	none	Example
2-2							A1	0	8.7	11.4	3.9	none	Example
2-3							A3	0	8.2	10.4	4.3	none	Example
2-4							A5	0	7.8	10.2	4.2	none	Example
2-5		B5.0	b10.0	D3.0	0.5	33	B3	0	7.5	10.7	5.0	none	Example
2-6							0	-1.5	6.0	8.0	2.9	observed	comparative
2-7							A3	-1.0	5.4	7.8	3.0	none	comparative

[0043]

Table 4 illustrates that the present filling material can prevent subsidence during the filling and hardening processes, and exert excellent compressive strength and bending strength. Furthermore, the present filling material can
5 improve the bending strength after combining with asphalt and a certain amount of the specific polymer.

INDUSTRIAL APPLICABILITY

[0044]

10 The semi-rigid pavement filling material according to an embodiment of the present invention can provide a semi-rigid asphalt pavement with excellent workability and durability.

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CLAIMS

1. A quick-setting, semi-rigid pavement filling material comprising a binder, the binder including, with the proviso that the total amount of the
5 binder is 100 parts:
- 5 to 30 parts of a rapid hardening agent, the agent comprising an amorphous calcium aluminosilicate compound in which a glass content is 50 % or more, and gypsum;
- 1 to 5 parts of an ettringite-based or ettringite-lime-based expansive
10 material, wherein a mean grain size is 1 to 20 microns; and
- 1 to 10 parts of acidic silica fume.
2. The semi-rigid pavement filling material according to Claim 1, further comprising 1 to 5 %, as solid content, of elastic emulsion and/or elastic latex
15 on the basis of the amount of the binder.
3. The semi-rigid pavement filling material according to Claim 1 or 2, wherein a water cement ratio (W/C) is 30 to 40 %, a P-value for cement milk is 10 to 14 seconds, an initial expansion is -0.5 to +1.5 %, and a bleeding ratio
20 is 0.3 % or less.
4. A semi-rigid asphalt pavement comprising the semi-rigid pavement filling material according to any one of Claims 1 to 3.