

APPENDIX 3-B.2

PART 1

Currently Used Geometric Design Standards and Specifications for Highways and Expressways

Table: Minimum width of cross section of rural highway on flat and rolling terrain

No.	Category	I	II	III	IV	V	VI
1	Design speed (km/h)	120	100	80	60	40	20
2	Minimum number of lanes of carriageway	6	4	2	2	2	1
3	Width of lane (m)	3.75	3.75	3.50	3.50	2.75	3.50
4	Width of carriageway (m)	2x11.25	2x7.5	7.00			
5	Width of median (m)	3.00	1.50	0	0	0	0
6	Width of shoulder and paved shoulder (m)	3.50 (3.00)	3.00 (2.50)	2.50 (2.00)	1.00 (0.50)	1.00 (0.50)	1.50
7	Width of road reserve (m)	32.50	22.50	12.00	9.00	7.50	6.50

Table: Minimum width of cross section of rural highway on mountainous terrain

No.	Category	III	IV	V	VI
1	Design speed (km/h)	60	40	30	20
2	Minimum number of lanes of carriageway (number)	2	2	1	1
3	Width of lane (m)	3.00	2.75	3.50	3.50
4	Width of carriageway (m)	6.00	5.50	3.50	3.50
5	Width of shoulder and paved shoulder (m)	1.50 (1.00)	1.00 (0.5)	1.50 (1.00)	1.25
6	Width of road reserve (m)	9.00	7.50	6.50	6.00

Table: Minimum sight distances

Category	I	II	III		IV		V		VI	
Design speed (km/h)	120	100	80	60	60	40	40	30	30	20
Stopping sight distance (S_1) (m)	210	150	100	75	75	40	40	30	30	20
Opposing sight distance (S_2) (m)	—	—	200	150	150	80	80	60	60	40
Passing sight distance (S_{XV}) (m)	—	—	550	350	350	200	200	150	150	100

Table: Minimum Radii of horizontal curves

Category	I	II	III		IV		V		VI	
Design speed (km/h)	120	100	80	60	60	40	40	30	30	20
Radii of horizontal curves (m)										
+ Limited Minimum	650	400	250	125	125	60	60	60	30	15
+ Normal Minimum	1000	700	400	250	250	125	125	60	60	50
Non superelevation radii	5500	4000	2500	1500	150	600	600	350	350	250

Table: Minimum Radii of Crest & Sag Curves

Design speed (km/h)	120	100	80	60	40	30	20
Radii of crest curves (m)							
+ Limited minimum	11000	6000	4000	2500	700	400	200
+ Normal minimum	17000	10000	5000	4000	1000	600	200
Radii of sag curves (m)							
+ Limited minimum	4000	3000	2000	1000	450	250	100
+ Normal minimum	6000	5000	3000	1500	700	400	200
Length of vertical curves (m)	100	85	70	50	35	25	20

Table: The main technical specification for expressway TCVN 5729-1997

No.	Factors	Class of expressway			
		60	80	100	120
1	Design speed (km/h)	60	80	100	120
2	Maximum superelevation i_{sc} (%)	7	7	7	7
3	Minimum radii with maximum superelevation $i_{sc} = +7\%$ (m)	140	240	450	650
4	Normally minimum radii with $i_{sc} = +5\%$ (m)	250	450	650	1000
5	Radii with $i_{sc} = +2\%$ (m)	700	1300	2000	3000
6	Non-superelevation radii $i_{sc} = -2\%$ (m)	1200	2000	3000	4000
7	Length of spiral curves for R_{min} (m)	150	170	210	210
8	Length of spiral curves for R_{min} (m)	90	140	150	150
9	Length of spiral curves for radii put in bracket ()	50 (450)	75 (675)	100 (900)	125 (1125)
10	Minimum stopping sight distance (m)	75	100	160	230
11	Upgrade minimum grade (%)	6	6	5	4
12	Downgrade maximum grade (%)	6	6	5.5	5.5
13	Minimum radii of curves (m)	1500	3000	6000	12000
14	Minimum radii of sag curves (m)	1000	2000	3000	3000

Expressway Design Standard TCVN – 5729 – 1997 is being used for geometric expressway design.

Table: The standard dimensions of urban road cross-section

Structure of median	Class of expressway	Shoulder		Carriageway width	Median width			Carriageway width	Shoulder		Road bed with
		Shoulder with grass	Paved shoulder		Shoulder	Central median	Shoulder		Paved shoulder	Shoulder with grass	
Paved, without engineering poles	60	0.75	2.5	7.0	0.50	0.5	0.50	7.0	2.5	0.75	22.0
	80	0.75	2.5	7.5	0.50	0.5	0.50	7.5	2.5	0.75	23.0
	100	0.75	3.0	7.5	0.75	0.5	0.75	7.5	3.0	0.75	24.5
	120	1.00	3.0	7.5	0.75	1.0	0.75	7.5	3.0	1.00	25.5
Paved, with engineering poles	60	0.75	2.5	7.0	0.50	1.5	0.50	7.0	2.5	0.75	23.0
	80	0.75	2.5	7.5	0.50	1.5	0.50	7.5	2.5	0.75	24.0
	100	0.75	3.0	7.5	0.75	1.5	0.75	7.5	3.0	0.75	25.5
	120	1.00	3.0	7.5	0.75	1.5	0.75	7.5	3.0	1.00	26.0
Not paved	60	0.75	2.5	7.0	0.50	3.0	0.50	7.0	2.5	0.75	24.5
	80	0.75	2.5	7.5	0.50	3.0	0.50	7.5	2.5	0.75	25.5
	100	0.75	3.0	7.5	0.75	3.0	0.75	7.5	3.0	0.75	27.0
	120	1.00	3.0	7.5	0.75	3.0	0.75	7.5	3.0	1.00	27.5

Note 1): For a 6-lane road one 3.75m lane is added for the both carriageways. Note 2): For an 8-lane road two 3.75 lanes are added for the both carriageways.

PART 2

Currently Used Structural Highway and Expressway Standards and Specifications

At present, the following main standards and specifications for pavement design are being used in Viet Nam:

1. For flexible (AC) pavement:

- Specification for flexible pavement design 22 TCN.211-93-
- The guidelines for the design of flexible pavements 22 TCN-274-01, which is based on American AASHTO Guidelines for Design of Pavement Structures, 1996.

According to 22 TCN-211-93, classification for surface of pavement structure is presented in table below

Table: Classification for Surface of Pavement Structure

Category of Surface	Material Structure of Surface	Performance Period	Frequency for periodic maintenance	Using Scope
A1	Cement concrete (CC) pavement or Fine AC pavement	20	8	*Category 60 to 120 of expressway *Arterial urban roads of city and districts or roads in industrial zones.
A2	- Cold AC with surface dressing sealing - Penetration macadam. - Macadam sealed with surface dressing pavement. - Aggregates, soils or stones stabilized by cement or lime sealed with surface dressing.	8-12 8-10 8-10	5 5 3-5	Class 40, 60 and 80 (V= 40-80km/h) All urban roads including communes and villages
B1	Macadam or aggregate having protective layer made by fine crushed stone compacted into the course material.	5	2-3	Class 20 (V=20km/h)
B2	Non-paved, sometimes local materials are used as surface material (such as slag).	2-3	0.5-1.0	Village roads

Structure of layers connected to flexible pavements as used for category A1 for expressways and rural (categories I, II and III) and urban highways in Viet Nam.

Table: Pavement Layer Structure for Flexible Surfaces (A1 category)

Surface course	D1	Wearing course = Fine AC/Mid. AC (D1= 4 – 5 cm)
	D2	Binder course- Medium/Course AC (D2= 5 – 7 cm)
Base course	D3	Aggregate I, aggregate I treated by cement 6-8% of volume penetrated by bitumen or black crushed stone (Crushed stone mixed with bitumen in-situ or in mixing plant) Minimum thickness D3= 8 cm
Sub-base course	D4	Aggregate II, natural aggregate or soils – cement or soil – lime required thickness by calculation but minimum D4 = 10 cm.
Subgrade	50 cm	Required density $K_{yc} \geq 98\%$ with $V_{tk} \geq 40$ km/h $K_{yc} \geq 95\%$ with $V_{tk} < 40$ km/h

Notes: 1. Category 80, 100 and 120 expressways should be topped by open-graded asphalt overlay of 3cm on dense-graded wearing course.

2. Category 60 of rural highway on rolling and mountainous areas with crossfall at least 4% should be topped by open-graded asphalt overlay of 3cm on dense-graded wearing course.

2. For Rigid (CC) pavement: - 22TCN-211-95 Specification for rigid pavement design

Structure of layers for rigid pavements as used for expressways, rural, urban highways and airfield pavements are introduced in the Table below:

Table: Pavement Layer Structure for Rigid Surfaces

Surface course	D1	CC slab, class of CC 300, 350 or 400 Minimum thickness of slab D1 = 18 cm for highways and D2 = 24 cm for airfields.
Base course	D2	Aggregate I, aggregate I treated by cement 6-8 % of volume of aggregate or poor cement concrete. Minimum thickness D2 = 12 cm
Sub-base course	D3	Soils or sand treated by cement, or natural aggregate
Subgrade	50 Cm	Required density $K_{yc} \geq 98\%$ (proctor test)

The structural design standards give dimensions to the required pavement depth based on E-modulus for materials of layers in question. The calculations are then checked using CBR values according to AASHTO requirements AASHTO. AASHTO-based approach normally requires a little heavier dimensioning and thus construction would cost more. If the difference between these two is not big, the standards of Vietnam are to be followed. Failures have been observed in domestic contracts, but mainly due to construction methodology and perhaps due to inadequate supervision.

PART 3

Construction Specifications

The following illustrates the main specifications used for construction and inspection for highways in Viet Nam:

1 Specifications for Earthwork

1. Sampling method of soil-in-situ, TCVN- 268- 91
2. Particle analysis of soils, TCVN.4198 -95
3. Determining liquid limit and plastic limit of soils, TCVN.4197- 95
4. Specific gravity of soils, TCVN.4197-95
5. Determining of moisture-density relations of soils, TCVN 4201-86 or 22TCN-59-84 or AASHTO T79 and T180-90.
6. Determining of soil density in place by the drive cylinder method, TCVN.4196-95.
7. Determining of soil density in place by the sand-cone method, TCVN 4196-95.
8. Field vane Shear-Test for cohesive soil, AASTO T223-76 (1990).
9. Test of unconfined compressive strength of cohesive soil, TCVN 4199-95.
10. Laboratory test of resilient modules of soils, 22TCN.211.93.
11. Unconsolidated, undrained compressive strength of cohesive soil in triaxial compression, AASHTO T296-93
12. Repetitive static plate load tests of soils and flexible pavement components for use in evaluation and design of airport and highway pavements. AASHTO T221-90.
13. Construction and inspection of earthwork. TCVN 4447-97
14. Construction and inspection of PVD (Prefabricated vertical drainage) for road foundation on soft soils TCVN.236.97.
15. Soil compaction for road foundation TCVN.4201-95.
16. Testing for determining of elastic modulus for flexible pavements by Benkelman Beam 22TCN-251-98.
17. Testing for determining of elastic modulus for flexible pavements by Falling Weight Deflectometer (FWD) 22TCN 273-01.

2 Specifications for Construction of Pavements

Aggregate materials:

1. Construction and inspection for aggregate layer (type I & II) use for base/subbase of highway pavements. 22TCN.334.06.
2. Determining for resistance to degradation of small-size course aggregate abrasion and impact in the Los Angeles Machine 22TCN.319.04.
3. Determining for load capacity index CBR of aggregate with $K_{cy} = 98\%$ after 96 hours in water 22TCN.332.06.
4. Determining for plastic index of aggregate AASHTO T90.02.
5. Determining of aggregate density with $K_{cy} = 98\%$ 22TCN.333.06.(II.D method).

6. Determining of compressive strength of aggregates. 22TCN.59.84.
7. Determining of clays lumps and friable particles in aggregates. TCVN.1772.87.
8. Determining of organic impurities in fine & course aggregate TCVN.345.86.
9. Determining of tensile strength of aggregate 22TCN.73.84
10. Construction and inspection of crushed natural aggregates mixed (treated) with cement for pavements. 22TCN.245.98.
11. Construction and inspection of sand mixed with cement for pavements 22TCN 246.98.
12. Construction and inspection of macadam crushed stone 22TCN.06.77.

Bitumen used for flexible pavements.

1. Penetration of bituminous materials 22TCN 63.84.
2. Loss of heat of asphalt compounds at 163⁰C during 5 hours, 22TCN 63.84
3. Flash and fire points by (level and open cup 22TCN.63.84).
4. Ductility of bituminous materials 22TCN.22TCN.63.84.

Asphalt Concrete (AC)

1. Specific gravity of AC 22TCN.62.84.
2. Specific gravity of mineral filler materials for, AC 22TCN 248.98.
3. Determining the void content of aggregate, 22TCN 248.98
4. Determining the void content of AC, 22TCN.62.84.
5. Compressive strength of AC, 22TCN 248.98.
6. Bitumen content in AC, 22TCN.248.98.
7. Aggregate content in AC 22TCN, 248.98.
8. Cohesion between bitumen and stone, 22TCN.63.84
9. Determining degree of pavement compaction for bituminous aggregate mixture AASHTO T230-G8 (1993)

Cement Concrete (CC)

1. Specific gravity of CC, TCVN 3112.93.
2. Standard for testing ready mixed CC, TCVN 4031.95.
3. Compressive strength of CC using portion of beams broken in flexion, TCVN.4032.85.
4. Slump of CC, TCVN 3106.93.
5. Absorption of CC, TCVN 3113.93.
6. Compressive strength of cylindrical concrete specimens, TCVN 3118.93.
7. Determining of resilient modulus of CC, 22TCN.60.84.
8. Capping cylindrical concrete specimens, TCVN 3105.93

Quality of Wearing Course

1. Friction properties using the British pendulum tester, AASHTO T278-90.
2. Friction properties using the spray sand method, 22TCN-65.84.
3. Measurement of vehicular response to traveled surface roughness, AASHTO T286-90.
4. Measurement of vehicles response to traveled surface roughness by 3 meter straight edge, 22TCN 65.84

PART **E/4**

**STANDARDS AND SPECIFICATIONS FOR CAU GIE – NINH BINH
EXPRESSWAY PROJECT AS DECIDED BY THE MINISTER OF MOT.**

THE MINISTRY OF TRANSPORT

SOCIALIST REPUBLIC OF VIETNAM

Independence – Freedom – Happiness

Ref. No.: 3407/QD-BGTVT

Hanoi, September 15, 2005

DECISION OF THE MINISTER OF THE MOT

**On the Approval of “Standard Frame applies to construction, quality control
and supervision, inspection and hand-over of Cau Gie – Ninh Binh
Expressway Construction Project”**

THE MINISTER OF THE MOT

- Based on the Decree no. 34/2003/ND-CP dated April 4th, 2003 of the Government stipulating functions, duties, rights and organization mechanism of the MOT;
- Based on the Ordinance on goods quality no. 18/1999/PL-UBTVQH 10 dated December 24th, 1999 of the Parliament Standing Committee;
- Based on the Decree no. 179/2004/ND-CP dated October 21st, 2004 of the Government stipulating state management on product quality;
- Based on the Decision no. 09/2005/QD-BXD dated April 7th, 2005 of the Minister of the Ministry of Construction (MOC) on the issuance of “Statute on application of foreign construction standards in construction activities in Viet Nam”;
- Based on the Decision no. 25/2005/QD-BGTVT dated May 13th, 2005 of the Minister of the MOT on the issuance of “Regulations on standard application in construction of transport works”;
- Reviewing the submission no. 476/TTr-VEC dated September 7th, 2005 of Viet Nam Expressway Development Investment Company (VEC) asking for approval of “Standard Frame applies to construction, quality control and supervision,

- inspection and hand-over of Cau Gie – Ninh Binh Expressway Construction Project”;
- According to the requirement of the Manager of Department of Science & Technology;

DECIDES:

Article 1.

- 1.1 To approve the addition of the Project standard frame following the Decision no. 1505/QD-BGTVT dated May 4th, 2005 including standards applied to construction, quality control and supervision, inspection and hand-over of Cau Gie – Ninh Binh Expressway Construction Project with the enclosed list.
- 1.2 If any unsuitability or overlap is found during application of these standards, it is required to timely reflect by writing through VEC for collection to submit to the Ministry (via the Department of Science & Technology) for review and settlement.

Article 2. Based on the approved standard frame in the Decision no. 1505/QD-BGTVT dated May 4th, 2005, in this Decision and in relevant regulations, VEC requests supervision consultants and contractors to comply during construction process.

Article 3. The Chief of the MOT Secretariat, Manager of the Department of Science & Technology, Manager of the Department of Plan & Investment, Director of the Bureau of Appraisal & Quality Management of Transport Works, General Director of VEC, Leaders of relevant units are responsible for carrying out this Decision./.

Recipients:

- As mentioned at the Article 3;
- The Minister (for report);
- Keep as archives.

**FOR THE MINISTER OF MOT
DEPUTY MINISTER**

(Signed & Stamped)

Nguyen Viet Tien

LIST OF STANDARDS

Issuance as the enclosure of the Decision no. 3407/QĐ-BGTVT dated September 15th,
2005 of the Minister of the MOT on approval of the “**Standard Frame applies to
construction, quality control and supervision, inspection and hand-over of Cau Gie
– Ninh Binh Expressway Construction Project**”

No.	Standard	Code
(1)	(2)	(3)
I	<i>Design standard (additional)</i>	
1	Instruction for signboards on expressway	22 TCN 331-05
2	Noise definition for road transport	TCVN 5964-95
3	Design process of supporting works for bridge construction	22 TCN 200-89
4	Design process of construction arrangement and construction design	TCVN 4252-88
II	<i>Construction & Inspection standards</i>	
5	Earthworks, construction & inspection norms	TCVN 4447-87
6	Inspection process of soil foundation density in transport branch	22 TCN 02-71 & QĐ 4313/2001/QĐ- BGTVT
7	Construction & inspection processes of geotextile in construction of road-bed on soft soil foundation	22 TCN 248-98
8	Construction & inspection processes of PVD in construction of road-bed on soft soil foundation	22 TCN 236-97
9	Construction & inspection processes of asphalt concrete pavement	22 TCN 249-98
10	Construction & inspection processes of asphalt pavement	22 TCN 271-2001
11	Construction & inspection specifications of macadam pavement and acid emulsion macadam aggregate pavement	22 TCN 250-98
12	Construction & inspection processes for macadam aggregate layer in pavement structure	22 TCN 252-1998*

13	Construction & inspection processes of stone (gravel) layer stabilized by cement in pavement structure	22 TCN 245-98
14	Construction & inspection processes of pavement structures made of natural aggregate	22 TCN 304-03
15	Test process defining general elastic modulus for flexible pavement by Benkelman beam	20 TCN 251-98
16	Test process defining pavement roughness by sand sprinkle method	22 TCN 278-2001
17	Check and assessment standards of pavement according to IRI international roughness index	22 TCN 277-2001
18	Process of pavement flatness measurement by 3m long straight edge	22 TCN 16-79
19	Steel girder and steel structure: Specifications for fabrication and inspection at workshop	22 TCN 288-2002
20	Bridge testing process	22 TCN 170-87
21	Verification process for existing bridges	22 TCN 243-98
22	Bored pile. Construction & inspection standards	22 TCN 257-2000
23	Bored pile. Construction & inspection standards	TCVN 326-2004
24	Checking of bored pile quality	ASTM D6760-2002
25	Pile driving & pressing. Construction & inspection standards	TCVN 286-2003
26	Pile. Site testing method	20 TCN 88-82
27	Pile loading test method	TCXDVN 269-2000
28	Pile testing according to P.D.A method	ASTM D4945-89
29	Construction & inspection processes of pre-stressed concrete bridge girder	22 TCN 247-98
30	Elastic rubber bearing shoe. Hardness; Tensile strength; Heat-proof strength; settlement pressing; ozone; Adhesive force; Strength of cover; Material for bearing shoe fabrication.	ASTM D2240; D412; D573; D395; D1149; D429; D4014; A570
31	Basin bearing shoe. Steel plate and stainless steel plate; pin; Teflon plate	ASTM A709; A240 Grade 304; A2074; JIS K6666
32	Rubber expansion joint. Expansion joint material test	ASTM D676; D471; JIS G3106; JIS

		G3101; JIS G3112; JIS G4305
33	Welding specifications for steel bridge and steel structure	22 TCN 280-01
34	Metal galvanizing. Material test; Finished-product at workshop; Nut, washer and steel washer, etc...	AASHTO M111; M232; JIS H8641; JIS H0401; ASTM A525; B209
35	Fibre steel net. Specifications	ASTM A392
36	Shaped steel. Metal galvanizing; Specifications; Salt impact test	ASTM F1233; A572 Grade 45; B117
37	Steel wire. Specifications	ASTM A824
38	Paint for steel girder and steel structure. Specifications – Test method	22 TCN 235-97
39	Steel structure painting. Construction & inspection processes	22 TCN 253-98
40	Metal protection paint. Test method in natural condition; Paint material. Specifications	22 TCN 300-2002; AASHTO M69, M70; M310; M311; M312
41	Traffic sign paint. Specifications; Light reflected layer on signboard (Specifications – Test method); Light reflected glass pearls (road marking specifications)	22 TCN 282, 283, 284, 285-2001; AASHTO M249-79, M247-81, M248
42	Bituminous paint. Methods of sampling, packing, labeling, transporting and preserving; defining methods of fineness, viscosity, solid content; membrane fabrication	TCVN 2090- 2094:93; TCVN 6557-2000
43	Structures of brick and stone. Construction & inspection norms	TCVN 4085-85
44	Inspection of installed equipment, fundamental rules	TCVN 5639-91
45	Norms for green tree planting	529/BXD/VTK-97
46	Full block Reinforced Concrete (RC) structure. Construction & inspection norms	TCVN 4453-95
47	Structures of concrete and concrete elements	TCVN 4452-87
48	Big concrete block. Construction & inspection norms	TCXDVN 305-2005

49	Process of concrete casting into water by mortar rising method	22 TCN 209-92
50	Concrete and RC structures. Construction & inspection conditions	TCVN 5724-93
51	Concrete and RC structures. Specifications of crack prevention	TCXDVN 313-2004
52	Concrete and RC structures. Maintenance instructions	TCXDVN 318-2004
53	Heavy concrete. Maintenance requirements	TCVN 5592-91
54	Anti-corrosion in construction of concrete and RC structures – Classification of corrosion environments	TCVN 3994-85
III	<i>Material Testing</i>	
55	Cement concrete testing process	22 TCN 60-84
56	Concrete maintenance compound	AASHTO M148(91)
57	Concrete. Durability check & assessment (General rules)	TCVN 5440-91
58	Heavy concrete. Methods of sampling; slump testing; definition of hardness, capacity volume, mortar-water separation, components, air void content, specific volume, water absorption, abrasion, waterproof, shrinkage, compression strength, tensile strength when bending, tensile-resistant strength when splitting.	TCVN 3105-3120:93
59	Heavy concrete. Methods of defining diagonal strength	TCVN 5726-93
60	Heavy concrete. Methods of defining compression strength	TCXD 171-89
61	Defining methods of protection concrete layer thickness, locations and diameter of rebars in concrete	TCXD 240-2000
62	Using process of admixture for increasing plasticity of cement concrete	22 TCN 202-1989
63	Chemical admixtures for concrete	TCXDVN 325-2004
64	Chemical admixtures for concrete. Specifications	ASTM C494-92
65	Concrete admixtures. Shrinkage	ASTM C157
66	Concrete admixtures. Density	ASTM C260-86
67	Concrete admixtures. Optimal mixing ratio	ASTM C1017-85
68	Construction mortar, mechanical & physical figures	TCVN 3121-2003
69	Construction mortar, mixing & using instructions	TCVN 4459-87
70	Construction mortar, specifications	TCVN 4314-2003

71	Construction mortar, defining methods of adherence on floor	TCVN 236-99
72	Standard test method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)	ASTM C939
73	Standard test method for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory	ASTM C940
74	Construction sand. Methods of sampling; defining mineral component, specific volume, capacity volume, spongy level, humidity, grain component, content of mud & clay, organic impurities, sulfate content, mica content, etc	TCVN 337-86 to TCVN 346-86; TCXD 127-85; TCVN 4376-86
75	Sand Equivalent Value Test	ASTM D2419-7 (91) AASHTO T176-89
76	Light aggregate for concrete	TCVN 6220-6221:97
77	Process of testing mechanical & physical properties of stone	22 TCN 57-84
78	Sand, stone & gravel for construction. Specifications and testing method	TCVN 1770 to TCVN 1772-87
79	Test of compressing 3 edges of culvert	AASHTO T280 (97)
80	Improved compaction test	AASHTO T180 (97)
81	Macadam aggregate. Material requirements	AASHTO M147 (95)
82	Test of flow limit for macadam aggregate	AASHTO T89 (97)
83	Test of plastic limit & index for macadam aggregate	AASHTO T90 (97)
84	Test of CBR defining for macadam aggregate	AASHTO T193 (97)*
85	Water for concrete & mortar. Specifications, definition of PH level, ion chloride content, ion sulfate content, organic impurities, sampling, etc...	TCVN 4506-87; TCVN 2655 to 2671- 78; TCXDVN 302- 2004
86	Water analysis process used in transport works	22 TCN 61-84
87	Water for concrete mixing. Definition of acid and alkaline levels	ASTM D1067-92
88	Mechanical & physical test of construction of brick	TCVN 6355-98
89	Cement. Mechanical & physical testing method,	TCVN 4029; 4031;

	definition of standard fineness & plasticity, bending & compressive strength limits	4032-85
90	Cement. Methods of sampling and sample preparation	TCVN 4787-2001
91	Cement quality list	TCVN 4745-89
92	Cement. Classification	TCVN 5439-91
93	Portland cement. Specifications	TCVN 2682-99
94	Cement. Fineness defining method	TCVN 4030-2003
95	Cement for plastering	TCXDVN 324-2004
96	Cement. Hardening & stabilizing time	TCVN 6017-95
97	Cement. Definition of bending & compressive strength limits of cement	TCVN 6016-95
98	Cement. Test for defining loss on heating	TCVN 144-86
99	Cement. Chemical analysis method	TCVN 141-98
100	Cement. Definition of thermo-hydro process of cement	TCVN 6070-95
101	Cement. Quick definition method for compressive strength	TCVN 3736-82
102	Cement. Sulfate expansion definition	TCVN 6068-95
103	Mineral admixture for cement	TCVN 6882-2001
104	Standard sand for cement testing	TCVN 139-91
105	Standard sand for cement strength definition	TCVN 6227-96
106	Pre-stressed steel. Methods of sampling, testing mechanical & physical figures	TCVN 6284-97
107	Cold-drawn low-carbon steel	TCVN 3101-79
108	Hot-milled rebar	TCVN 1651-85
109	Hot-milled carbon steel in construction	TCVN 5709-93
110	Construction steel. Methods of chemical analysis and testing mechanical & physical figures	TCVN 6285-6288:97
111	Steel for reinforced concrete. Methods of trial bending & re-bending	TCXD 224-98
112	Elements of steel for welding. Material requirements	TCVN 4059-85
113	Waterproofing membrane. Specifications	TCXDVN 328-2004
114	Sampling process of asphalt material for road	22 TCN 231-96
115	Testing process of asphalt material	22 TCN 279-2001
116	Polymer asphalt material standards	22 TCN 319-2004
117	Asphalt concrete testing	22 TCN 62-84

118	Defining process of indirect tension strength of consolidation material	22 TCN 73-84
119	Asphalt emulsion. Test of water content, asphalt content, viscosity, equality, stability, separation	22 TCN 63-84
120	Asphalt emulsion. Saybolt viscosity definition	AASHTO T72
121	Mineral powder test	22 TCN 58-84
122	Steel scaffolding. Safety regulations	TCVN 6052-95; TCXDVN 296-2004
123	Specifications of material for chocking expansion joint of cement concrete pavement	AASHTO M173 (1997)
124	Specifications of cement concrete maintaining compound	AASHTO M148-91
125	Slump test of cement concrete for pavement	AASHTO T119 (1997)
126	Strength test of cement concrete for pavement	AASHTO T22 (1997)
127	Classification of construction soil	TCVN 5747-1993
128	Construction soil. Sampling, packaging, transporting & preserving	TCVN 2683-91
129	Construction soil. Sampling, collecting, transporting & storage	TCVN 5960-95
130	Soil quality – sampling – general requirements	TCVN 5297-95
131	Construction soil – Correction, edit and statistics methods of results on mechanical – physical characteristics of soil	20 TCN 74-87
132	Construction soil – Dryness & water content definition	TCVN 5963-95
133	Construction soil – Specific volume definition at laboratory	TCVN 4195-95
134	Construction soil – Humidity and humidity absorption definition at laboratory	TCVN 4196-95; 22 TCN 13-79
135	Quick definition process of soil humidity by capacity method	22 TCN 67-84
136	Construction soil. Plastic and flow limit definition	TCVN 4197-95
137	Construction soil. Grain component definition	TCVN 4198-95; 22 TCN 66-84
138	Construction soil. Definition of cutting resistance on flat	TCVN 4199-86

	cutter	
139	Construction soil. Settlement definition at laboratory	TCVN 4200-86
140	Construction soil. Definition of standard density at laboratory	TCVN 4201-95*
141	Construction soil. Definition of capacity volume at laboratory	TCVN 4202-95
142	Construction soil. Confined compressive strength test	BS 1377-90
143	Construction soil. Un-confined compressive strength test at laboratory	BS 1377-90
144	Construction soil. Definition of CBR loading capacity	AASHTO T193-90*
145	Construction soil. Definition of bloating & expansion	ASTM D4546-85
146	Construction soil. Confined compressive strength test	ASTM D4546-85; ASTM D4767
147	Construction soil. Un-confined compressive strength test	AASHTO T208
148	Construction soil. Definition of shrinkage	AASHTOT92
149	Construction soil. Test for definition of elastic module	22 TCN 211-93
150	Construction soil. Static and dynamic penetration testing methods at site	20 TCN 174-89; BS 1377
151	Construction soil. Standard penetration test	TCXD 226-99
152	Construction soil. Shearing test	ASTM D2573
153	Geo-material. Tensile test, stretch, absorb coefficient, dimension of filter hole, anti-penetration, etc...	ASTM D4595; D4491
154	Melt phosphate. Specifications	TCVN 1078-99
155	Agricultural urea. Specifications, test method	TCVN 2619, 2620:94
156	Uni- phosphate. Specifications	TCVN 4440-87
157	Mineral fertilizer. Technical quality standard list, definition of static durability of grains, of grain size component, etc...	TCVN 4727, 4852, 4853-89
158	NPK mixed fertilizer. Test method	TCVN 5815-2001
159	Nitrogen fixed microorganism fertilizer	TCVN 6166-2002
160	Micro-organism fertilizer for analysis of hard-to be-melted phosphorous compound	TCVN 6167-96
161	Micro-organism product for analysis of cellulose	TCVN 6168-2002
162	Fertilizer and soil improvement substance. Classification	TCVN 7159-2002

163	Micro-organism organic fertilizer	TCVN 7185-2002
164	Fertilizer. Labeling, presentation and announcement	TCVN 7288-2003
IV	<i>Equipment</i>	
165	Truck roller. Specifications and checking method	22 TCN 254-98
166	Hot asphalt concrete batching plant. Specifications and checking method	22 TCN 255-99

Remarks: (*) These standards will be issued in the branch standard – 22 TCN in the near future. If there is any difficulty during usage, it is possible to apply the other corresponding standards but obtaining acceptance by the MOT is required.