MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT
MINISTRY OF EDUCATION AND TRAINING
VIET NAM ACADEMY FOR WATER RESOURCES

Nguyen Thanh Le

RESEARCH ON INFLUENCE OF CHEMICAL ELASTICITY ADMIXTURES FOR INCREASING SETTING TIME ON MECHANIZATION CHARACTICITIES OF ROLLER COMPACTED CONCRETE FOR GRATIVATION DAM CONSTRUCTION

SUBJECT: HYDRAULIC ENGINEERING

CODE: 62. 58. 02. 02

SUMMARY OF DOCTORAL THESIS

HÀ NỘI, 2017

The research was completed at Institue of Hydraulic Science Vietnam

Supervisors:

1. Assoc.Prof.Dr. Hoàng Phó Uyên/ Mr – Institue of Hydraulic Engineering
2. Prof. Dr.Vũ Thanh Te/ Mr – Univerisity of Water Resource

Reviewer 1:

Reviewer 2:

Reviewer 3:

The thesis would be accessed by Institue Approving Assembly at Viet Nam academy for water Resources in 2017……,……

The thesis is available at:

1. Library – Viet Nam academy for water Resources
2. National Library

PREFACE

1. Background of the research

The applicable and researches on Roller Compacted Concrete (RCC) is a sigfinical development in construction which contribute in reduceing cement volume resulting in reducing a concrete heating, speeding up process of concrete works, using waste and localized materials , v.v...

Currently, There has been 17 RCC dams which are finished construction or on operation, also many other dams project on proccesing of preparing construction. Unfotunately, The national standardsis still not applied to classify and choose an admixture of chemical plasticity for reducing settings time (MINERAL CHEMICAL ADMIXTRURE),it is very important part for quality of RCC construction. The applicable of MINERAL CHEMICAL ADMIXTRURE admixtures would keep on workability, increase settings time in order to increase constrcution period and reduce cool crack, improve quality and water proof capacity for RCC dam.

With above mentioned issue, the thesis is proposed to this solution is " E**search on influence of chemical plasticity admixtures for increasing setting time on mechanization characticities of RCC in Hydro Dam**'.

2. Purpose of research

Research on influence of MINERAL CHEMICAL ADMIXTRURE admixtures on mechanization characticities of RCC for hydro dam and make suggestion to usage of MINERAL CHEMICAL ADMIXTRURE admixtures for any actual demands on site.

3. Subjects and range of research

- Subjects : Some of RCC characticities for hydro dam constrcution which is applicable MINERAL CHEMICAL ADMIXTRURE admixtures in proportions.
- Range of research: Influence of MINERAL CHEMICAL ADMIXTRURE admixtures (TM25 / Sika, Rheoplus 26 RCC / BASF, ADVA 181/ GRACE) on mechanization characticities of RCC for hydro dam construction.

4. Research support

Both of lab studies and experiments on site.

5. Science Meaning

- Find out the rules of an influence of Mineral Chemical Admixtrure admixtures on charaticities of RCC for hydro dam construction.

6. Applicable meaning

- Suggest to choosing MINERAL CHEMICAL ADMIXTRURE admixtures for design of proportions of RCC.
- Suggest to RCC proportion design which is used MINERAL CHEMICAL ADMIXTRURE admixtures at Nước Trong Project, and construction methods, technical support.

7. Advanced Update of thesis

- Thesis results coulddetermind an influence of three admixtures generation of MINERAL CHEMICAL ADMIXTRURE on basic mechanization charaticities of RCC as followings: workabilities, starting time and finishing time of settings, strength of tension, compression, water proofing of RCC.
- To Supply the background of choosing types and volume of MINERAL CHEMICAL ADMIXTRUREadmioxtures to respond to any actual request of quality and period of RCC construction.

CHAPTER 1. OVERVIEW OF APLLYING RCC TO HYDRO DAM CONSTRUCTION

1.1. Background of RCC Hydro Dam

RCC is concrete which compacted by Rolling compactor, concrete in the non-setting form would receive the compacting force from roller during process of compaction. RCC proportion is equivalent to Traditional concrete, however, Rolled compaction technologies would be very especially effective to apply to hydro dam construction support as well as big volume quantity constructed.

1.2. Material applicable to RCC

Cement :porland cement; Mineral admixtures: Sieved ash, fly ash or poozerland; Chemical admixtures: MINERAL CHEMICAL ADMIXTRURE admixtures(VS applicable); Aggregate : Fine aggregate : natural sand or milled sand from quarry; Coarse aggregate : aggregate D 10-20.

1.3. Technologies Support for RCC

RCC construction application could create high effectiveness of costing as request high-speed processing on construction so the preparation of planning

and schedule should be detailed and strict., the effectiveness of compaction should be affected by proportion of RCC and specification of compaction equipments.

1.4. Situation of researches and applicable RCC to Hydro dam construction

1.4.1.World wide

In 1960, Concrete proportion used low volume of cement was studied; in 1980, RCC was apllied in Dam Construction in United States; In 1974, RCC was applied in Japan; In 1980, RCC was initially apllied in China. Currently, RCC Damis ranked in the top of the world for quality,quantity, height of dam, technologies.

1.4.2.Việt Nam

In 1990, RCC was innitially applied in Việt Nam.In 2003, the first RCC dam construction is applied in Pleikrong HYDRO DAM. Currnetly, there has been 20 dams applied RCC Technologies and many others preppared to started construction...

1.5. Situation of research and applicable to Chemical Mineral admixtures.

1.5.1. Situation of research and applicable to Chemical Mineral admixturesin the world

The improvement of RCC quality by using Chemical Admixtures was in 1980. In the Standards of Indutry of Japan or United States, Chemical admixtures were determided as one of component in proportion of RCC.

1.5.2. Situation of research and applicable to Chemical Mineral admixturesin Việt Nam

In Việt Nam, RCC was innitial to applied in 1990s; In 2003, Pleikrông HYDRO DAM was applied RCC technology without Chemical admixtures. After that, all HYDRO DAM has been applied RCC technolgy with Chemical Admixtures such asTĐ A Vương – Quản Nam, TĐ Bản Vẽ - Nghệ An, TĐ Sơn La – Sơn La, TĐ Lai Châu – Lai Châu, TL Đình Bình – Bình Định, v.v…

1.6. The disadvantages of RCC technology in Việt Nam

- The heating problems in RCC: If Thetemperature diffirences of inner concrete and outside concrete is big enough, The non-constant eslasticity in between inner concrete and outside concrete would create the crack of concrete.

- Water proofing of RCC: The differences of water pressure is significal, the uniform of structure and capacity of water proof is low. The design and installation of water stop is not qualified.

1.7. The factors affect on RCC constrcution:

Workabilities of RCC, Time of settings, Processing on improving RCC strength, processing on heating

1.8. Purpose and Mision of Thesis

- Purpose: Research on influence of Chemical admixtures on mechanization characticities of RCC for HYDRO DAM constrcution.
- Mision: Research on Influence of Chemical admixtures on workabilites, setting time, strength of compression and tension, heating development, compacting time, water proofing, period of construction..

Conclusion of Chapter 1

- RCC use chemical admixtures to extend the time of setting, improve workability, and water proof of dam.
- Việt Nam has not carried out any an intensive and full research on chemical admixtures, also the suggestion to usage of chemical admixtures in RCC.

CHAPTER 2: SCIENCE BACKGROUND, APLLICABLE MATERIAL AND RESEARCH METHODS

2.1. Science background of using chemical admixtures in RCC

2.1.1.Science background of using chemical admixtures in RCC

Chemical admixtures would be divided in 3 generations: G1, G2, G3. Admixtures could create a adsorptivity membrane to cover cement spot and prevent from cement combination and capacity of independing by themself inorder to inporve the effectiveness of elasticity.

2.1.2. Science background of using Chemical admixtures for increasing setting time in RCC

To Create membrane to protect cement and prevent from hydrating progress; to increase the progress on setting crystal seed of Hydrosytecanxi; to prevent from development of crystal seed; to prevent from forming hydro canxi crystal seed; sedimetantion extracts of components to increase time of settings and forming protective membrane.

2.1.3.Plasticity result of Chemical admixtures to strength of RCC

Imporvecharacticities of cement in concrete and respond concrete specification to requirements such as increase settings time, reduce water content,improve flexibility, water proof v.v...

2.2. Materials for research

CementPC40 Kim Đỉnh, Fly ash Phả Lại, Granit coarse aggregate, natural sand,pChemcal Mineral admixtures TM 25/ Sika, Rheoplus 26 RCC/ BASF, ADVA 181/ GRACE.

2.3.Methods of research

Both of lad studies and experiment on situ.

2.3.1. Standards of materials

Cement: TCVN 6017:1999; TCVN 4030:2003; TCVN 6017:1999; TCVN 6016:2011.

Fly ash: TCVN 7131:2002; TCVN 7572:2006; TCVN 4030:2003; TCVN 8827:2011; TCVN 7131:2002; TCVN 6882:2001.

Fine and coarse aggregate: TCVN 7572:2006; TCVN 7570:2006.

2.3.2. Stardards of testing RCC

SL 48:94; TCVN 3118:1993; TCVN 3108:1993; TCVN 3116:1993.

Conclusion of chapter 2

1. Through studies, analysies, statistic process, the science background of influence of admixtures on RCC as followings:

- The mechanism of elasticity is creating membrane of electrostatic and space.
- The mechanism of increasing settings time, prevent from development of srystal seed and form a new material that can reduce cement hydraulic progress.

2. Through surveys and experiments result, thesis has choosen materials and admixtures which could respond to requirement of producing RCC:

3. The standards of experiments of aggregates is applicable : VS. Design and experiments standards: China / SL48-94.

CHAPTER 3: RESEARCH ON INFLUENCE OF CHEMICAL ADMIXTURES ON SOME CHARACTISITY OF RCC

3.1. Design proportion of RCC in accodancewith SL48-94

Table proportion of RCC basic: refer to table 3.1, specification: refer to table 3.2

Table 3.1. Basic RCC Proportion

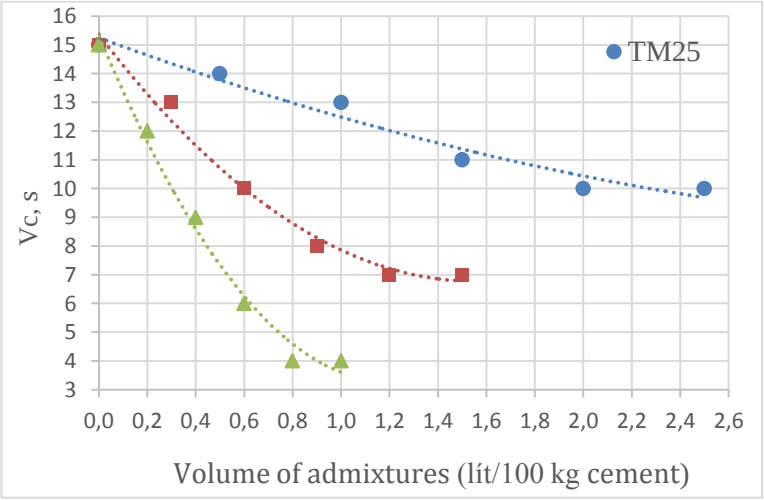
Material	Cement, kg	Fly ash, kg	Fine admixtures , kg	Sand, kg	Coarse aggregate , kg	Water , lít
Volume	80	140	57	751	1318	115

Table 3.2. Specification of basic RCC proportion

Specification	Vc, s	R_{28}, MPa	R_{90}, MPa	$T_{bđđk}$, hour	$T_{kđđk}$, hour
Value	15	13,6	20,3	7,5	18,25

3.2. Research on influence of Chemical admixtures on RCC workability

Refer to table 3.1, if volume of admixtues changed in order to monitor the adjustment of workability of RCC(V_c). Result is shown in diagram of picturte 3.1.

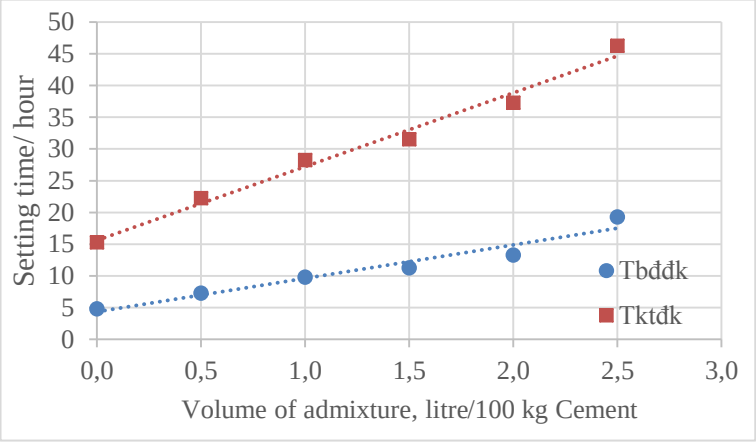


Picture 3.1. Figure shows the influence of chemical admixtures on RCC workabilites

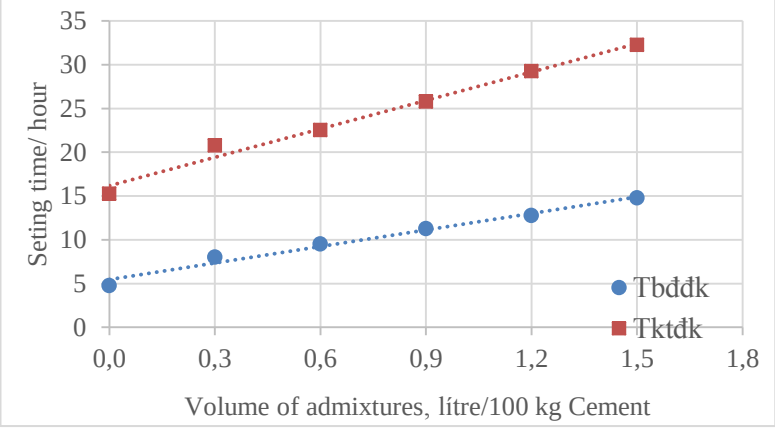
Chemical admixtures would stimulate flexibilities/ workabilites of RCC. The capacities of improving workabilites would besignificallyincrease from usage of TM25,Rheoplus 26 RCC to ADVA 181.

3.3. Research on chemical admixtures on settings time of RCC

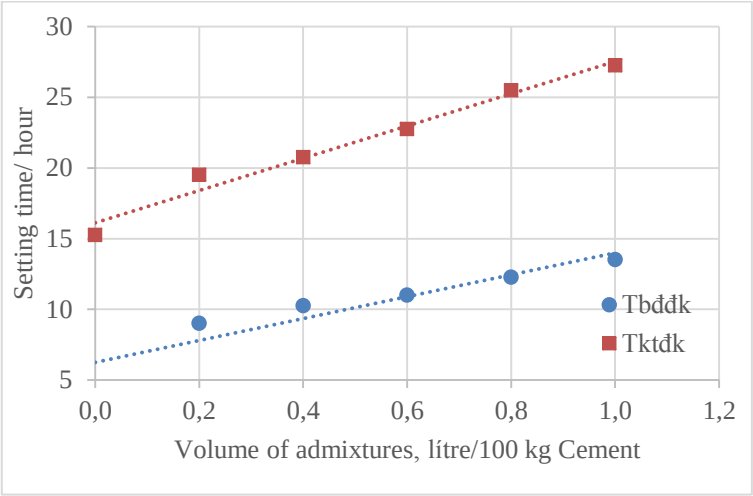
Basic RCC proportion in table 3.1, the volume of admixtures should be changed to monitor the adjustment of setting time of RCC. Result of expriments is shown in figures 3.2, 3.3 and 3.4.



Picture 3.2. Figure is shown the influence of admixtures TM 25 volume on setting time of RCC



Picture 3.3. Figure is shownthe influence of volume of admixtures Rheoplus 26 RCC (A1) on setting time of RCC



Picture 3.4. Figure is shownthe influence of volume of admixtures ADVA 181 on setting time of RCC

Note: Three of admixtures should insrease settingtime of RCC.

3.4. Research on Chemical admixtures on strength of RCC

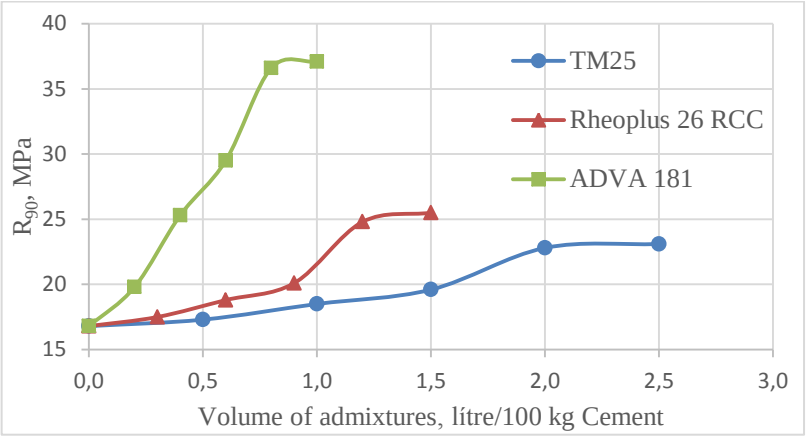
3.4.1. Compression strength:

Monitor the influence of Chemical admixture on Compression strength of RCC on the base of keeping workabilites constant (Vc = 10±1s). Refer to proportion at table 3.9, adjustment should be made to compensate workabilitiy as Vc = 10±1s.

Table 3.9. RCC Proportion to test compression strength

Material	Cement, kg	Fly ash, kg	Fine admixt-ures, kg	sand, kg	Coarse aggreg-ate , kg	water, lít	Chemical admixtures, lít
Volume	80	140	57	751	1318	125	0

The result should be shown in figure picture 3.5.

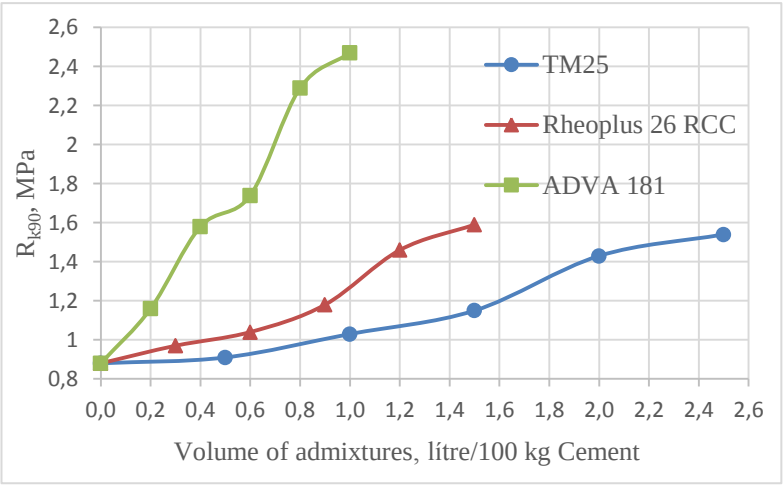


Picture 3.5. Figure is shown the influence of colume of admixtures on compression strength of RCC

Three of admixtures should increase significally the compression strength of RCC from usage of TM25,Rheoplus 26 RCC to ADVA 181.

3.4.2. The strength of tension along center axis

Refer to proportion at table 3.9, the volume of water would besignifically reduced and increased a volume of admixtures, also kept workability of RCC as constant. The result should be shown in picture 3.6.



Picture 3.6. Figure is shown the influence of volume of admixtures on strength of tension along center axis

Three of admixtures should increase significally the stretching strength of RCC from usage of TM25,Rheoplus 26 RCC to ADVA 181.

3.5.Research on chemical admixtures on time of compaction

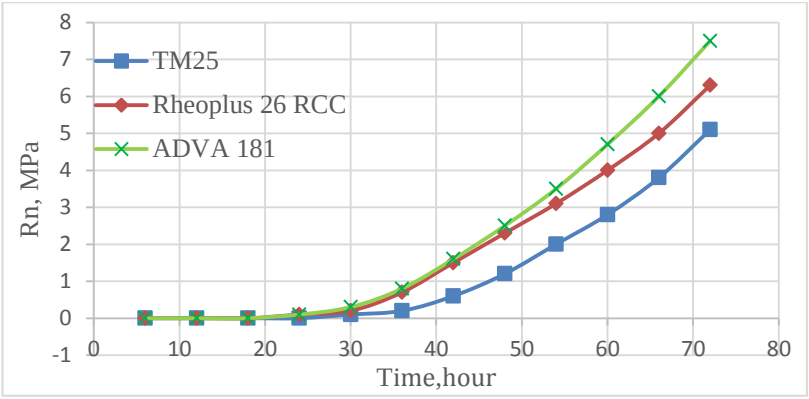
To test the compression strength of RCC sample at lower layers meanwhile pour RCC concrete at many difference processing period. In the research, sample at higher layers after pouring to sample RCC concrete at lower layers at every 6 hours.

Table 3.16. proportion of RCC to test at compaction period

Material	Cement, kg	Fly ash, kg	Fine admixt-ures, kg	sand, kg	Coarse aggreg-ate , kg	water, lít	Chemical admixtures, lít
TM25	80	140	57	751	1318	119	4,40
Rheoplus 26 RCC	80	140	57	751	1318	108	2,64
ADVA 181	80	140	57	751	1318	82	1,76

3.5.1. Mornitor the strength of RCC at short setting time

The result of expoeriments of compression strength of sample as picture 3.7.

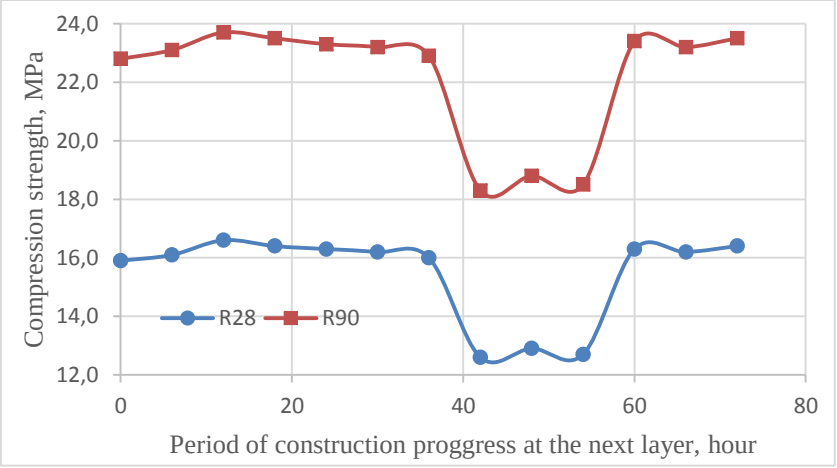


Piture 3.7. Figure is shown compression strength in period of progess

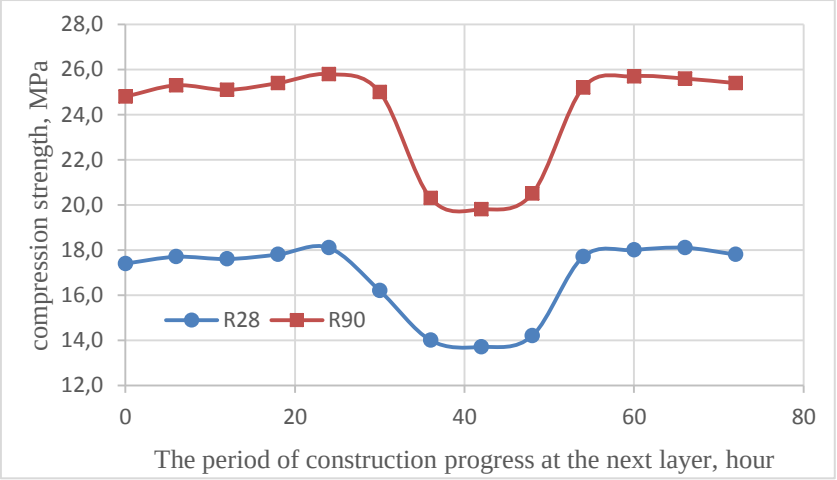
The velocity of development of strength depends on admixtures usage , the level of development is sigfinically increased from TM25, Rheoplus 26 RCCto ADVA 181.

3.5.2. Mornitor the influence of chemical admixtures on compaction period

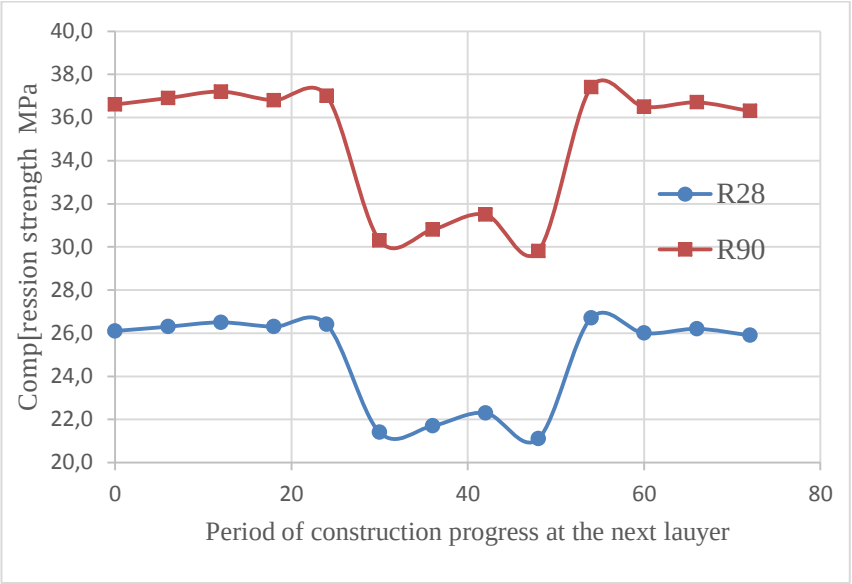
The experiemnts of RCC strength at lower layers in the period of construction progress of higher layer at every 6 hour. The result is shown ar picture3.8, 3.11, 3.9and 3.10.



Picture 3.8.Figure is shown compression strength of RCC sample used chemical admixtureTM25 at diffirence period of construction progress



Picture 3.9. Figure is shown compression strength Rheoplus 26 RCC (A1) at diffirence period of compaction progress

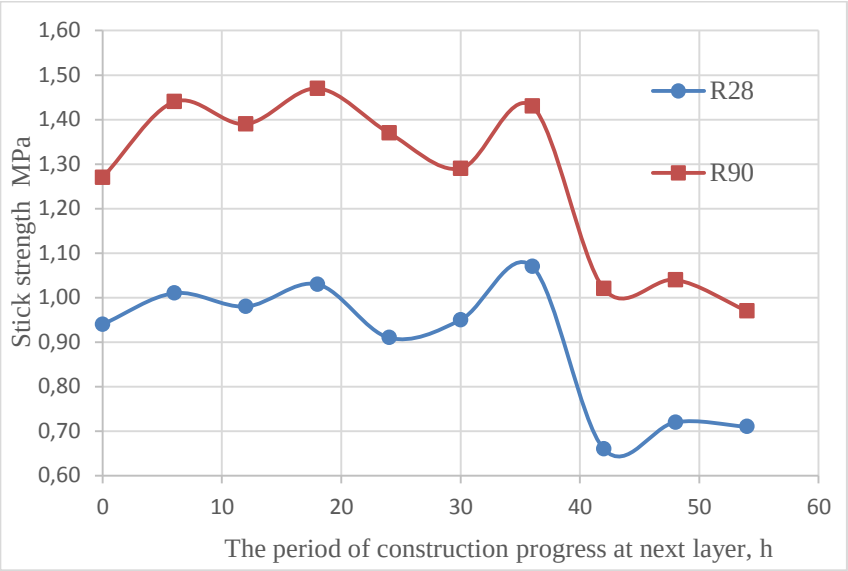


Picture 3.10. Fiugure is shown compression strength sample used admixtures ADVA 181 ở at diffirence period of compaction preogress

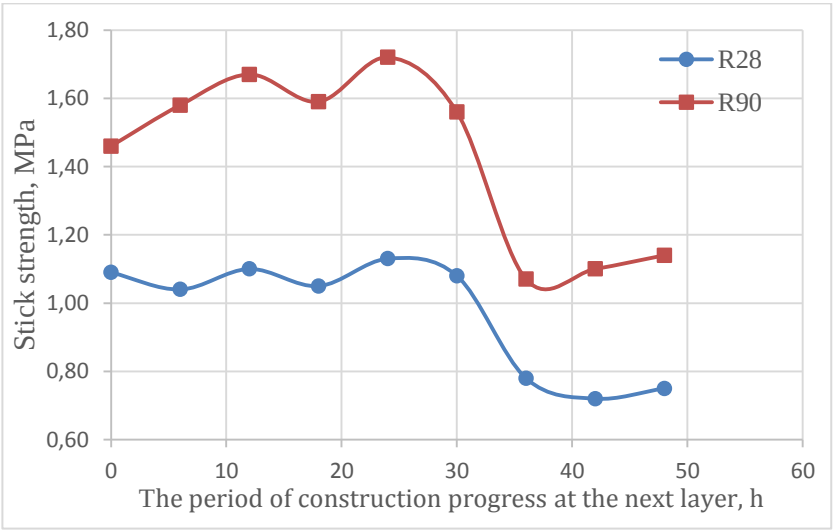
The period of compacting RCC at higher layers would affect on RCC strength of lower layers and the connection joint of two these layers. This is a cause of reducing the strength of tension at surface of layer, also this is a background knowledge to choose the specification of equipment, design and prepare the planning as well as keep continue of progress of construction from starting pouring conctete, compacting lower layer to finishing the higher layer is not excceding 36 hours for M25, 30 hour forRheoplus 26 RCCand 24 hour forADVA 181.

3.6. Research on the influence of chemical admixtures on tension of each layer

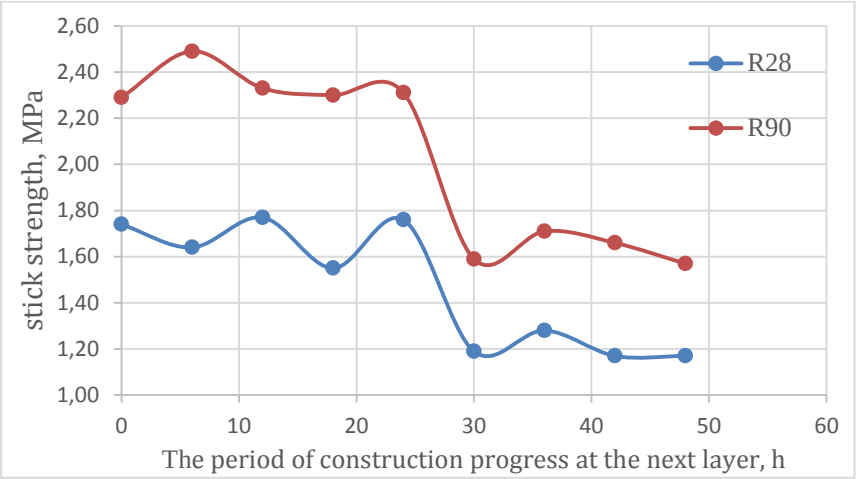
The result of testing tension strength between 2 layers at diffience period of compaction is shown at picture 3.11, 3.12 and 3.13.



Picture 3.11. Figure is shown the tension strength at between old and new layer of RCC used chemical admixtures MINERAL CHEMICAL ADMIXTRURE TM25



Picture 3.12. Figure is shown the tension strength at between new and old layers of RCC used admixtures MINERAL CHEMICAL ADMIXTRURE Rheoplus 26 RCC



Picture 3.13. Figure is shown the strength of tension at between old and new layers of RCC used admixtures MINERAL CHEMICAL ADMIXTRURE ADVA 181

- The period of compaction progress for RCC higher layers from 0 ÷ 36 H would compensate the best compression strength with TM25,0 ÷ 30H, Rheoplus 26 RCC and0 ÷ 24with ADVA 181.This matter should be explained that meanwhile RCC finished setting causes significal reduce of combination between old and new RCC layers.

3.7. Research on ithe influence of chemical admixture for increasing setting tim on water proof of RCC

The proportion for testing shown in table 3.22.

Table 3.22. Proportion for permeable parameters

Material	Cement, kg	Fly ash, kg	Fine admixt-ures, kg	sand , kg	Coarse aggreg-ate , kg	water, lít	Chemical admixtures, lít
Benchmark proportion	80	140	57	751	1318	125	0,00
TM25	80	140	57	751	1318	119	4,40
Rheoplus 26 RCC	80	140	57	751	1318	108	2,64
ADVA 181	80	140	57	751	1318	82	1,76

Result of testing the permeable paramettersos RCC at 90 days is shown as table

Table 3.23. Result of testing permeable parametterssosRCC at 90 days

Sample	R_{90}, Mpa	Permeable paraetters, K_{th} ($\times 10^{-8}$ cm/s)	Permeable pressure, atm
Benchmark proportion sample	16,8	1,675	2
TM25 sample	22,8	1,314	4
26 RCC sample	24,8	0,523	6
ADVA 181 sample	36,6	0,173	10

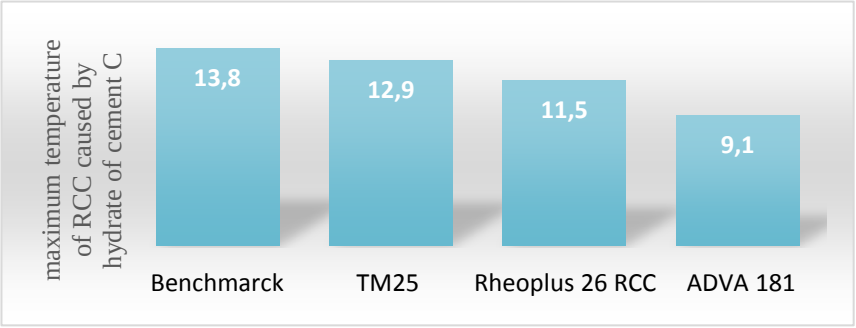
When RCC used Chemical admixtures, the permeable parametters is significally reduced and water proof capacity is improved). Chemical admixtures for increasing setting time at higher generation would be improved water proofing capactities

3.8. Research on the influence of Chemical admixtures on adiabatic heating of RCC

The result of work out Δ_t of RCC used admixtures and benchmark RCC(no used admixtures) is shown at table 3.24.

Table 3.24. Maximum temperature of RCC cause by hydrate of cement

Material	**Cement**	**Fly ash**	**R28**	**R90**	Δ_t(LT)	Δ_t(đo)
Benchmarck	80	140	11,7	16,8	14,1	13,8
TM25	75	145	11,5	16,5	13,2	12,9
Rheoplus 26 RCC	67	153	12,1	17,1	12,3	11,5
ADVA 181	53	167	12,8	17,5	9,7	9,1



Picture 3.14. Maximum temperature of RCC caused by hydrate cement

If TM25 used , $\Delta_t$will be reduced 0,9 ^oC g, Rheoplus 26 RCC reduced 2,3^oC, ADVA 181reduced 4,7^oC to compare with benchmark proportion.

3.9. Compare the velocity of pouring RCC when used chemical and not used chemical admixtures

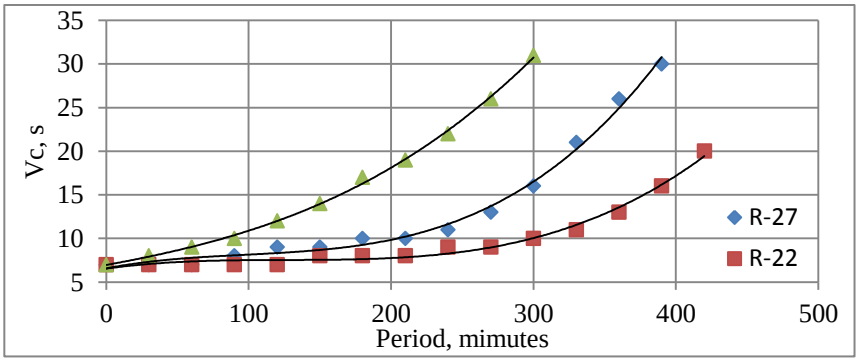
The velocity of puring concrete is shown by followed fomular:

$$h = \frac{P.K.(t_2^1 - t_1)}{A}$$

h –the thickness of pouring layer ; P – productivity of concrete manafacture; K –the factor relative to non constant of concrete construction progress (K = 0,8 ÷ 0,9); t_2– the setting time at beginning of concrete (h); t_1– the period from unloading concrete from truck to pouring to structure component location (h); A – area section of concrete layer (m^2); t_2^1 is allowed period ofr construction progress which not affect on the development of strength of RCC. Admixtures MINERAL CHEMICAL ADMIXTRURE TM25: t_2^1 = 36 h; Rheoplus 26 RCC: t_2^1 = 30 h; ADVA 181: t_2^1 = 24h.

3.10. Research on the influence of environmental temperature on workability of RCC.

Porportionapllicable is shown in table 3.1 .RCC mass was tested indoor which humemidity must be 90% at three diffirence of Temperature are 22^oC, 27^oCvà 32^oC.The result is shown in picutre 3.15.



Picture 3.15. Figure is shown the change of workability of RCC massusedMINERAL CHEMICAL ADMIXTRURERheoplus 26 RCC at diffirenceenvironment temperature

With equivalent proportion and temperature, humidity; if temperature is as high as well as workability is reduced rapidly(value Vc increasingly) mean while period of construction is on progress. Theinceaseof environment temperature will make the velocity of hydrating cement increase also reduce the workability of RCC (meaning increase the Vc).

Progress of construction in high temperature emviroment should be reduced hydrating processing of cement by decreasing temperature of RCC or increasing volume of Chemical admixtures.

Conclusion of chapter 3

1. Choose admixtures and proper volume of admixtures for RCC porportion when admixtures G1,2,3 applied .

2. Find out the influence of each admixtures on RCC characticities:

- Increase workabiltiy od RCC: TM25 reduced 5s, Rheoplus 26 RCC (A1)reduced8s, ADVA 181 reduced 11s.
- Increase time of starting setting of RCC: benchmark is 7,5 h, increase to 13,25 with TM25, to 12,75 h with Rheoplus 26 RCC (A1) and to 12,25 H with ADVA 181;
- Increase time of finsihing setting of RCC : benchmark is 18,75 H, increase to 37,25 H with TM25, 29,25 H with Rheoplus 26 RCC (A1) and 25,5 H with ADVA 181;
- Increase compression strength of RCC: TM25 increase 37,5%, Rheoplus 26 RCC (A1) increase 51,79%, ADVA 181 increase 120,83%;
- Increase tension of RCC: TM25 increase 75%, Rheoplus 26 RCC (A1)increase 80,7%, ADVA 181 increase 180,7%;
- Increase the water proof of BTĐL: benchmarck $K_{th}=1,675\times10^{-8}$ cm/s has water rpoof fator W2, TM25 $K_{th} = 1,314\times10^{-8}$ cm/s water rpoof factor W4, Rheoplus 26 RCC (A1) $K_{th} = 0,523\times10^{-8}$ cm/s water rpoof factorW6, ADVA 181 $K_{th} = 0,173\times10^{-8}$ cm/s water rpoof factorW10;

3. Chemical admixture has influnece on period of construction progress of compacting heigher layer in order to lower layer of RCC would not be reduced the compression stength.

- TM 25 admixtures, the period of construction for heigher layer of RCC from time of pouring lower layer is not later than 36 h or after 60 H; Rheoplus 26 RCC (A1), the period of construction for heigher layer of RCC from time of pouring lower layer is not later than 30 H or after 54

giờ;ADVA 181, the period of construction for heigher layer of RCC from time of pouring lower layer is not later than 24 H or after 54 H;

4. Chemical admixtures could be reduced volume of cement in RCC so caused in reducing temparature in RCC: TM 25 reduced 0,9 ^{o}C; Rheoplus 26 RCC (A1)reduced2,3 ^{o}C;ADVA 181reduced 4,7 ^{o}C.

5. Chemical admixtures could be extended the setting time and controlled the period of construction progress longer than $T_{bđdk}$. These advantages contribute in speeding up the pouring concrete, reducing the cold crack and others temporary works.

6. With constant humidity, temperature and equivalent proportion; high temperature will reduce the workability of RCC significally.

With above mentioned results, Chemical admixtues types could be choosen and volume of chemical admixtures could be controlled to be suitable to RCC which required exact workabiltiy, strength, time to pour concrete.

CHAPTER 4.EXPERIMENTING RRC USED CHEMICAL ADMIXTURES FOR INCREASING SETTING TIME AT SITE

With the approval from PMU of Nước Trong project (Division 6 – MoARD), the thesis carried out design the proportion for RCC and made a tolerance for applying at Nước Trong site.

4.1. Description to Nước Trong Project

Nước Trong Dam locates in Sơn Hà - Quảng Ngãi province with total volume is V_h=289.50x10^{6}m^3. The main Dam is used RRC technology which its height is 69,0m.

Picture 4.2.Material dock

RCC is batched by 02 batching machine with vertical aixes and capacity of batching is 250 m^3/h

Picture 4.3. Batchingplan

Picture 4.4. Trucking and pouring RCC

Picture 4.5. Compacting RCC

Picture 4.6.Testing Volume Density for RCC after compacting

Picture 4.7. Maintainance works

4.1.2. Proportion of applicable RCC Cấp phối BTĐL at Nước Trong project

RCC requirement at Nước Trong project : Workability Vc = 10 ± 3s; $T_{bđđk}$ =18 ± 2 h; $T_{ktđk}$≤ 70 h; Compression Strength at 90 days≥20 Mpa; Water proofing Level W6 at 90 days; Workability maintain ≥ 4 is Vc = 10 ± 3s.

Table 4.2. Proportion for RCC at Nước Trong Project

Material	Cement, kg	Fly ash, kg	Sand, kg	Aggregate, kg	TM25, l	PL96, l	Water, l
Volume	125	240	713	1383	2,6	0,8	115

Table 4.3. Proportion for RCC after applicable adjustment for construction at Nước Trong project

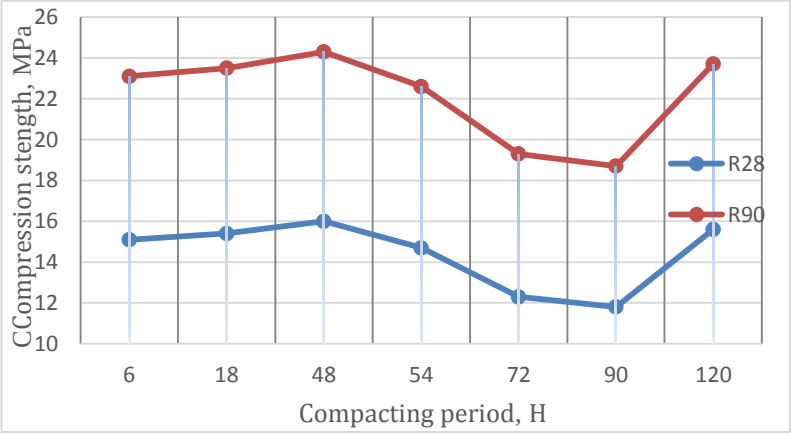
Material	Cement, kg	Fly ash, kg	Sand, kg	Aggregate , kg	TM25, l	PL96, l	Water, l
Volume	80	140	57	751	1318	3,96	108

Workability Vc = 8s; T_{bddk} =17,25h; T_{ktdk} = 58,25h; Compression Strength at 90 days= 26,4 Mpa; Water proofing Level W6 at 90 daysWorkability maintain Vc = 10 ± 3s.

4.2. Result of Testing at site

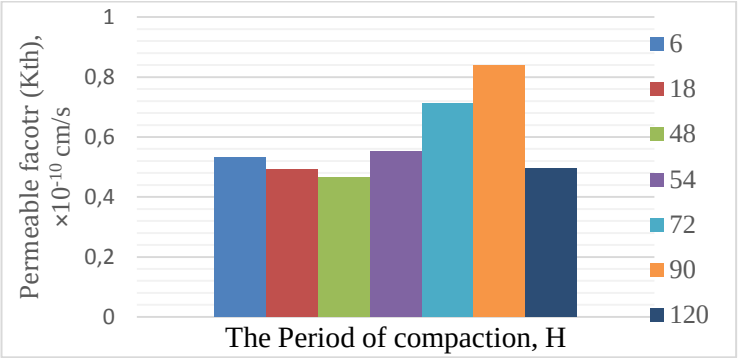
Volume of testing is 70 m^3 for RCC at Nước Trong project, the progress and result as followings:

Concrete was poured at site with thickness after grading is 34 cm ± 2. The parametter of Vc at batching plan is 10 ± 3s; Size dimension of sample W x H x L = (3,3 × 0,9 × 25) m; Compaction round is 10 times consisting of 8 silent compaction and2 vibrating compaction. The result is shown in Picture 4.8 and 4.9.



Picture 4.8. Compression strength at every period of compaction

- The progress of compaction before setting time getting started did not affect on compression strength of RCC. From settingtime getting finished, the the moment that RCC strength was obtained about3 MPa, compaction would reduce the compression strength of RCC.



Picture 4.9. Permeable factor at every period of compaction

Conclusion :Compaction progress before the moment that RCC is not finished setting would be increased compression strength and reduced the permeable factor value (meaning water proofing capacity is heigher/ better).

Conclusion chapter 44

1. Site experiment for 70 m^3 RCCM20B6R90 used Rheoplus 26 RCC.

2. To decide the suitable momment of compaction: Compacting RCC before setting time would not influence on mechanization characticities of RCC; compaction between finishing setting time to moment that RCC strength is 3 MPa would be reduced mechanization characticities of RCC ; compactionafter Stength is over 3 MPa would not be influenced on compression strength and water proofing capacity of RCC.

CONCLUSION AND KẾT LUẬN VÀ REQUEST

CONCLUSION

1.Admixture type and reasonable volume should be significantly choosen for RCC and decided by level of grade. Reasonable volume of TM25is 2,0; Rheoplus 26 RCC (A1) is 1,2; ADVA 181is 0,8 litres/100 for 100kg cement.

2.To find out the influence of admixtures type on RCC specification: to Increase workability (reduce Vc): TM25 reduced 5s, Rheoplus 26 RCC (A1) reduced 8s, ADVA 181 reduced 11s to be compared to benchmark sample; to increase setting time,settingtime of benchmark sample is 7,5 h, increased to 13,25useing TM25, to 12,75 using Rheoplus 26 RCC (A1) and to 12,25useing

ADVA 181; to increase time of finishing setting of RCC, setting time of benchmark sample is 18,75, increased to 37,25 using TM25, to 29,25useingi Rheoplus 26 RCC (A1) and to 25,5 using ADVA 181; to increase compression strength, TM25 usage increased 37,5%, Rheoplus 26 RCC (A1) increased 51,79%, ADVA 181 increased 120,83%; tension strength,TM25 inceased 75%, Rheoplus 26 RCC (A1) increased 80,7%, ADVA 181 increased 180,7%;to increase water proofing capacity, benchmark sample Kth = 1,675×10-8 cm/s with Water Proofing is W2, TM25: Kth = 1,314×10-8 cm/s with Water Proofing is W4, Rheoplus 26 RCC (A1) : Kth = 0,523×10-8 cm/s with Water Proofing is W6, ADVA 181 : Kth = 0,173×10-8 cm/s with Water Proofing is W10;

3. Mineral chemical admixture influenced on construction time of compacting the heigher layer in order to lower layer is not decreased the compression strength. The period of compaction is suitable to dam construction progress: for TM 25, the construction time of heigher layer from period of pouring lower layer is before 36 hours or after 60 hours; for Rheoplus 26 RCC (A1), the construction time of heigher layer from period of pouring lower layer is before36 hours or after 54 hours; for ADVA 181, the construction time of heigher layer from period of pouring lower layer is before24 hours or after 54 hours;

4. Mineral chemical Admixture in the proportion of RCC will be reduced the volume of cement, so the heating inside RCC would be reduced:TM 25reduced 0,9^{o}C;phụgiaRheoplus 26 RCC (A1) reduced 2,3 ^{o}C; ADVA 181reduced 4,7^{o}C.

5. Mineral chemical admixtures will be increased the setting time of RCC and increased the velocity of pouring concrete, reduced the cold crack and others facilitiy works.

6. The result of site testing is shown that the suitable moment of compacting for testing RCC proportion could be decided, also strongly confirmed the result at chapter 3 for compaction time:

- Compacting works should be started before RCC to finished setting time so the mechanization characticity of RCC would not be affected;
- Compacting works started at the moment from setting time finished to strength of RCC is 3 Mpa would be reduce mechanization characticities of RCC;
- Compacting works started after RCC strength is 3 Mpa would not affect themachenizationcharacticities of RCC.

REQUEST

1. From the result of thesis for designing the proportion of RCC, the admixtures type and the volume of elasticity admixtures for increasing setting time should be decided to respond to demand of tenology on construction progressing or technical, specification of RCC.

2. The research on RCC should be kept continue to propose the detailed instruction for designing RCC proportion used elasticity admixtures for increasing setting time of RCC in Dam construction.

ANNOUNCING DOCUMENTS

1. Nguyễn Quang Phú, Nguyễn Thành Lệ, Nguyễn Văn Tuân*; Optimalizing the condition of water proofing to design RCC proportion for constructing a dam.* The Juarnal ofEnviroment and Hydraulic Science, Engineering, Vol.3, No.30, 9/2010.

2. Nguyễn Quang Phú, Nguyễn Thành Lệ, *The influence of Fly ash admixtures from Thermal plantand natural Poozerland on mechanization charaticities of RCC*; The Juarnal of Hydraulic Science and Civil Engineering, Vol. 2, No. 155, 40-46, 6/2011.

3. Ngô AnhQuân, NguyễnThànhLệ, *The research on solution to structure of ditch to be suitable to condition of Mekong delta and apply chemical admixtures to Concrete Structure,* The report on Ministrial Topic , 2013.

4. Nguyễn Thành Lệ, *The chemical admixtures used in RCC in Vietnam Condition,* The Juarnal of Agriculture and Rural Development No 6 (2014).

5. Nguyễn Quang Phú, Nguyễn Thành Lệ, *The research on influence of Chemical Elasticity Admixtures for increasing Setting time on characticity of RCC*, The Juarnal of Enviroment and Hydraulic Science, EngineeringNo 51 (12/2015).

6. Nguyễn Quang Phú, NguyễnThànhLệ, *The influence of Chemical Elasticity Admixtures for Increasing Setting time on characticity of RCC for Grativationdam*,The Juarnal of Enviroment and Hydraulic Science, Engineering, Vol.2, No.53, 6/2016.

7. Nguyễn Thành Lệ, The result of testing the influence of *Chemical Elasticity Admixtures for Increasing Setting timeon optimal Period of compacting RCC in Gravitation dam construction,* The Juarnal of Agriculture and Rural Development No18 (2016).