Summer Practice Report on the Construction of the

“Gebze-Orhangazi-İzmir (Including IZMIT BAY CROSSING Bridge and Access Roads) Motorway”

CE 200-Summer Practice I

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INTRODUCTION

The construction project which is called Gebze–Orhangazi–İzmir (Including İzmit Bay Crossing Suspension Bridge and Access Roads) Motorway is the project I did my summer practice. The main purpose of the project is link the two major cities of the Turkey called İzmir and İstanbul. When the alternatives of the transportation are compared, instead of passing the İzmit Bay by an automobile in 80 minutes or using ferries taking time between 45 or 60 minutes, İzmit Bay Suspension Bridge will be more economical since passing İzmit Bay will just take 6 minutes. When project is done, İstanbul-İzmir motorway will be shorter about 140 km.

Name of the Work: Gebze–Orhangazi–İzmir (Including İzmit Bay Crossing Suspension Bridge and Access Roads) Motorway Build-Operate-Transfer Project

Owner: General Directorate of Highways- KGM

Contractor: OTOYOL / Nömayg Joint Venture

Figure 1: The map shows the route of project
Through the summer project I worked in not just one location of the project. In the first and second weeks, I have observed the works continue in the Izmit Bay Bridge.
Figure 3: Map Sections of Izmit Bay Bridge
During summer practice works related to the tower erections, erection of the blocks and constructing of the anchorages have been observed. There are 22 blocks that are steel will be placed. After installation of the blocks, tower height will be 241. 85 m. 17000 ton steel to be used for towers. 45.000 m³ concrete casted in the tower foundations including the caisson structures. In the North Side there is a North Anchorage Block, 44.800 m³ concrete will be casted and 6.300 ton steel reinforcement bars will be used. In the South Side there is also an anchorage block, 90.000 m³ concrete will be poured and 12.500 ton steel to be used. Izmit Bay Crossing Suspension Bridge will be the fourth biggest bridge in the world with respect to its main span length, after it is completed. Total length of the bridge will be 2682 m. It is thought that bridge will be completed March 2016.

**Bridge Contractor:** IHI Infrastructure Systems Co. Ltd.

**Bridge Designer:** COWI

Also the works related to motorway construction continue. I worked in that part of the project for two weeks as well. The motorway construction will be done phase by phase. From the 0+000 km to 58+300 km, it is called as the first phase of the project. First phase covers Izmit Bay Bridge and Samanlı Tunnel Construction as well. Samanlı Tunnel is the longest motorway tunnel in the Turkey with its 3390 m. length.
Table 1: The Subcontractors of the Project

<table>
<thead>
<tr>
<th>Km</th>
<th>Sub-Contactor</th>
</tr>
</thead>
<tbody>
<tr>
<td>0+000 – 4+150</td>
<td>Astaldi</td>
</tr>
<tr>
<td>4+150 – 7+084 (İzmit Bay Bridge)</td>
<td>IHI Infrastructure Systems</td>
</tr>
<tr>
<td>7+084 – 8+411 (South Approach Viaduct)</td>
<td>Nurol</td>
</tr>
<tr>
<td>8+411 – 19+213</td>
<td>Makyol-Göçay</td>
</tr>
<tr>
<td>19+213 – 30+700</td>
<td>Yüksel-Özaltın</td>
</tr>
<tr>
<td>30+700 – 34+350 (Samanlı Tunnel)</td>
<td>Dağcan</td>
</tr>
<tr>
<td>34+350 – 43+296</td>
<td>Nurol</td>
</tr>
<tr>
<td>49+076 – 58+300</td>
<td>Makyol</td>
</tr>
<tr>
<td>58+300 – 83+441</td>
<td>Makyol</td>
</tr>
</tbody>
</table>

Appointed Company which is Otoyol Inc., Co signed Engineering Procurement Construction (EPC) contract with Nömayg JV company. The main contractor called Nömayg JV has sub-contractors just as listed above. Nömayg is a joint venture company which is founded by Nurol-Özaltın-Makyol-Astaldi-Yüksel-Göçay. Except İzmit Bay Bridge and Samanlı Tunnel’s sub-contractors, the sub-contractors are the constituent of Nömayg JV.
PREFACE

Name of Organization: OTOYOL Inc. Co

Contact Address: Bilkent Plaza A3 Blok No:21-24 06800, Bilkent/ANKARA

Site Location (Center Worksite): Yalova İzmit Yolu Cad. Devletaltı Yolu Tersaneler Bölgesi Çavuşçiftliği Mevkii, Altınova – YALOVA – TÜRKİYE

Brief History: The tender of Gebze-Orhangazi-İzmir (Including İzmit Bay Crossing Suspension Bridge and Access Roads) Motorway Build-Operate-Transfer Project was held 9 April 2009 and the tender was gotten by Nurol-Özaltın-Makyol-Astaldi-Yüksel-Göçay Joint Venture. OTOYOL Inc. Co was established by Nurol-Özaltın-Makyol-Astaldi-Yüksel-Göçay Joint Venture’s partners in September 20, 2010 so that the company undertakes the works related to the Gebze-Orhangazi-İzmir (Including İzmit Bay Crossing Suspension Bridge and Access Roads) Motorway Build-Operate-Transfer Project. Otoyol Inc. Co will both construct and operate the motorway for 22 years and 4 months.

Organization Chart:

![Organization Chart](image-url)

Figure 4: Organization Chart
Week 1

On the first day (25.08.2014) to be able to get down on summer practice, insurance taken from the school was given to the company where I completed my summer practice. It is a document that is necessary to work in any construction company. When you have an accident in the construction site, insurance covers your assurance and makes restitution about the risks that you had. After I supplied necessary documents to the company, I met Fatih Zeybek who is the project manager of the bridge construction. Project manager is the person who manages the work and direct the sub-managers about what they will do and he controls the process of the work. He told me that I have to take an Occupational Health and Safety training for working in the construction area. Occupational Health and Safety expert gave a presentation about how we work safe in the construction area and the importance of safety training is emphasized. The accidents happened in the construction site depends on basically three reasons. The first one is accidents due to doing job without knowing how to do it or not using the proper equipment and 70 percent of the accidents happen because of that reason. The second reason why accidents happen is due to not taking required safety precautions in the construction area and it takes 28 percent of the accidents. The rest 2 percent is due to unknown reasons. There are some equipment must be used in the construction area that are helmet, safety vests and shoes. The helmets are used to save workers’ head, when a material drops from a high point or head injuries that workers have. Helmets have different colors and they represents the workers such as white helmets are used by technical staff who are engineers and architects, yellow helmets are used by labors and red helmets belongs to the Occupational health and safety experts, and the last one which is grey is used by interns in the construction area where I worked the company through my summer practice. We were informed about the speed limitations while using car in the construction area and it must not exceed 20 km/h. Occupational Health and Safety trainings are always given to the workers and the expert.
Occupational Health and Safety trainings were done in the second day of the summer practice (Figure 5). The expert said that these are vital because predicting how we need to
behave in a possible case of accidents. After the trainings, we are informed by Fatih Zeybek about the construction of the İzmit Bay Crossing Suspension Bridge Project. He gave a presentation about the construction techniques of İzmit Bay Bridge and importance of bridge.

As we were informed by Project Manager, the bridge will be located between Kocaeli-Dilovası and Yalova-Hersek Cape. Total length of bridge will be 2682 meters and it will be the fourth largest bridge in the world with respect to its main span length. Main span length will be 1550 meters. Total tower length will be 252.00 meters. There are 22 blocks which are steel will be erected (Figure 7). First 12 blocks and lower cross beam will be erected by a floating crane called Taklift 7 which has maximum lifting capacity of 1200 ton. After the block number 12, the towers will be erected by a self-climbing crane of the lifting capacity of 46 ton located on the lower cross beam. Self-climbing crane will erect the towers panel by panel. Temporary cross beams are used in the towers with the aim of maintaining a separation of the tower legs to provide access between tower legs and to have extra space for placing welding equipment and so forth. These beams are also installed by floating crane. Temporary Beams will be located on the fourth block and then will remove to seventh block.

![Figure 7: Towers from North Side (Kocaeli-Dilovasi)](image.png)
There are two anchorage blocks in both side of the bridge and their technical drawings are as follow:

Figure 8: North Anchorage Block

Figure 9: South Anchorage Block

Anchorages shown in figures 8 and 9 are the structures that will transmit the load on the suspension cable to the foundation. Also some other information were given in the presentation by Project Manager about suspension cables but I was not able to see the works related to decks and cables since these processes will be done after erecting the towers.
On the third day (27.08.2014) we went to the aggregate pit which they handle their aggregates used in the concrete. Quality Assurance and Quality Control Department is responsible for the quality of the aggregates taken. Quality Control Chief gave some information about the aggregate taken in that aggregate quarry. He told us that they are using three different aggregate sizes: these are 0-5 mm, 5-12 mm and 12-22 mm. To be able to handle aggregate, rock crushers are used. Aggregates are separated here with respect to their sizes. As aggregates are affected by organic materials, they are needed to be stored in an appropriate area. Quality Control Chief told that when the organic materials mixed with aggregates, they will bring about further problems in concrete.

![Aggregate sampling in the quarry](image)

**Figure 10: Aggregate sampling in the quarry**

QC Chief said that as the region where aggregates are taken affected by fault zones, there might be differences in the aggregate properties. That’s why aggregate samples were taken from the pit and they sent them to the laboratories for required experiments.

The manufacturing of the tower blocks, panels and cross beams continue at Yasarsan Shipyard. We went to Yasarsan shipyard so that we can observe the works done there. We had
an inspection at the block number nine which is the weightiest approximately 288 ton and also we observed lower cross beam’s welding operations (Figure 11). Lower cross beam has three segments and it is welded here as well.

We have observed the block number 9 manufacturing and sandblasting operations. Sandblasting is a cleaning method especially used in huge structures. In the tower blocks, sandblasting operations have done so that the surface be rough. By this method the corrosions are cleared and surface gains rough pattern.
Copper Slag is generally used with high air pressure to make sandblasting in the tower blocks.
Manufacturing of the Lower Cross Beams continue in the Yasarsan Shipyards as well (Figure 14). Lower Cross beam will be located in the weightiest block which is ninth block. After installing these blocks, Lower Cross beam will take place and it will carry a self-climbing crane on itself.

Figure 14: welding of the lower cross beam segments

The reason why the joints of the segments are closed is because welding operations inside still continue. Since preventing the any fire damage in the work site they closed the segment connections. Quality Control Engineer said these beams are also erected by Taklift 7 which is floating crane.
Week 2

On 01.09.2014, we had an inspection with the construction technician of the company. He gave us a brief speech about the concrete casting and curing methods used in the construction of the transition piers and anchorage blocks. Concrete strength is one of the most important things for concrete structures. That’s why, samples are taken from the concretes casted so that they check the concrete strength for 7 and 28 days. C45 concrete is used in the transition piers and anchorage structures. At the North Anchorage Block Segment 52 West, the curing was done. While we were observing the curing, upon the question of an intern, technician defined how they cure the concrete and the purpose for curing. The aim of curing is preventing the water extraction from the concrete and providing hydration reactions to happen on the time. Furthermore, for the hydrations in the concrete there must be sufficient water and temperature. The first method used to cure concrete is water. After the concrete casted, the water can be sprayed on the concrete. This method is a good way of curing concrete. But when the surface of the concrete is not wet enough, there might be cracks observed on the concrete due to loosing of water in the concrete. Curing the concrete using the hessian cloth is another way. After concrete is hardened, these hessian clothes must be used and the concrete must be covered with them. It is important that the hessian clothes are wet and it must be checked regularly (Figure 16).
Some pipes are used for controlling the temperature of the concrete and preventing the water extraction (Figure 17). These are attached to the reinforcement bars. Before casting the concrete, the pipes kept with water and during the casting there also be water inside the pipes.
Erection of the block number 9 was observed and construction chief informed us about the works related to the erections of the blocks. Ninth block is the heaviest block as it is mentioned before which has a weight of 288.2 ton and it is 13.00 meters high. The weight of each tower will be 9275 ton.

Figure 18: Taklift 7 erects the block No: 9
Figure 19: Technical Drawing for the Erection of the Tower
After the blocks are erected by floating crane, bolted and welded connections are made. However to be able to work with welding machines a power supply is a requirement. When I asked that question, the site chief told me that they are using submarine cables to use power. Submarine cables for power supply for the construction work are laid on the sea bed, one line each for the working platform of each tower, from the north shore to the north tower and from the south shore to the south tower (Figure 20). The other question that was asked what will happen when the floating crane cannot reach the higher blocks. Since ninth block will carry the lower cross beam, a self-climbing crane which has maximum lifting capacity of 46 ton located on it. This crane will erect the tower just as panel by panel.

Figure 20: Submarine Cables from North Side to North Tower
Figure 21: 3D Modelling of the Self-Climbing Crane on the lower cross beam

Block Number 12 through 22 will be erected by the help of this crane (Figure 21). Since it has 46 ton capacity of lifting and the blocks are heavier than its capacity. It is preferred that the blocks must be erected as panels.

On 04.09.2014, we were informed about the welding connections at South Tower-West third block. Automatic welding robot is used for welding. Ceramic Welding Backing are used. These welding technique is especially used for ships. Since it reduces the welding errors and you only have to do welding for one side of the connection. By this method, the quality of welding is also increased.
Figure 22: Ceramic Welding Capping

Figure 23: the surface which was welded
Week 3

On the first day of the third week, I went to the motorway construction site of the first phase between 49+076 – 58+300 kilometers. At the beginning to be able to understand the works related to the motorway construction, it is told us that we have to know what types of construction materials are used and how they are produced. That’s why we went to the plant that both wet mix and warm mix asphalt are manufactured. Aggregates are the main production materials for both wet mix and warm mix asphalt production. The aggregates that are used can be classified as 0-5 mm, 5-12 mm, 12-25 mm and 25-38 mm. Wet mix plant is used for the production of sub base materials. In the wet mix plant, the maximum aggregate class size used is 25-38 mm (Figure 24). The aggregates that are loaded into the plant are taken with determined ratios. The percent of the aggregate class sizes was calibrated by a computer software and there is a sieve on the plant for proper mixing. After deciding the percent of the aggregate class sizes used, the aggregates moisturized with water again with determined water percent. This is the way to produce the sub base material used under warm mix asphalt.

Figure 24: Wet Mix Plant

The other plant is used to manufacture the warm mix asphalt (Figure 25). It has more complex working principle than wet mix plant since bitumen is used for the asphalt production.
The same aggregates class sizes are used. The materials are heat by using a drier. After it loses its’ water, the materials are elevated. The same sieving procedure that used in wet mix is also used here. From the aggregate classes above, the percent of them are uploaded to a computer software. After the necessary aggregates are taken, instead of water bitumen is used here to combine it with aggregates to make warm mix asphalt.

![Warm Mix Asphalt Plant](image)

**Figure 25: Warm Mix Asphalt Plant**

After I was informed about the mixing types used in motorway construction, I went to the construction site where the sub base and asphalt manufacturing continue. Sub base and base are obtained from the production of wet mix plants and the maximum aggregate size used is 38 mm (Figure 26). From the warm mix asphalt plant, we obtain bituminous treated base, binder and wearing course.

Bituminous treated base is the layer 38 mm maximum aggregate size is used. Finishers are the machines used to tar asphalt (Figure 26). It has 12 cm thickness. The layer above the bituminous treated base is called as binder and it has thickness of 11 cm. As the specification of General Directorate of Highways requires, it is not possible to tar binder layer in one time if it passes 8 mm. The maximum aggregate size used is 22 mm. Therefore binder layer is tarred as two separated layers. The layer above the binder is called as wearing course. It has thickness of approximately 5 cm. and the maximum aggregate size used is 19 mm for that layer.
Figure 26: manufacturing of the bituminous treated base

Rods are used for the aim of determining the grade or the height of bituminous treated base, as it can be seen in figure above.

After observing the applications of asphalt manufacturing, I went to Selçukgazi Tunnel Construction which is involved in the second phase of the project (Figure 27). The tunnel will be twin tube and the length of each one will be 1,234 meters. Tunnel Chief informed us about the construction method of the tunnel simply. The type of the tunnel is Cut and Cover Tunnel and the method which is used is New Austrian Tunneling Method. In cut and cover tunnels bored piles are used. Rocket Boomers are the machine for drilling in the tunnels. After it drills, the necessary equipment are settled inside the holes. Explosive materials are used for blasting operations in the tunnel. Rock bolts are used as well to support the rocks that is not stable. Shot Crete is applied in the tunnel. It is also used for supporting the non-stable part of the tunnel. The purpose of all these fortifications are making ground improvement for preventing any collapse failure of the tunnel.
Segregation observed in the concreting of the tunnel. When the concrete is not vibrated, then we may see like these cases. The fittings could be easily seen due to the segregation (Figure 28). Plaster materials are used in the segregation to cover them so that the fittings do not corrode easily.
Pre-stressed Concrete Beams are used in viaducts of the motorway construction (Figure 29). These are fabricated in the construction area as well. C40/50 concrete used in the fabrication of the pre-stressed concrete beams. Self-Compacting concrete casted and while casting the vibrators work simultaneously so that segregation does not occur. The type of steel used is S420 as defined in specifications.

![Pre-stressed Concrete Beam Casting](image)

**Figure 29: Pre-stressed Concrete Beam Casting**

Also through the third week, I have observed the works related reinforced earth walls. It is a way of supporting the load by using reinforcements. The main components of a reinforced earth walls are precast facing panels and the strips that are used for reinforcement (Figure 29& 30). The method of construction was told by an engineer. She told that the first facing panels is set and then the strips are placed. After placing the strips attached to the facing panels, the select granular material is compacted on the strips. Then the process is done for each facing panel. Since facing panels could be produced rapidly, it is easy to build these walls. They can resist loads since they show high strength under loads.
Figure 29: Front Face of Panels

Figure 30: Reinforced Earth Walls
Week 4

On 15.09.2014, I have worked in the highway construction between the 1+365 and 2+000 kilometers. Some of the works about embankment were observed. The chief engineer works here described me the works continue here. He told that the materials that are used in embankment must be proper for the best compaction so that it can resist the loads on the highway. Some experiment are done on the materials of embankment. These experimental results makes us whether we may use the material for embankment or not. Drainage excavations are also shown me between the kilometers 15+300 and 15+800 (Figure 31). The reason why we excavate them is warding off the water that is collected due to the rains and so on. If not to do so, the chief engineer told that some of the problems of collapse failure could be observed and the highway constructed could be affected from that waters. The drainage pipes are located between 1.00 or 1.20 meter deep.

![Figure 31: The Drainage Pipes](image)

Sand cone method is used to determine the bulk density of the materials that are used in the field and by using them it is easy to define the field compaction.
By using the plate above an area is taken, then the sample of wet sample is taken by the help of excavating up to 15 centimeters. Instead of the sample taken, the empty place is filled with sand in the cone. The necessary values will be used was taken from here. As we know the weight of the sand in the cone, we may calculate the mass of sand inside the empty space. After determining the dry bulk densities at both field and laboratory we may calculate the field compaction by dividing them with each other (Figure 32 & 33).

**Table 2: Sand Cone Test Data**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Calibrated dry density of sand</td>
<td>1579 kg/m³</td>
</tr>
<tr>
<td>Calibrated mass of sand to fill the cone</td>
<td>0.545 kg</td>
</tr>
<tr>
<td>Mass of jar + cone + sand (before use)</td>
<td>7.59 kg</td>
</tr>
<tr>
<td>Mass of jar + cone + sand (after use)</td>
<td>4.78 kg</td>
</tr>
<tr>
<td>Mass of moist soil from hole</td>
<td>3.007 kg</td>
</tr>
<tr>
<td>Moisture content of moist soil</td>
<td>10.2%</td>
</tr>
</tbody>
</table>

Volume of the hole can be determined since we know all of the properties of the sand that is used to fill the hole.
Volume \( = \frac{\text{The sand used in hole}}{\text{Dry density of the Sand}} = \frac{2.265}{1570 \text{ kg/m}^3} = 0.00144 \text{ m}^3\)

\[ \rho_{\text{moist}} = 20.45 \text{ kg/m}^3 \]

\[ \gamma_{\text{dry}} = \frac{\gamma}{1 + w} = 18.56 \text{ kN/m}^3 \]

Relative Compaction can be determined by dividing the dry density at the field and dry density in the laboratory. We found %97 relative compaction for the parking area of the motorway. As required in the specifications, the relative compaction must be above %97.

On 16.09.2014, I have observed some of the experiments applied on the aggregates. The first experiment which was sieve analysis was applied. One kilogram of aggregates used and the aggregates were shaken in the sieves. It is determined the percent of cumulative retained in the sieves and checked aggregate gradations is inside the tolerances or not.

**Table 3: Sieve Analysis Test Results**

<table>
<thead>
<tr>
<th>Sieve Number</th>
<th>Sieve Opening (mm)</th>
<th>Sieve Opening</th>
<th>Percent Finer (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 in</td>
<td>50,8</td>
<td>5,86</td>
<td>100,00</td>
</tr>
<tr>
<td>1-1/2 in</td>
<td>39,0</td>
<td>5,20</td>
<td>97,00</td>
</tr>
<tr>
<td>1 in</td>
<td>25,4</td>
<td>4,29</td>
<td>93,00</td>
</tr>
<tr>
<td>3/4 in</td>
<td>19,1</td>
<td>3,77</td>
<td>90,00</td>
</tr>
<tr>
<td>1/2 in</td>
<td>12,5</td>
<td>3,12</td>
<td>86,00</td>
</tr>
<tr>
<td>3/8 in</td>
<td>9,53</td>
<td>2,76</td>
<td>74,00</td>
</tr>
<tr>
<td>No. 4</td>
<td>4,76</td>
<td>2,02</td>
<td>60,00</td>
</tr>
<tr>
<td>No. 8</td>
<td>2,38</td>
<td>1,48</td>
<td>49,00</td>
</tr>
<tr>
<td>No. 16</td>
<td>1,19</td>
<td>1,08</td>
<td>42,00</td>
</tr>
<tr>
<td>No. 30</td>
<td>0,60</td>
<td>0,79</td>
<td>30,00</td>
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<td>No. 50</td>
<td>0,30</td>
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<td>No. 100</td>
<td>0,15</td>
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<td>No. 200</td>
<td>0,08</td>
<td>0,31</td>
<td>8,00</td>
</tr>
</tbody>
</table>
Marshall Stability testing is also applied in the laboratory. The stability of the bituminous mixture was defined by using the test. The bitumen and the aggregates were warmed up to 170 °C and then they were mixed in a mold of Marshall Compactor. For both side of the sample put into the mold 75 blows are applied. After they were compacted by Marshall Compactor, they were left to room temperature. In the next day, the samples that were put in a bath and it is heated up to 60 °C. When it reached the requested temperature, the Marshall Stability Testing applied on them to be able to observe the change in stability while increasing of the bitumen content.
Another experiment that is applied on the soils is methylene blue. The aim of the experiment is to determine dirtiness of the materials. For this purpose, 200 grams of soil were taken and it was sieved from 2 mm sieves. 500 grams of water were added. Mixer was set 600 revs and the methylene blue was added for once in the first five minutes. After five minutes, for every 2 minutes we added methylene blue with 400 revs. In every addition of the methylene blue, solution was dropped on a paper.
Ring and Ball Softening Point Test applied on the bitumen so that we can understand when bitumen will start to soften under the temperature.

In the experiment called Ring and Ball, we tried to observe the behavior of the bitumen under temperature change. The rings and bitumen are placed in water and it was left to cool down which has 0 or 0.05 C temperature. Sample of the bitumen was placed on the rings, after a while it was placed on a furnace just as shown above. Then the balls are placed on the rings which was carrying bitumen. While the temperature increases, the bitumen start to be soften. The temperature which was soften was taken as Ring and Ball Softening Point.
Penetration of the bitumen was the other experiment that was shown to us in the quality control laboratory.

Figure 39&40: Ring and Ball Softening Point Experiment

Figure 41: When the sample waiting at about 25 C
The hardness and consistency of 50/70 bitumen was determined by its penetration value. A needle is used to determine the penetration value. Three reading was taken by putting the needle inside the bitumen up to 5 seconds. The test was done at 25 C (Figure 41).

Figure 42: Los Angeles Abrasion Resistance Experiment

The Los Angeles abrasion resistance test applied on the aggregates (Figure 42). The aggregates that are used must be in dry form. 5000 kilograms of aggregates were taken that cannot pass the sieve size of 10 or 14 mm. Then the aggregates were put into the drum with the steel spheres. 500 revs were done by the drum. The aggregates were taken and then sieved from the sieve size of 1.7 mm. If the aggregate amount which passed the 1.7 mm sieve size is high, then we say that it has low resistance to abrasion. Up to 30 % of the abrasion could be used in the designs.
Table 4: Los Angeles Test Materials

<table>
<thead>
<tr>
<th>Sieve Size mm (in.)</th>
<th>Passing</th>
<th>Retained on</th>
<th>Grading #</th>
<th>Weight of indicated Sizes, g</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>14</td>
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<td>3250.5</td>
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<td>8</td>
<td>1750.3</td>
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<td>10</td>
<td>8</td>
<td></td>
<td>6.3</td>
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<tr>
<td>8</td>
<td>6.3</td>
<td></td>
<td>5</td>
<td>1750.3</td>
</tr>
<tr>
<td>6.3</td>
<td></td>
<td></td>
<td>5</td>
<td>5000.5</td>
</tr>
<tr>
<td>Total (g)</td>
<td></td>
<td></td>
<td></td>
<td>5000.5</td>
</tr>
</tbody>
</table>

Table 5: Abrasion after 500 Rev.

<table>
<thead>
<tr>
<th>ABRASION DATA</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>500 Rev.</td>
<td></td>
</tr>
<tr>
<td>Total Sample Weight, (A)</td>
<td>5005.5 g</td>
</tr>
<tr>
<td>Dry weight on 1.6 mm sieve,(8500)</td>
<td>3673.9 g</td>
</tr>
<tr>
<td>Passing 1.6 mm sieve</td>
<td>1326.6 g</td>
</tr>
<tr>
<td>Percent Water</td>
<td>26.5</td>
</tr>
</tbody>
</table>

\[
\text{Percent Wear} = \frac{1326.6}{5005.5} \times 100 = 27 \%
\]

As the laboratory result of the Los Angeles Test shows that we have 27% of loss due to the abrasion. We can use it in our designs. Since specifications of General Directorate of Highways allows us up to %30.
Interview with the supervisor

Q: What is your name?
A: My name is Mehmet Yardım.

Q: What is your position in the company?
A: I am the technical office chief.

Q: What kind of works do you do in that position?
A: The things that I have done in that position is preparing the statements and examining the contracts that are proposed from the sub-departments. Performing on the quantity takeoff and preparing the progress payment for the sub-contractors are part of my job as well.

Q: What is the importance of technical office in a construction company?
A: Since technical offices are made the quantity takeoff, we might be able to say that this is where the payments begin first. For the process of the construction, payments to the sub-contractors must be done regularly.

Q: What a civil engineering student must do to work in that position?
A: I strongly think that a new graduate student must work in a construction area for a few years so that they can control what is going on the construction area. Experience in a construction area is my suggestion to the students who think work in technical office.

Q: Thanks a lot for spending time to me.
A: You are welcome.
CONCLUSION

Consequently, I have to say that through the summer practice I found a great opportunity to understand theory with the applications on the site. I have learnt about the construction stages of a suspension bridge and the structural element that are used in construction of a bridge. The importance of the anchorages and the reason why we manufacture them have been learnt as well. The erection of the tower blocks and the methods that were used observed. As the project does not contain only the bridge, it was suggested me to work in also motorway construction. The engineers helped me to examine the works related to cold laid mixture and warm mix asphalt which is made of bitumen and aggregates. The layer properties of the warm mix asphalt and so on. Besides, I have found chance to examine the works related to tunnel constructions. The things that were told me about the fortifications used for making the ground stable and prevent any landslide that may occur during the excavations. The fortifications used in the tunneling were bolts, bracing, grouting and you name it. The machineries constitute one of the main parts just as material. It was a great experience to learn about the working principles and usage areas of them. Many of the cranes which including a floating crane and its usage were told by the engineers. Since I have found the chance to meet with the technical office chief, I followed the works in the technical office. What a technical office engineer does now makes sense in my mind. I can easily say that quality control laboratories are the main places that permit us working in the site. It is not possible to do any work in the construction area without testing the materials in quality control laboratories. As a result, it could be easily said that summer practice makes us understand the practice of the civil engineering easily since we reinforce our perspectives based on the theory we learnt in school.
REFERENCES


APPENDIX

The appendix covers the brief information about the daily works.
25.08.2014

- Şantiye stajının ilk gününde işe giriş işlemlerinin yapılması için sigorta belgesinin teslimi yapıldı.
- Proje Müdürü Fatih Zeybek ile tanıştı kendi şantiyede çalışabilmek için her çalışanın iş güvenliği eğitiminden geçmesi gerektiğini bildirdi.
- İş sağlığı ve güvenliği süpervizörü tarafından şantiyede uygulması gereken kurallar ve aldıkları güvenlik önlemleriley birlikte iş kazalarının yaşanmamasını sağlamak için çalışıkları belirtti.
- Şantiyede olabilecek kazalar ve yaşanmış olan kazalara dahil bilgiler de sunuldu.
- İş sağlığı ve güvenliği kanununa göre çalışan ve işverenlerin hakları hakkında bilgiler verildi.
- Eğitimin ardından iş sağlığı ve güvenliği hakkında bir sınav yapıldı.
- Şantiyede kullanılan olacak koruyucu ekipmanlar baret, yelek, iş ayakkabısı ve emniyet kemerı teslim alındı.

İmza:

26.08.2014

- İş sağlığı ve güvenliği süpervizörü tarafından verilen eğitim esnasında şirketin düzenli olarak tatbikatlar ve eğitimler yaptığı belirtildi.
- Bugün köprü şantiyeminin kuzey kısmında bir kurtarma eğitimi verildi.
- Kuzey Kenar Açıklık ayağında Batı Segmentinde +17.50 katında çalışan bir işçinin kalp krizi geçirdiği varsayılırak kişinin en kısa sürede müdahale edilerek aşağı indirilmesi sağlanmaya çalışıldı.
- Sedeye alınan kişi halatlar yardımıyla aşağı indirildi.
İş sağlığı ve güvenliği süpervizörü tatbikatların yaşanacak herhangi bir kazada nasıl davranışını bilmek için gerekli olduğunu belirtti. Tatbikatın bir benzerinin 28.08.2014 tarihinden yeniden yapılacağı belirtildi.

Proje Müdürü tarafından devam etmekte olan otoyol inşaatı ve İzmit Körfez Köprüsü hakkında bilgi verildi.

İzmit Körfez Köprüsü ana açıklık itibariyle (1550 m.) dünyanın en uzun dördüncü köprüsü olacağı belirtildi.

Kuzey ve güneydeki kenar ayakları ile kuleler arasındaki mesafe 566 m. olacaktır.

Köprüün toplam uzunluğu 2682 m. olup ileri asma köprü teknolojileri ile yapımı devam etmekteydır.

İmza:

27.08.2014

Betonda kullanılmak üzere alınan agreganın getirildiği taş kırmma ve eleme tesisine gidildi.

Kalite kontrol şefi bölgeden alınan agrega hakkında bilgi verdi.

Konkasörün malzemeyi agrega sınıfları olan 0-5 mm, 5-12 mm ve 12-22 mm olarak ayırdığı belirtildi.

Agreganın organik madde içerip içermedğinin test edilmesi gerektiği ve bunun betonda organik madde kaynaklı problemler yaratması için numuneler alındığı söylendi.

Alınan numunelere metilen mavisi deneyi uygulanıp agreganın kirliliği hakkında sonuçlara ulaşılmaktadır.

Aşınma direncinin yüksek olması gerektiği belirtildi. Aşınma direncinin düşük olması agreganın betonda kullanıldığında mukavemetin düşmesine neden olduğu belirtildi.

Bölgenin fay hatlarından etkileniyor olması nedeniyle aynı ocaktan farklı özellikte agrega alınabildiği söylendi. Bunun kontrol altına alınabildiği için malzemeler düzenli olarak teste gönderilmekte olup çuvallar üzerine tarih, tane aralığı ve hangi labaratuvara gönderilceği yazılmaktadır.
• Üç labaratuvar kullanılmakta olup bunlar IHI, STFA İnşaat ve İTÜ-Marmaray labaratuvarlardır.

İmza:

28.08.2014

• Kule kurulumları devam etmektedir.
• Güney Bloktaki ikinci 8 numaralı bloğun yerleştirilmesi tamamlandı.
• Blok imalatlarının devam ettiği Yaşarsan Gemi İnşaat Sanayi tesislerine gidildi.
• Gemlik Çimtaş fabrikasından gelen blok ve bağ kirişlerinin imalatlarının burada devam ettiği belirtildi.
• 2. ile 12. Blokların yerleştirilmesi TAKLİFT 7 isimli bir yüzdekili vinç ile yapılmakta olup Vinç kapasitesinin 1200 ton olduğu söylendi.
• Bağ kirişlerinin imalatına burada devam edilmektedir ve kaynak ile birleştirme devam etmektedir.
• Bağ kirişlerinin 9. Blokta konumlandırılması söylenildi.

İmza:

29.08.2014

• Bloklarda kaynak işlemi devam ediyor.
• Kulelerde geçici olarak bir kiriş kullanılmaktadır. Sebebi hem ekstra bir çalışma alanı yaratmak ve kaynak işleminde kullanılan araçları depolamak hem de iki ayak arasındaki mesafeyi sabit tutmak olduğu belirtildi.
• Blokların yerleştirilmesinde kullanılan TAKLİFT 7 özel bir şirketten kiralanmış olup 12. Ayağa kadar olan blokların yerleştirilmesini yapacaktır. Ekonomik giderlerinin

- 12. Bloklardan sonrası blok olarak değil panel olarak yerleştirilecektir.

İmza:

01.09.2014

- Daha önce 7 günlük basınç dayanımları alınan beton numunelerinin 28 günlük dayanım sonuçları alındı.
- Kalite Kontrol Teknikeri 7 ve 28 günlük sonuçlarına bakarak sonuçların Karayolları Genel Müdürlüğü’ne verildiğini belirtti.
- Kuzey Ankraj bloğunda beton dökülen 52 West segmentinin kürlenmesine devam ediliyor.
- IHI labaratuvarından gelen 28 günlük beton dayanımları alınan numuneler segmentler ve tarih sırası gözetilerek MS Excel’e girildi.
- Numunelerden alınan sonuçlarda toleransın altında bir değer gözlemlenmedi.

İmza:

02.09.2014

- Agreganın tane sınıflarına bakılarak aşınma dirençleri alınmış ve Los Angeles deneyi sonuçları kalite kontrol teknikerine gönderilmiştir.
- Aşınmadan kaynaklı kayınlık %30’u geçmemesi şartnamelerde belirtilmiştir. Aşınma değeri bu değerin üstünde olan agregalar kabul edilmemiştir.
- Kuzey ayakta Alt Bağ Kirişinin yerleşeceği 9 numaralı bloğun ilki getirilmiş tir. Taklift 7 tarafından kuleye yerleştirilecektir.
- Kuzey Ankraj Bloğu Segment 33 West kürleme işlemine devam edilmektedir.

İmza:
03.09.2014

- Kuzey Ankraj Bloğu Segment 53 (Bati) kalıp imalatı devam ediyor.
- Kalıpların temiz olup olmadığını içinde beton ya da diğer malzemelerin kalıp kalmadığına bakıldı.
- Kenar açıklıklar, geçiş ayakları ve Ankraj Bloklarında C45 sınıfı beton kullanılmakta olduğu söylendi.
- Kuzey Ankraj Bloğunda kullanılan beton numuneler labaratuvarda basınç deneyine tabi tutuldu ve 7 günlük dayanımları 45.5 mPa, 55.5 mPa ve 55.4 mPa olarak gözlemlenmiştir. 28 günlük sonuçlar ise 65.84 mPa, 78.70 mPa, 75.50 mPa olarak gözlemlendi.

İmza:

04.09.2014

- Kulelerde Blokların birleştirilmesi ve kaynak işleri devam etmektedir.
- SW3 nolu blokta devam eden kaynak işleminde kaynak makinasının raylı bir sisyem üzerinde hareket ettirilerek kaynak yapıldığı gözlemendi.
- Kaynakta hataların azaltılması için seramik kaynak altlığı kullanılmaktadır.
- Seramik kaynak altlığı kaynağın yapıldığı yüzeyin arkasına yerleştirilerek birleştirilecek segmentin arka yüzeyinde de kaynağın verimli olarak gerçekleşmesini sağladığı belirtildi.

İmza:

05.09.2014

- Kuzey kenar açıklık ayağında +21,50 kotunda donatı imalatı devam ediyor.
- Betonun sıcaklıklktan kaynaklı olarak terleme yapmaması ve nemini kaybetmemesi gerektiğini anlatıldı.
- Kürleme işleminin betonun mukavemetini nasıl etkilediği hakkında bilgiler verildi.
- Sıcak havalarda beton dökümünden sonra betonun güneş ve sıcakta etkilenmemesi için betonun üzerinde telis ile kaplanmaktadır.

İmza:

08.09.2014
- Soğuk ve sıcak karışımının imalatının devam ettiği plente gidildi. Plentin çalışma mekanizması hakkında bilgi verildi. Sıcak ve soğuk karışım kavramları anlatıldı.
- Plentin soğuk karışım ve sıcak karışım hazırlarken kullanılan agrega tane sınıfları 0-5 mm, 5-12 mm, 12-25 mm ve 25-38 mm olmak üzere 4 sınıftır.
- Terasman seviyesinde gelindikten sonra soğuk karışım, bitümlü temel, binder, aşınma tabakası dökülmektedir.
- Selçukgazi Tünel Şantyeni’ne gidildi. Tünel Yeni Avusturya Tünel Açma yöntemi ile inşaat edilmektedir.
- Bulon ve süren gibi geçici ve kalıcı tahkimatlar kullanılmaktadır. Kalıcı ve geçici tahkimatlar ile ilgili kavramlar tanıtıldı.
- İksalar zeminin kaymasına karşı bir destek görevi görmekte olup zeminin elverişli olmadığı bölgelerde kullanılmaktadır.

İmza:

09.09.2014
- Toprakarme duvarlar hakkında bilgi verildi. Toprakarme duvarların hem yapılan yolda destek sağlamak hem de yola sınır çizmek amacıyla öngermesiz çelikler ve prekast beton paneller ile inşaat edildiği gözlemlendi.
- Temel betonu atıftaßen sonra, prekast olarak hazırlanan cephe panelleri öngermesiz çeliklere bağlanarak üzeri dolgu malzemesiyle kapatılır ve bir üst beton panel yerleştirilerek imalatı aynı şekilde devam etmektedir.
- Temel betonu sınıfı olarak C20 yada C25 betonun kullanıldığını söyledi.
- Viyadüklerde kullanılmakta olan öngermeli kirişlerin imalat alanına gidildi.
- Kirişlerin imalatında C45 ve C55 beton sınıfı kullanılmaktadır.
Kirşlerde beton dökümü gözlemlendi. Beton dökülmesiyle eş zamanlı olarak kalıplar üzerine konumlandırılmış olan vibratörler betonun homojen dağılması amacıyla çalıştırılmaktadır.

İmza:

10.09.2014

- Samanlı tüneli tamamlanma seviyesine gelmiş olup elektromekanik işleri devam etmektedir. Bu tünel Türkiye’nin en uzun otoyol tüneli olacaktır.
- Bitümlü temel ve binder tabakaları dökülen bölgelerden karot numuleri alındı.
- Püskürte betonu atılmış olan 53+900. km sol palye çelik tel ile güçlendirilecektir. Çelik telden alınan numuneler gerekli deneylerin yapılması için İTÜ labaratuvarına gönderildi.
- Kazık beton imalatı devam eden Viyadük 6 dan 3 çift küp numunesi 7 ve 28 günlük dayanımlarına bakılması için alındı.
- 34+900 ile 35+930 arasında sol eksende binder imalatı devam etmektedir.

İmza:

11.09.2014

- 21+000 ile 22+400 arasında sağ ekse deşev dibi drenaj kazıları devam etmektedir.
- 30+300 ile 30+600 arasında eksen sol palye deşev püskürme betonu döküldü.
- Labaratuvarda küp numunelerin kırmı yapıldı.
- 19+700 ile 20+120 km arasında sağ ekse plentmix alttemel imalatı devam ediyor.
- Plentmix alttemelde kullanılan maksimum agrega boyutu 38 mm olduğu belirtildi.
- 19+700 ile 19+140 km arasında sol ekse binder tabakasının serimi devam ediyor.
12.09.2014

- 19+700 ile 19+140 km arasında eksen sağ binder ilk tabakanın serimi tamamlandı.
- 19+700 ile 20+120 km arasında eksen sağ bitümlü temel imalatı devam ediyor.
- 21+000 ile 22+400 km arasında sağ eksen şev dibine drenaj kazısı devam ediyor.
- Nebati toprağın peyzaj alanlarında kullanılmak üzere depo edildiği belirtildi.
- Asfalt emülsiyonu bitümlü temel üstüne döküldü ve test yapıldı.

İmza:

15.09.2014

- 1+365 ile 2+000 km arasında dolgu imalatı devam etmekte olduğu gözlemlendi.
- 15+300 ile 15+800 km arasında drenaj çalışması devam etmektedir.
- 10+700 ile 11+090 arasında sağ ve sol eksenlerde terasman çalışması devam etmektedir.
- Kum konisi deneyi yapıldı.

İmza:

16.09.2014

- Nömayg Anonim Ortaklığı Labaratuvarında yapılan deneyler gözlemlendi.
- Labaratuvarda agregaya uygulanan deneyler hakkında bilgiler verildi.
- Binder tabakasında kullanılan agrega için elek analizi yapıldı.
- Marshall deneyi uygulandı ve deneyin amacı hakkında bilgi verildi.
- Metilen mavisi deneyi yapıldı ve tolerans değerleri hakkında bilgi verildi.

İmza:

17.09.2014
Labaratuvarda bitüm ile ilgili deneyler gerçekleştirildi.
Parlama deneyi yapılarak bitümün kaç derecede parladığı ve yanmaya başladığının belirlendiğine anlatıldı.
Yumuşama deneyi yapıldı. Deneyin hangi amaçla yapıldığını anlatıldı.
Bitüme batma deneyi uygulandı. 50-70 penetrasyon değerleri içinde olup olmadığını baktı. 
Yassılık deneyi yapıldı ve çok fazla yassı malzemenin kullanılmasının dezavantajları hakkında bilgi verildi.
Los Angeles Aşınma deneyi yapıldı. Demir bilyelerle birlikte 500 devir yaptırılan malzeme 17 mm elekten elenerek. Aşınma yüzdesine bakıldı.

İmza:

18.09.2014

- Toprak deneyleri hakkında bilgi verildi.
- Toprağa uygulanan deneylerin elek analizi, renk yöntemiyile organik madde tayini, Proctor, CBR ve Likit-Plastik Limit deneyleri olduğu belirtildi.
- Elek analizi ve Proctor deneyleri yapıldı.
- Likit-Plastik Limit deneyi yapıldı. Deneyin hangi amaçla yapıldığını belirtildi.

İmza:

19.09.2014

- Labaratuvarda küp dayanımlarına bakıldı.
- Küpler 7 ile 28 günlük kırmıllar için labaratuvarda bulunan kür havuzlarına beklentilmiştir.
- Marshall deneyi uygulandı sıcak kırım konulan kabin her iki yüzeyi için 75 vuruş yapıldı.
- Bitümlü temel teorik özgül ağırlık deneyi yapıldı.
Stajın son günü olması nedeniyle koruyu ekipmanlar baret, yelek ve iş ayakkabısı şirkette teslim edildi.

İmza: