Middle

East

Technical

University

Department of

Civil

Engineering

CE300 Surveying

Final

Report

**Submitted by:**

**Project Group:** Subgroup 4

**Course Info:** CE300 Group 5

**Completion Date:** 20.07.2011

**Dates of the practice**: 13.06.2011-08.07.2011

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# Introduction

In the modern society, the purpose of any bachelor degree education is to prepare and qualify the individual for the upcoming professional life. The students therefore attend lectures in their universities on a daily basis every week, absorbing information and taking exams correspondingly.

The students, however, rarely leave the campus for first hand experience necessary to solidify this acquired information, or to enhance it. In the civil engineers’ case, specifically the construction site engineer, it is important to get this experience beforehand in their free time, during a summer practice or an internship. This would help the students visualize some abstract concepts included in the curriculum, and improve themselves on many subjects such as management, professional jargon, construction site capabilities and computer programs. Acquiring such abilities would aid a civil engineer greatly in the professional life, qualifying oneself better than one’s colleagues, providing faster advancement in one’s career. The bachelor program of civil engineering in the Middle East Technical University requires its students to attend two of such programs; one summer practice in the university at the end of the second year, and one internship in an institution of the students’ own choice at the end of the third year of education.

As a student of this department, I and my classmates were obliged to engage in various activities the practice curriculum had to offer, such as field trips, presentations by both the students and teachers, MATLAB programming language lessons and surveying sessions.

**Surveying:** Measuring angles and distances on the site is an integral part of the process of construc- tion, and the mankind has long depended on precise and accurate measurements to create ever-standing constructs. Surveying is the process of measuring and mapping the construction site before and during construction, and one of the longest surviving branches of civil engi- neering. Although mechanical, optical and analog systems were used most recently until the 20th century, only the digital equipment developed in the last few decades are commonly used today.

We used these ultra-sensitive digital equipments—i.e. total stations and reflectors—in our surveying sessions which provided great ease and comfort relative to the older mechanical equipments. (Note that although newer technologies such as GPS, laser rangefinders and field computers exist, these are rarely of practical use in the contemporary construction sites.) We respectively learned how to make leveling adjustments, create curve layouts, building layouts and topographical maps.

**MATLAB Programming Language:** With the advancement of computational technologies, every discipline of engineering has been introduced to newer methods of solving problems. Civil engi- neers can now use computers to conduct excessive iterations in order to solve real-life problems

numerically, rather than analytically. Since the mid-20th century, a variety of computer lan- guages have been implemented for engineering uses, e.g. FORTRAN, C, Java etc.

In our practice, however, we were presented with the popular high-level programming lan- guage MATLAB as an introduction to computational engineering since its clear syntax, flexible structure and simplistic use would provide dexterity for inexperienced programmers. As an introduction to MATLAB, we were presented with the fundamentals of the language such as syntax, conditionals, iterations as well as methods of creating functions and scripts, analyzing data, numerical integration and creating GUIs.

**Field trips:** During their bachelor degree education, seeing real-life examples would help students get acquainted with their profession, gain experience and align their interests accordingly.

For our practice, we visited several sites which included a structural steel fabrication facility, excavation sites, dams, a water treatment facility, a green building, reinforced concrete struc- tures, a concrete railroad tie fabrication facility, a precast concrete fabrication facility, landslide sites and a concrete mixing station.

**Seminars:** There are many sub-disciplines to the discipline of civil engineering, other than first-hand construction. During the practice, it was our teachers’ duty to get us acquainted with many areas of interest such as computational fluid dynamics, green construction materials, effects of global warming on water resources engineering, transportation engineering and computational mechanics of biological systems.

**Presentations by students:** To ensure the permanence of the knowledge acquired during the prac- tice, the students were entailed to make presentations in groups on various subjects encountered during the practice. Our subject was “Sustainable & Green Structures”.

# Activities

## Surveying

The purpose of the putting surveying in the curriculum was to provide an introduction to geomatics since the disciplines of civil engineering and geomatics are inextricably dependent in each other. In order to create a construct on the face of the Earth, one must first go through a thorough procedure of measurements in order to guarantee the sustainability of the construct. In that sense, procedures involved in geomatics comprise the intermediary step between the theoretical design and real-life construct. The discipline of geomatics is therefore an integral part of the process of construction. The curriculum involved various activities including angle & distance measurements, leveling, creating layouts for curves & buildings, traversing, and creating a topographical map of a site for the term project. The aim of this part of the practice was to get introduced to surveying and become adept with using various surveying equipment such as the total station, the leveling rod and the reflector. Each session was divided into several tasks which would carry the students onto the next level of experience.

Figure 2.1: Parts of a total station instrument, with view of eyepiece end of telescope.

### Angle Measurements

**Objective:** The objective of this session was to learn setting the total station up, identifying sharp points and measuring angles.

Before beginning to take measurements, the surveyor must make sure that the plane of the total station must coincide with the absolute horizontal plane. This would ensure the accuracy of the measurements, along with compatibility with the measurements prior. The absolute plane is defined by the plane that is tangent to the earth at the site that is being surveyed. When a finite area on the earth is taken into account, there are normally infinitely many tangent planes corresponding to this area. When taken an area small enough however–actually, the ratio of the chosen area to the ratio of the total area is meant by ’small’–the area becomes euclidean and all those tangent planes approximate to the same tangent plane, hence the consistency of the measurements. For the total stations horizontal plane to overlap with the absolute plane, the physical implications of the mathematical space must be taken into account—gravitation. Considering the earth as a sphere, the gravitational vector field would always direct to the center of this sphere overlapping with the normal vector field to the surface. Therefore by ignoring for a second the fact that the earth is a geoid and adjusting the station accordingly, we would have an approximate leveling with an error no grater than the human error.

The first task was hence to level the total station for the subsequent measurements. Leveling the total station involves adjusting the height of the three foot screws of the station; crude adjustment is done by actively controlling the pond bubble, fine adjustment requires checking the plate bubble. The surveyor first gets into a position facing orthogonally any side of the equilateral triangle formed by the three foot screws. The surveyor then turns the station so that the plate bubble overlaps longitudinally with the line connecting the two foot screws closest to the surveyor. The surveyor adjusts the two closest foot screws, balancing the bubble. The surveyor then turns the total station 90 degrees, and adjusts the last foot screw, balancing the plate bubble for the last time. In a brief explanation, the surveyor first aligned one orthogonal axis, then the other, locking the station’s horizontal plane perpendicular to the gravitational field.

Figure 2.2: Figures showing the steps of leveling adjustment.

Another subject that the students were introduced was the importance of selecting proper sharp points for accurate angle measurement. Long and slim objects, such as flagpoles at a considerable distance from the total station approximate to perpendicular line segments in the mathematical space from the observer’s point of view, thus these objects are perfect candidates for sharp points.

After a few leveling adjustment and sharp point selection exercises, the students were ready to measure angles, e.g. the latest task involved measuring angles from sharp points in several steps to complete a whole revolution, helping observe the human and/or instrumental errors represented by the deviation from the literal value of 400 grads.

### Leveling

**Objective:** The objective of this session was to obtain the elevation points on a straight line in the spectator section of the university’s stadium, creating an elevation profile.

Direct (or differential) leveling technique was used to obtain the profile. The instruments used for this task were the level and the leveling rod. The students had their levels fixed at predefined points with their (points’) elevations given beforehand, and were asked to create the profile on a straight line down the benchmark.

Getting the elevation values are pretty straightforward, contrary to the tasks with the total station. The level is purely an optical instrument, with one degree of freedom—rotating about the perpen- dicular axis. Therefore, once the level is adjusted, one parameter read from the leveling rod would be sufficient to calculate that point’s elevation relative to the benchmark.

**Collimation Error & The Two Peg Test:** The second task of the session was to determine the amount of the collimation error, which is simply the departure of one or more optical elements from the line of sight or optical axis. The process involved comparing elevations from 2 sets of readings, resulting in the error.

The report of this session can be found in the appendices.

### Curve and Building Layout

**Objective:** The objective of this session was to successfully carry the points comprising a layout from 2 dimensional space to a real-life near-flat surface. These layouts included the layout of a curve and layout of a rectangular building.

The process of creating the layout for a curve consisted of making calculations with the required parameters, obtaining the coordinate for a set of points, and then using trial and error to find the loci of these points on the site. The task required using a total station and a reflector, to measure the distance.

The students started to lay the curve out by selecting their initial point on the ground, called ’the point of curvature’. They installed their total stations on the point of curvature, then proceeded establishing the other points using trial and error. The procedure required for first setting the station on the precalculated deflection angle, then moving back & forth over the straight line overlapping the station’s objective axis while trying to find the right distance to the total station. After the

adjustment of the distance, a metal pin was nailed down to the ground in the place of the reflector, and the students moved on to the next point. Eventually, all the points were established, hence the layout of the curve.

For the process of the building layout, the points were calculated beforehand by the instructors. The task is similar to the first one, however simpler, only requiring entering coordinates to the digital interface, i.e. creating a “job” from the menu, then establishing the points with the same method as before.

The report of this session can be found in the appendices.

### Traversing

**Objective:** The objective of this session was to establish the coordinates of the total stations overlooking an area, in our case the rugby field, by traversing. Then the each group would move to its own point and compare the differences and sums of the azimuthal angles from the points of other groups.

Traversing is important and necessary when one total station overlooking an area is not enough to gather data from a site with greater distances and elevation differences. Those kinds of sites would require several total stations, distributed throughout the site by traversing over a straight line or in a closed loop in order to overcome visual impasses created by geological features, etc.

The first task required the students to install their station at any point on the field overseeing the predefined points (traverse points). The students would then obtain the coordinates by using the reflector and the features of the digital interface of the station.

The second task is a check for azimuthal angles. The students would start their measurements from a point in the closed loop formed by the traverse points, and then continue measuring the differences of the angles while proceeding on the loop. They should eventually obtain 0 grads or 400 grads, since they are moving on a closed loop.

The report of this session can be found in the appendices.

### Topographic Survey

**Objective:** The objective of this session was to create the entire topographical map of an area, in our case, the rugby field.

The process of construction involves the act of exploring the site of construction beforehand, since the geological features of the site may affect the process of design. Therefore, the first thing done is to create the topographical map of the site. Data is gathered from the most important features of the land, such as roads, buildings, forest borders etc. Determination of these features would lead to the next step in the process of design.

This session consisted of a single task and that was to get many points as possible in a short period. The students acquired the coordinates from the layout points of important features such as the swimming pool, the rugby field, the road, the forest borders, the beach volley fields etc. A total

number of 110 points were necessary for the map, however we went on and saved 120 points. The measurements were done using the reflector and the total station, and all calculations were handled by the digital features of the station. At the end, the station gave an autocad file and a csv file corresponding to the points and their coordinates (X, Y, and elevation).

Figure 2.3: Graph showing the 3d map of the surveyed field. The csv data acquired from the station were inputted to MATLAB, and it gave this output using cubic interpolation between the points. Our station, station 4 is marked on the map.

## Field Trips

### Atak Mu¨hendislik – Steel Structures – 13.06.2011

Steel has played a decisive role in reaching the modern civilization that is today. There are many areas of use for steel for its versatility and durability, being a construction material is one of them. Furthermore, steel has been embedded in buildings in various ways; in concrete in the form of rebars, beams and columns, roof systems etc. Atak Mu¨hendislik provides a variety of structural steel, from specialized roof systems to standard plates.

After being presented with information on steel, we were allowed to tour in the facility, to be informed on the techniques of shaping and cold-working steel.

Some of the work done by Atak include the roof system above Panora AVM, Adnan Menderes Havalimanı in I˙zmir, ODC ˙I¸s Merkezi in Ankara, Erbil Havalimanı in Iraq, Lafarge Dalsan Al¸cı Fabrikası in Gebze etc.

Figure 2.4: A view from the inside of the steel manufacturing warehouse. The moving bandsaw seen (left) is used to cut a variety of steel structures.

### Pasifik I˙n¸saat & Ege Grup – Excavation – 17.06.2011

Excavations are done when a part of the construct needs to extend to underground, namely the foundation.

An excavation would sometimes require a retaining wall if the load near the excavated area is too much. There are various techniques of retaining walls, but we observed the anchored retaining wall. The process of an anchored retaining wall begins with drilling circular holes of required depth (depth of the excavation). These holes are filled with concrete, which then hardens to constitute the piles that comprise the retaining wall. After all the piles are ready, the workers then start to excavate. As the piles begin to be revealed, the workers drill 30m long near-horizontal holes between the piles. The anchors are then placed within these holes, a bunch of high quality spiraled 7-part steel ropes, hold together by a special plastic structure to form a bunch of 5 steel ropes. After being placed in the hole, grout is poured into the hole, which expands into a bulb-like structure to form the base of the anchor. The bunch is stressed to a load of 10 to 30 tons in order to carry the load behind, which is then sealed into the hole by a special plastic aperture on the retaining beam. The excavation continues until another set of anchors is necessary, and this goes on until the desired depth is reached.

### Kurtbo˘gazı and E˘grekkaya Dams, I˙vedik Water Treatment Facility – 22.06.2011

#### A Brief Terminology

**Dam:** A dam is a barrier that impounds water or underground streams.

**Embankment dam:** An embankment dam is typically created by the emplacement and compaction

Figure 2.5: A retaining wall in the Pasifik excavation. Tips of the tiebacks can be seen between the columns and on the retaining beams.

Figure 2.6: The spillway of the Kurtbo˘gazı Dam.

of a complex semi-plastic mound of various compositions of soil, sand, clay and/or rock, usually from the site of construction.

**Spillway:** A spillway is a section of a dam designed to pass water from the upstream side of a dam to the downstream side.

**Deviation tunnel:** Tunnels constructed to alter flow direction of a river bed.

**Dead volume:** Amount of sediment expected to accumulate in a dam throughout its economic life.

**Drainage area:** An area of land which drains into one point.

**Reservoir:** An artificial lake used to store water.

Designing and building dams is one the objectives of the hydromechanics division under civil engi- neering. Thus we visited two of the dams closest to Ankara, Kurtbo˘gazı and E˘grekkaya dams. These embankment dams provide water storage for the city of Ankara and are adjacent. Here is some information on these dams:

Kurtbo˘gazı Dam was constructed between the years 1963-1967 in southern Ankara. The dam is connected to the Ivedik Treatment Plant by two 2200 mm pipes. Distance between Ivedik Treatment Plant and the dam is 47 km. Total maximum water volume is 97,947,000 m3, dead volume is 5,922,000 m3, and lake area is 5.5. km2.

E˘grekkaya Dam was constructed between the years 1985-1992 to feed Kurtbo˘gazı Dam. It is located 75 km to Ankara, in Kızılcahamam. The dam is connected to Kurtbo˘gazı Dam by a pipeline of 15 km long and 2200 mm wide. Total maximum water volume is 112,300,000 m3, dead volume is 27,500,000 m3, and lake area is 1.91 km2.

#### I˙vedik Water Treatment Facility

The water stored in the Kurtbo˘gazı Dam comes to the ˙Ivedik water treatment facility for treatment, before being ready for public use. This water gets mixed with the water coming from the C¸amlıdere dam after being aerated. The facility is located in ˙Ivedik Ankara, and is among the ten biggest water treatment facilities in Europe. It had been constructed in 1969, with a service life of 50 years. Here is a brief description of the processes involved in water treatment.

**Aeration:** The water is mixed to liberate dissolved gases and to suspended particles in the water column.

**Flocculation:** The materials and particles present in the water (clay, organic material, metals, mi- croorganisms) are often quite small and so will not settle out from the water column without assistance. To help the settling process along, aluminum sulphate and polyelectrolites are added to the water, and suspended particles stick together to create large and heavy clumps of material.

**Sedimentation:** The water is left undisturbed to allow the heavy clumps of particles and coagulants to settle out. Additional chlorine, activated carbon or potassium permanganate may be added if necessary.

Figure 2.7: The steps of water treatment.

**Filtration:** The water is run through a series of filters which trap and remove particles still remaining in the water column. Typically, beds of sand or charcoal are used to accomplish this task.

**Disinfection:** The water, now largely free of particles and microorganisms, is treated to destroy any remaining disease-causing pathogens. This is commonly done with chlorination, ozone, or ultraviolet radiation.If necessary, lime can be added for pH regulation. The water is now safe to use and is sent to pumping stations for wide distribution.

Figure 2.8: A view from the aeration chambers in the ˙Ivedik Water Treatment Facility.

### Eser I˙n¸saat – Green Buildings – 24.06.2011

There are a lot of aspects to the subject of environment friendly buildings, but only a brief abstract of the concept and an overview of the trip are going to be presented in this report.

Environment friendly design is a concept that has been around since the 1970s, however recently acclaimed in Turkey. Efforts for green started with the 2000s, and many pioneers appeared since on the market, like Eser ˙In¸saat. While building their new headquarters, Eser ˙In¸saat avoided no expense in order to make their building sustainable and environment friendly. The building received the platinum LEED certificate.

Figure 2.9: The side view of the Eser Building. The structure in the front has solar panels over its branches; a rather idealistic approach from Eser ˙In¸saat.

For their building, Eser Holding used many systems, dynamic and static, in order to make their building energy and water efficient. First of all, the building went through a state of the art isolation to prevent heat loss, with the walls and windows. All of the illuminatory devices in the building were hooked up to a central mainframe to regulate and optimize the electric consumption. The toilets had double flushing options, and the urinals did not need water at all. The gray water produced in the building was utilized for a second time where pure water was not necessary, like the toilets. The paint used in construction was made sure to be minimum on emission of carcinogenic organic compounds, and a state of the art ventilation system was installed. Solar panels were utilized in various places. A system was installed to send and bring water from 20m underground in order to benefit from the advantages of temperature difference. These are some of the examples from the Eser Building.

### Gimat A.S¸. – Reinforced Concrete Structures – 27.06.2011

Reinforced concrete has been developed in order to reduce the disadvantages of concrete which are its structural weaknesses. Concrete is not the most ideal material to withstand tension, therefore it is embedded with the most feasible champion of tension—steel. With concrete’s resistance to com- pression and steel’s resistance to tension, reinforced concrete becomes the most suitable construction

material in the world,

Figure 2.10: Workers setting up the structural steel that is going to constitute the foundation beams of the shopping center.

Figure 2.11: The steel construction roof of Gimat Headquarters.

### Ilgaz Ltd. & KAM A.S¸. – Prestressed Concrete Railroad Ties & Precast Concrete Structures – 29.06.2011

The 19th century of history has witnessed the industrial revolution, and dawn of the railroad transit. Mankind made it possible to travel long distances with less effort, through the invention and im- provement of the steam engine. Part of our civilization was built over the possibilities that this fast transport system could provide.

Since its first invention, the train was improved and developed constantly, starting from the steam engine, moving on to the diesel engine, further onto the electric engine. Throughout the 19th century,

Figure 2.12: Railroad ties manufactured in Ilgaz facility being presented to the visitors at the entrance of the facility.

however, the inseparable companion of train did not witness many breakthroughs—the railroads. The purpose of the railroad was to provide a medium that the train could proceed through with the responsibility of being durable and unyielding, independent of the surrounding environment.

The traditional railroad is composed of two structures: the rail and the tie, and all types of railroad tracks are built through various combinations of these. Although various types of rails existed with different cross sections, the railroad tie never needed any superficial improvement because of the sufficiency of its simple structure, namely the rectangular cross section. Any improvements, if could be done, would apply to the material that comprised the tie, and wood was the most durable and feasible option for a long time.

After wooden ties, the reinforced concrete ties were introduced in the 20th century, with the structural disadvantages brought by concrete. The steel was placed in the tie longitudinally, however this was not enough to provide the structural integrity required to withstand the dynamic train loads. Under these loads, the tie would eventually develop cracks of considerable size and would fail. The lack of fatigue resistance would also have an effect on the tie’s economic life.

To overcome these problems, engineers presented many alterations in design:

* The steel would be stressed before the tie’s construction, providing increased durability. Any superficial cracks would spontaneously disappear, and the tie would be more resistant to tensile loads with an additional cold working.
* The rails would be arranged so that they would not contact the ties. An absorbing material would be interposed, e.g. polymer bands, which would absorb and dissipate the load at the moment of impact.

The Ilgaz factory is currently contracted with the TCDD (Tu¨rkiye Cumhuriyeti Devlet Demiryolları) and the main manufacturer and distributor of concrete ties in the inner Anatolia region.

#### KAM Precast Concrete Factory

Concrete has a long history extending to the Roman Empire with a period discontinuation stretching from the fall of the Roman Empire to the beginning of the 19th century. The 19th century witnessed the concrete revival, with the widespread use of Portland cement. One breakthrough in the history of concrete was the invention of processes for precast concrete in early 1900s by the city engineer John Alexander Brodie.

Figure 2.13: Precast concrete floor tiles stockpiled in the KAM facility.

The principle of precast concrete is casting the concrete in a reusable mold, curing it in a controlled environment and transporting it to the construction site for assembly. This increases the quality of the concrete and notably shortens the period of construction, e.g. up to 1/5th or 1/6th of the original duration of construction. Some disadvantages of precast concrete arise from the fact that the structure is not monolithic, therefore more susceptible to damage during earthquakes. In the case of negligence, the building has a much higher possibility of collapsing, the example being precast structures in the industrial site in Du¨zce during the earthquake in August 17th 1999.

KAM Beton is the leading manufacturer and a pioneer in the market, with large facilities and many high-profile contracts (e.g. the IKEA store in Mamak, Ankara) KAM is an active developer, having contributed with the patented C-Strong technology, which allows the construction of monolithic 30m long precast columns.

### 2.2.7 Landslides – 30.06.2011

The responsibility of dealing with landslides belongs to the soil mechanics division, and a landslide is basically defined as any kind of ground movement, with the primary driving force being gravity. We visited a few sites of landslide, all of them the type of earthflow.

These were all slow paced earthflows, and possessed no imminent danger, however one landslide did damaged the driveway. This road faced a landslide with the rate of 0.3m/day, which caused observable differences between the visits.

Figure 2.14: A piece of road damaged by the slow-rate earthflow at the site of the landslide.

### 2.2.8 Oyak Beton – Concrete Mixing Station – 30.06.2011

Concrete has been used as a construction material for a long time, the Romans being the first ones to use. A traditional mix of concrete is composed of Portland cement, fly ash, aggregate, water and chemical admixtures.

Oyak Beton provides one of the most standard and highest quality concrete for constructions through- out Turkey. The facilities in Yuva K¨oyu¨ Yenimahalle work non-stop with maximum efficiency, using two mixers. The mixers mix on a certain schedule; the ingredients must be mixed with exactly 5 revs for each batch of concrete, otherwise the batch would not reach the desired strength. Each transmixer is allowed to carry a load of 8 tons, under recent regulations.

## MATLAB Programming Language

As previously mentioned in the introduction, with the advancement of computational capabilities of computers, entire sub-disciplines emerged within every area of science and engineering that dealt with theoretical models. Methods that required systems with iterative capabilities were already being developed from the beginning of the 20th century; these methods, however, could not find any practical use due to the lack of computers.

In 1950s, the Algol programming language broke the chains, followed by FORTRAN which revolution- ized computational engineering. These cleared the path for the birth of numerous other languages including MATLAB, which appeared in the late 1970s. The advantages of MATLAB include its clear syntax, framework built for mathematics, GUI support and built-in functions that provide ease in plotting, statistics, equation solving, engineering etc. MATLAB was chosen for the practice due to these reasons.

Figure 2.15: The silos from the Oyak Beton concrete mixing station containing concrete ingredients such as cement.

### Introduction to MATLAB

In the first lecture, the students were given information on various programming concepts such as parallel computing, high level & low level languages etc. Then the students learned about the user interface that is shipped with MATLAB, followed by the methods of assigning variables, built-in data types, mathematical operators, mathematical functions and terminal commands respectively.

Assigning variables:

>>>x=5;

The variable x is now equal to 5. The semicolon prevents any output from being written.

The mathematical operators for scalars are the standard + for

addition, - for subtraction, \* for multiplication, / for division and ^ for power. When vector arrays are handled, one must put a . before the multiplication and division operators.

When backslash is used is used instead of slash, the division operation gets inverted. ’ is the inverse operator for arrays.

The standard \* becomes matrix multiplication when making operations with matrices. The division means that the nominator ins multiplied with the inverse of the denominator. One must make sure that the array sizes agree before making operations.

The standard mathematical functions are sin(), cos(), log() etc.

### Fundementals of MATLAB

In this lecture, the students learned about assigning vectors, data sets, matrices and matrix opera- tions. The students were shown the methods for basic 2d and 3d plotting, and asked to compute with mathematical functions.

The standard definition of a vector array is:

>>>a=[1 2 3 4 5]

One could put a ’ at the end of the expression if a column vector was desired. An example matrix declaration is:

>>>A=[1 2; 3 4]

where the semicolon represents the row change this command would create a matrix A such as:

A=|1 2|

|3 4|

The command ’>>>a=0:0.1:10’ would create a 100 cell sized array with a=[0.0, 0.1, 0.2, ... , 9.9, 10.10]. In the expression a:b:c, a vector space would be created with a & c as the lower bounds and b as the step size. If one wishes to express the cell size rather than the step size, one could use the function linspace(a,b,c) where a and c would be the bounds and b would be the number of cells. One could create an array of zeros with the function zeros, such as zeros(a,b) where a is the number of rows and b is the number of columns.

### Functions & Scripts in MATLAB

The students were first given information on relational and logical operators, conditionals, flow controls and debugging. They then learned about defining global variables, structs and writing functions and scripts, which is basically writing MATLAB commands in a plain text file.

Basic loops are formed with the expressions:

for a:b:c \*newline\* expression \*newline\* end

while expression \*newline\* expression \*newline\* end

If conditionals: >>>if expression \*newline\* expression \*newline\* end The logical operators are & (and), | (or), xor (exclusive or) and ~ (not).

Relational operators are == (equal to), ~= (not equal to), >=

(greater or equal), <= (less or equal), > (greater than), < (less than).

The expression >>>global a defines the variable a as global.

Scripts are MATLAB commands listed in a plain text file with ASCII. Structs are created simply by defining a main array and assigning different attributes to the members of these array, just by appending

.attribute to the end of the array, e.g. the expression student(2).name would address the ’name’ attribute of the second member of the ’student’ struct.

There are different ways of defining functions, the difference being the syntax. If you would like to define a function in a line, you could write e.g. >>>square = @(x) x.^2

where the function square(a) would give the square of a. If a more complex definition was required, one could write

>>>function a=b(c) expression

end

where a is the output argument to be assigned in the \*expression\*, b is the function name and c is the function parameter.

### Data Analysis w/ MATLAB

In this lecture, the students were introduced to basic data analysis with MATLAB. They were given a text file with the acceleration readings from a seismograph, and were asked to numerically integrate the velocity and displacement functions using the trapezoidal rule.

file=fopen(’data.txt’,’r’); %the file is opened by matlab acc=fscanf(file,’%f’,5436); %acceleration data is scanned from the file

acc=acc’; %the array is inverted to form a column vector vel=zeros(1,5436); %zero vectors are prepared for the subsequent iteration dis=zeros(1,5436);

t=zeros(1,5436);

%the displacement and velocity values are obtained by using the

%trapezoidal rule. for i=1:length(acc-1)

vel(i+1)=vel(i)+(acc(i+1)+acc(i))/2;

dis(i+1)=dis(i)+(vel(i+1)+vel(i))/2; t(i+1)=i;

end

%the next step is to plot, but it is unnecessary to show here,

## Seminars

### Computational Fluid Dynamics – Asst. Prof. Dr. Mete K¨oken

As a major branch of engineering, civil engineering has many sub-disciplines that focus on fluid mechanics such as hydrology, water resources engineering, coastal engineering etc. Like the other branches of engineering, the processes involved in these fields incorporate core engineering principles like efficient problem solving and sustainable design. The goal is generally to create a structure that would interact with fluids, to simulate an event that involves fluids or both. When compared to the disciplines that deal with solid mechanics, fluid mechanics contain more dynamic and less conventional problems, in which the methods of solving problems vary with constantly changing

Figure 2.16: The results of the integration from the data analysis lecture. The acceleration readings were given, and were integrated twice to obtain the velocity and displacement.

irregular shapes that are difficult to model. Being dynamic as they are, fluid problems generally involve many steps of calculation.

Figure 2.17: A practical use for CFD in coastal engineering: it can be utilized for modeling the dissipation of contaminants and flow directions.

As mentioned before in the introduction, fluid mechanics is one of the disciplines of engineering that cannot go without utilizing computers to solve problems. The difficulties of solving such problems increase with the amount of irregularities and asymmetries in the model, so engineers eventually decide upon the benefits of using numerical techniques of solving methods. Let it be the design of a spillway or the analysis of dissipation of a contaminant, every analysis done would go through a phase of simulation using the finite element method or else before any project is carried onto the real world. Dr. K¨oken provided an introduction to CFD and presented informative visual material on the subject.

The process of simulation generally involves laying the governing differential equations out, e.g. Navier Stokes equations. The engineer would then discretize the system using either one of the finite element method, finite volume method, finite difference method, boundary element method etc. The engineer would either code the whole system into the computer, or use specialized computer software such as FLOW3D.

### Green Construction Materials – Asst. Prof. Dr. Sinan T. Erdo˘gan

Instead of giving an ordinary presentation on green construction materials, Dr. Erdo˘gan introduced some concepts on sustainability, environment friendliness, and philosophical background of becoming green.

The concept of sustainability have been around for at least 40 years, and it is at the times that environmental damage begins to take its effect on human lives that societies begin to admire the necessity of enforcement of environment friendliness. Although greenness and sustainability are different concepts, they are become interconnected when dealing with a closed ecosystem.

Figure 2.18: CFD modeling of a spillway. The color gradient represents velocity.

Sustainability is one aspect of environment friendliness, since a construct that is sustained for a long times would not require for another one to be built. There are three crucial prospects to sustainability: environment, society and economy. One of the arguments state that without the completion of these three pillars of sustainability, the society would eventually collapse.

Dr. Erdo˘gan then gave examples of efforts for sustainability throughout the world, and stated that there is a lag of 30 years for constructional and environmental technologies between developed and undeveloped countries.

### Network Traffic Management under Disaster Conditions – Asst. Prof. Dr. Hediye Tu¨yde¸s Yaman

Transportation engineering is a subdivision of civil engineering, and handles pretty much everything that has anything to do with transportation, while making use of statistics, analogical models to fluid mechanics etc. Dr. Tu¨yde¸s provided an introduction to the subject by narrating her academic experience as a grad student, her area of interest being the optimization of vehicular traffic during disasters.

Dr. Tu¨yde¸s explained that a network of fluid flow would suffice as an analogical models, despite the approximations arising from the fact that traffic is composed of discrete packets of material, contrary to the continuous mathematical model. The research unrevealed that the first residents to escape the region of disaster were the ones most distant to it; this aspect of the model is purely mathematical, disregarding the fact that the residents closest to danger would need immediate rescue. This, however, has a higher possibility of leading to congestion, endangering more lives. Therefore the system requires the sacrifice of the residents closest to danger, for a better survival. It is quite convenient that engineers do not have to deal with the ethical aspects of their research results.

### The atmosphere, global warming and its consequences on water resources

**engineering –Assoc. Prof. Dr. I˙smail Yu¨cel**

Global warming is the most important problem of the 21st century. Its driving force is the increasing amount of greenhouse gases, resulting from human activities such as deforestation and burning of fossil fuels. Its consequences include an overall raised temperature of the earth, which is going to cause catastrophic events worldwide, affecting many people’s lives.

The water cycle is currently being affected by the raised temperatures with the rising sea levels, retreating glaciers and shrinking Arctic Circle. Global warming pushes the climate into both extremes, increasing the number of disasters such as floods, drought, heat waves, blizzards and cyclic storms. The water cycle is entering into a vicious cycle, upsetting the water resources irreversibly. With the disturbance of the Gulf Stream, the rate of climate change would be accelerated. Excessive CO2 is absorbed by the ocean, causing the ocean to become saturated with CO2 and warming the ocean surface gradually. Freshwater sources are being depleted constantly; valuable resources are being contaminated due to excessive saltwater and eutrophication. Global warming acts as a biological sieve, allowing the most aggressive and swarming species, that can suit themselves to warmer habitats, to survive. Species of destructive algae conquer still water habitats, suffocating other species and ruining freshwater resources.

### Computational Modeling of Synthetic and Biological Materials – Asst. Prof. Dr. Serdar G¨oktepe

As mentioned before in the previous sections, computational mechanics is a relatively new and bare branch of engineering that attracts attention of the science community. Dr. G¨oktepe presented the audience the subjects of computational mechanics of rubbery polymers and the human heart.

Although depending on similar principles, modeling fluids is quite different than modeling solids; even solids have different types with different features to be modeled: viscous, plastic, etc. We were presented with an in-depth knowledge of the steps considered when modeling. When modeling, one must determine the type of problem, derive the governing differential equation and constitutive equations, decide upon the methods of discretization to be used, create matrices for the elements, determine the IVs or BVs, solve the equations at these values etc.

Dr. G¨oktepe demonstrated the biomechanical side of civil engineering, and showed methods of modeling biological systems for different circumstances from simulating the standard bio-electro- mechanical behavior of the heart, to modeling the disturbances caused by perturbations and the subsequent methods of defibrillation.

## Presentations by the Students – Sustainable and Green Struc- tures

For the summer practice, it was the students’ duty to prepare presentations about various subjects encountered during the field trips. Our subject was “Sustainable and Green Structures” and other

Figure 2.19: Finite element modeling of a uniaxial tension test with neck localization.

members of the group were Canan Elif S¸im¸sek, Sinem Songu¨r, Onur S¸im¸sek, Koray Soyal and Berkan S¨oylemez.

The presentation was done in three parts by three of the group members. Here is an abstract of the presentation:

* An introduction with an overall information on green buildings. These include the definition of sustainability and green, a short history of environment friendly structures and the reasons for building green (such as environment friendliness, economy and prestige).
* A coverage of the concept of efficiency, with references to energy efficiency, water efficiency and material efficiency. An overall information on the LEED certificate.
* A part on the present and future of green structures and environmental design including some inner reflections on the concept. A reference to newer technologies, examples of these on the market, a criticism of the LEED certificate and the results of environmental damage.

# Conclusion

The curriculum of the summer practice offered us many activities, all of them suited for and relevant to civil engineering.

The surveying course has been a standard for civil engineering education. Our department offered this course in the summer practice. We enjoyed the plenitude of outdoor activities, and learned how to use the total station, level, reflector and leveling rod to create profiles, layouts and topographical maps. Our technician and instructors were friendly, aided in the process of education and did not hesitate to answer questions.

In our field trips, we visited several sites of excavation, construction, fabrication, landslide etc. Gaining this first hand experience helped us visualize the concepts introduced in our courses. In fact, the experience was quite different than expected; the practical side of civil engineering has many concepts that are not presented in traditional courses, such as professional jargon, equipment utilization and construction management. These trips helped students expend their view of their profession.

MATLAB courses proved themselves to be quite useful, as a preparation to the next years CE305 Nu- merical Methods for Engineers course. Due to a lack of enthusiasm with the students and supervisors however, the courses did not get the positive feedback they deserved.

The seminars given to the students also proved themselves to be useful. The students enjoyed the interaction with the faculty members, and were interested in the subjects presented. The subjects chosen for the seminars provided a broad sense of understanding of the academic research going on in the department. These subject covered the computational and environmental aspects of engineering, and transportation engineering.

In my opinion, the presentations given by the students were actually unnecessary and helped fill the last week of the practice. I believe that the department can find an activity instead of student presentations for the next year.

# Glossary

e.g. exempli gratia (Latin) 3

etc. et cetera (Latin) 3

i.e. id est (Latin) 2

GPS Global Positioning System 2

GUI Graphical User Interface 3

km kilometer 11

LEED Leadership in Energy and Environmental Design 13

m meter 11

mm millimeter 11

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