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Determination of Optımum Irrigation Network in Land Consolidatıon Projects

Ela Ertunç, Tayfun Çay*

[1] *Department of Geomatic Engineering, Selcuk University, Aleaddin Keykubat Campus, 42030, Turkey*

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Abstract: In our country as it is all over the World, agriculture is extremely important in terms of food security and rural development. Food demand which increase as correctly proportional to population growth, unplanned urbanization and industrialization increase the pressure on land. The most important issue in order to sustain agricultural production is agricultural enterprise structure and the presence of land. A strong enterprise structure, the presence of sufficient size lands and efficient use of lands is of great importance in terms of the future of agriculture sector. It is necessary for sustainable agriculture that a strong enterprise structure is created and problems that threaten production are addressed. Therefore, land consolidation is used as one of the most effective land management tools. The areas where land consolidation is most used are irrigation areas. In particular that irrigation projects are done together with the consolidation save up to 40% in irrigation investment costs. With the new parcels formed after the consolidation, the agricultural infrastructure is adapted to modern agriculture, the efficiency of the watering is increased, the use of labor and input used in production is reduced, and the productivity of enterprises is increased. In addition, irrigation ratios and yields are increasing. In this study, Land Consolidation project in The Üçhüyük Neighborhood (Çumra-Konya-Turkey) has been used as a sample project. In Land Consolidation projects, it has been explained how the irrigation network affects the progressive stages of the project and how that should be determined as optimum.

Keywords: *Land Consolidation, Irregation network, rural area, Land management*

Introduction

The population of the world is now about 7.3 billion. The datas of The United Nations predicts that this population will reach to 9.7 billion by 2050. That food needs of growing world population are met is possible that agricultural production is increased. Şengün (2006) has stated that the world agricultural production must be increased by around 40-50% in 30-40 years and that 60% of this increase will be in developing countries. Also, he told that this increase which needs might be possible that agricultural areas are expanded, that seeding frequency is increased or that agricultural productivity is increased.

One of the most important implementations of the Agricultural Development Programs in our country is the rural area regulation. Rural area regulations, which is called as the Land Consolidation process, are the process that multiple parcels, which are different places and different sizes, belonging to landowners are given the appropriate size in designed blocks, where there is road and water connections, by bringing them together according to parcel indices (Ayten et al., 2007).

Land Consolidation, which is one of the most important issues in the planning of soil and water resources and forms the basis of rural regulation, enables to other agricultural infrastructure services, for example construction of field group roads, irrigation and drainage network installation, land reclamation, land leveling, conservation and development of soil and water resources (Yılmaz and Çiftçi, 2005).

Lands at large scale and efficient use of lands together with a strong enterprise structure have a great significance in terms of future of agriculture sector. For sustainable agriculture, They are necessary that a strong business structure is created and that problems that threaten production are resolved. Therefore, land consolidation is used as one of the most effective land management tools. Irrigation areas are the areas where land consolidation is most used. Especially that irrigation projects

* *Corresponding: E-Mail: tcay@selcuk.edu.tr; Tel: +905425944963; Fax: +90 3322410635*

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are done together with the consolidation reduces up to 40% the investment costs for irrigation in addition to production and yield increases. Along with new parcelation which formed after land consolidation; agricultural infrastructure is make suitable to modern agriculture, efficiency of irrigation is increased, the use of labor and input used in production is reduced, and the productivity of enterprises is increased. In addition, irrigation rates and yields increase. While irrigation projects are planned, many factors, e.g. soil, topography, plant and human factors, must be investigated very well. Also, irrigation system and irrigation method should be selected and projected as best suited to the conditions. In order to provide that agricultural activities which will be held in the project area become efficient, these must be planned and projected together with land consolidation projects. Land consolidation eliminates expropriation costs in irrigation projects. Also, it leads to decline in a significant amount at construction, operation and maintenance costs. That modern closed irrigation systems providing technically and economically high standards are applied in irrigation projects contributes significantly to farmers and a country's economy.

Land Consolidation facilitates the construction of irrigation, drainage and transport networks. Because parcel forms, transportation to parcels and topographical structure of parcels are corrected after consolidation, irrigation rates and accordingly irrigation efficiency are increasing. In irrigation projects carried out together with Land Consolidation studies, land losses in parcels where irrigation and transportation lines pass can be eliminated without the necessity of expropriation because share of participation for common facilities is distributed equally to all parcels on a field (Kumbasaroğlu and Dağdemir, 2007).

The first informations in land consolidation projects is very important. Based on the datas obtained from this informations, the project factors which are very important for a project obtain. The most important of these project factors is block planning. The block planning is one of the most important factors that constitute road and irrigation network which direct consolidation. Road and irrigation networks are the most of components which form the cost in projects. they increase or decrease the costs in projects. Therefore, block planning must be done by designing very well, and the project must be finalized without much change in the coming days. Block planning, which are road network and irrigation network, constitute the skeleton of land consolidation projects (Erkan, 1985). This skeleton is prepared in the most appropriate form to requirements and needs of area where will be done Project. While block planners are making their plans, They make planning by taking care that road passes at least one edge of each new parcel which will occur and that each new parcel reaches this network if there is an irrigation network.

In this study, Land Consolidation project in The Üçhüyük Neighborhood (Çumra-Konya-Turkey) has been used as a sample project. In Land Consolidation projects, it has been explained how the irrigation network affects the progressive stages of the project and how that should be determined as optimum.

Materials and Method

In this study, the project datas of Üçhüyükler Neighborhood (Çumra-Konya-Turkey; Figure 1) has been used. The end date of the project is 20 October 2016. Initially the projects were executed by Konya Regional Directorate of Agricultural Reform (KRDAR). After KRDAR was closed, Konya Directorate of Provincial Food Agriculture and Livestock (KDPFAL) have continued the works of these projects. Therefore, the datas for this project were obtained from KDPFAL. This project area is 875.69 hectares. In the project area, the number of cadastral parcels is 265, and the number of agricultural enterprises is 274 (Figure 2). 17 blocks were created in the project area after the consolidation (Figure 3).

In the Land Consolidation studies, project process steps are carried out under four headings, which are preliminary etudes, planning, project and application. The creation of blocks, namely the creation of irrigation network and road network, is the step most important part of the planning process. Block planning, which are road network and irrigation network, constitute the skeleton of land consolidation projects (Erkan, 1985). This skeleton is prepared in the most appropriate form to requirements and needs of area where will be done project.

Irrigation and drainage networks meet in a balanced manner the water needed for plants in the field of agriculture (Sungur, 1993). Irrigation networks are agricultural facilities where water is given to soil in a controlled way for plant production. Irrigation projects come from the facilities and from

technical and biological measures taken in irrigated agricultural land along with engineering facilities where water is supplied and transported and distributed (Çevik and Tekinel, 1990).

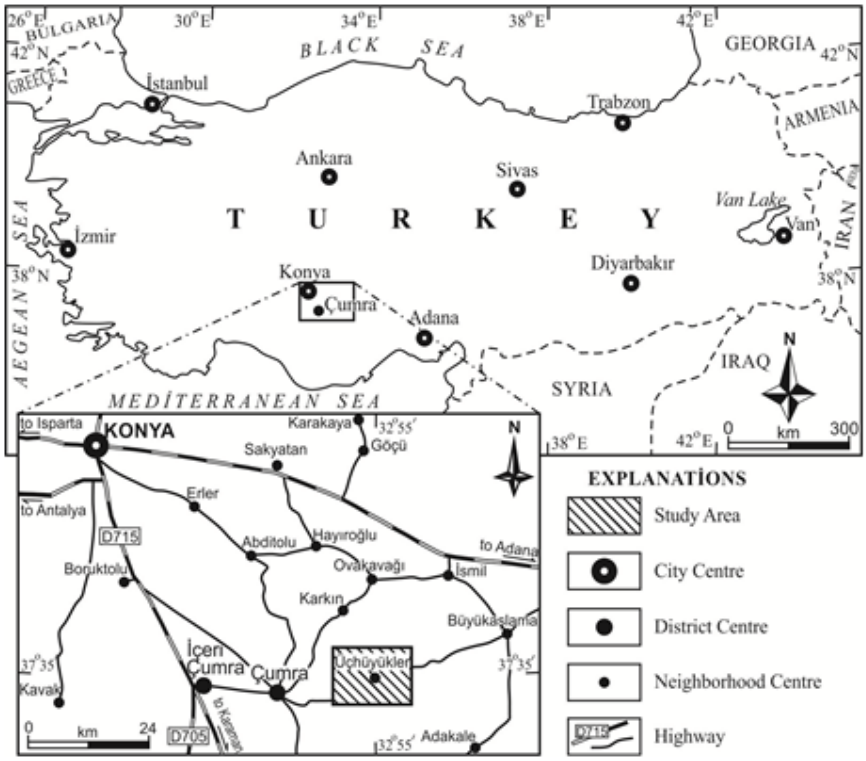

Figure 1. Project area

Figure 2. The cadastral state of Üçhüyükler Neighborhood

In Land Consolidation projects, irrigation network is a system consisting of irrigation and drainage channels. The system which carries to the project area by taking irrigation water from the water intake structure, such as bottom sluice of dam, regulator, pool and free water intake outlet, offers this water for plant use and distributes to the smallest capacitive outlets is called as irrigation network. Irrigation networks are gathered in 4 groups, which are irrigation networks with open channel, canalette irrigation networks, tubular irrigation networks and sprinkler irrigation networks. Irrigation channels which are located in irrigation networks with open channel built as shallow in order to irrigate the land and built as usually concrete coated in order to prevent seepage losses. These channels are divided into three groups according to their functions. These are Main Irrigation Channel, Spare Irrigation Channel and Tertiary Irrigation Channel.

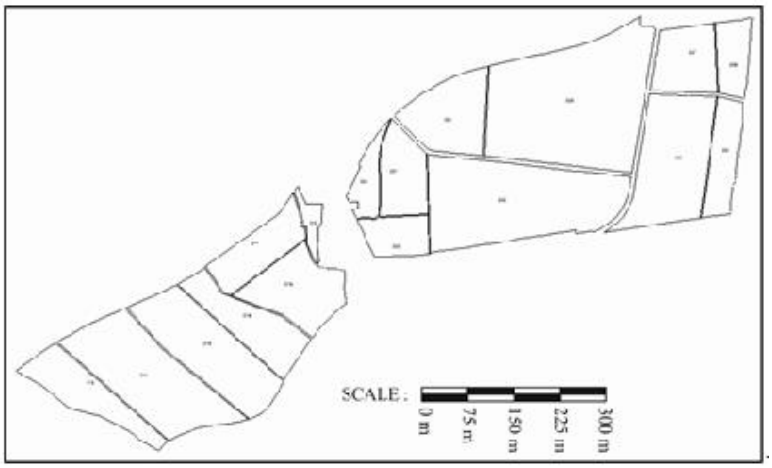

Figure 3. The block plan of Üçhüyükler Neighborhood

Main Irrigation Channel: The channels that carry the spare irrigation channels by taking irrigation water from the water intake structure is called as the main irrigation channel. These channels that draw the upper limit of the irrigation area may have a length of 20-150 km depending on the size of the irrigation area. The amount of irrigation water, the topographical structure of the route and the size of the irrigation area play an important role in selection of slope of the main channel. The slope of the main channel is taken from 0.0002 degrees to 0.0006 degrees.

Spare Irrigation Channel: The channels that convey to tertiary channels by taking the water from the main channel is called as Spare Irrigation Channel. These channels that are passed perpendicularly to the level curves between the two collecting drainage channels follow the boundaries of roads and parcels on condition that they pass through the back and the dominant places as much as possible. For this reason, the slope of these channels depends on the slope of the land. The most important artifacts on Spare Irrigation Channels are tertiary outlets. Tertiary outlets is putted reciprocal immediately after the outlet of the main channel are 350 - 400 m and 500 m at most. there isn't any limit for the lengths of the spare irrigation channels whose distances are 4-5 km each other in appropriate topographic conditions. Because the function of this channel is to supply water to the tertiary outlets, it can disappear at the excavation between the two tertiary outlets. After the spare channel gives water to the last tertiary outlet, it is connected to the main drainage channel from the shortest route in the case of excavation under the name of the reservist evacuation.

Tertiary Irrigation Channel: They put across the water which is take from reserve to the farm outlets which are located above them, make one-way watering and are built with 250 m intervals. their routes track the boundaries of the parcel and the bottom of the road. Their slope is between 0.0002 degrees - 0.0006 degrees as in the main irrigation channel. These slopes provides that the current is in the river regime and that the channels which are connected to themselves are connected vertically to this channel in the tertiary channels. But, their slopes are usually selected as 0.0004 degrees so that the speed is not too small. Tertiary channels are connected to the tertiary drainage channels which follow themselves in parallel by being cut at a distance of 100 - 150 m to the reserve drainage channel. In rainy regions, it may be enough that only drainage network is established. But, in everywhere where is located of the irrigation network, it is absolutely necessary to find the drainage network because excess irrigation water is removed without damaging the land (Kara, 1980).

While the planning of irrigation network is done, the flow lengths to be detected must be used based on a good irrigation project etude appropriate to local conditions if there is no irrigation length belonging to the project area which is determined by the local research directorate. Because, it is necessary that the flow length is taken into account in order to separate the blocks into which the parcels will be placed. There is a close relationship between length of winter and water absorption speed of soil, irrigation method, soil character, field slope and water amount (Takka, 1993).

Results and Discussion

The irrigation network plan of the Üçhüyük Neighborhood (Çumra-Konya-Turkey) project which is used in this study is shown in Figure 4. In this project, when channel lengths were measured,

it has been seen that the length of main channel was 15.22 km. While irrigation projects are done, main channel is sized between 20-150 km. Whereas, the length of main channel is 15.22 km in this project. The reason for this is due to the boundaries of the study area. In this Project, the length of spare channel is 10.36 km. The spare channel has been properly positioned to the slope of land as it is supposed to be. Same time, while the spare channel is passed, the existing parcel has been passed from the boundaries of road. In this Project, the length of tertiary channel is 28.02 km. While the tertiary channels were being created, the slope conditions between 0.0002 degrees and 0.0006 degrees protected as much as possible.

Figure 4. Irrigation network plan of the land consolidation project belonging to Üçhüyükler Neighborhood

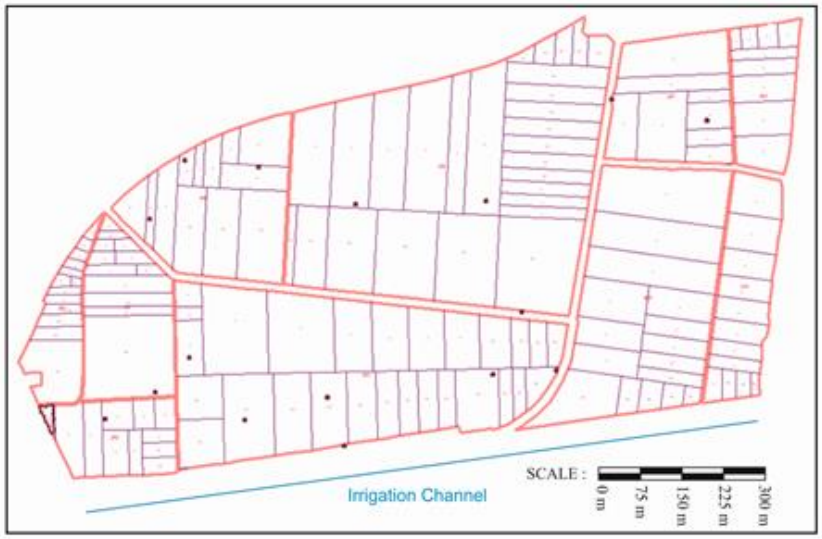

Figure 5. Ideal parcelation of Üçhüyükler Neighborhood, 1th Part.

In Land Consolidation projects, road and irrigation network constitute the skeleton of the project. Block plans are made according to this road and irrigation network, later, the most important process steps of the project are completed with land distribution and parceling operations.

Irrigation network is very important in land consolidation projects. Because, enterprise owners demand that their parcels is near the irrigation channel in interviews that are made with them. Ideal parcelation plans of the land consolidation project belonging to Üçhüyükler Neighborhood are seen in Figure 5 and 6. Ideal parcelations have been formed by being pay attention to the width / length ratio of parcels

But, the parcelation plan has been changed because they want to settle frontally at the irrigation channel rather than the width / length ratio of parcels in interviews which are made with the

enterprises in the study area. The parcelation plan which is approved by the enterprises are seen in Figure 7 and 8.

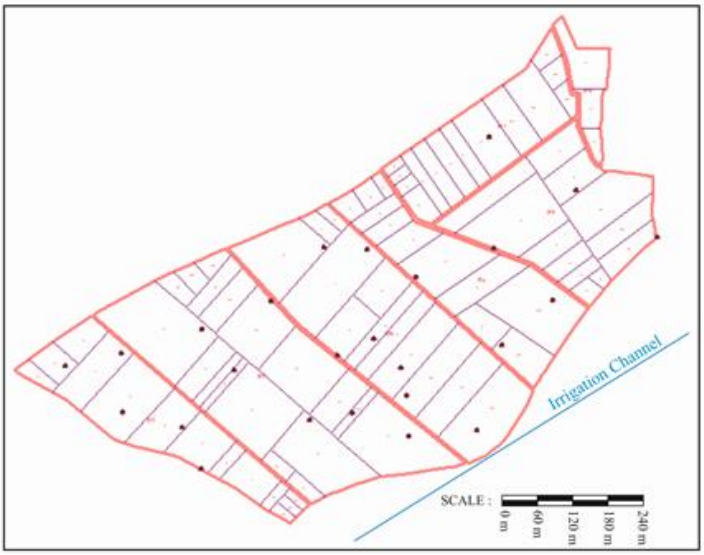

Figure 6. Ideal parcelation of Üçhüyükler Neighborhood, 2th Part.

As it is seen in this project, the irrigation network completely changes to the distribution and parcelation parts of land consolidation project. Therefore, irrigation network should be planned optimally, as long as the structure of the land allows it, the technical specification should be followed as much as possible, and the project must be implemented after the necessary planning has been made to ensure the maximum irrigation efficiency of the parcels.

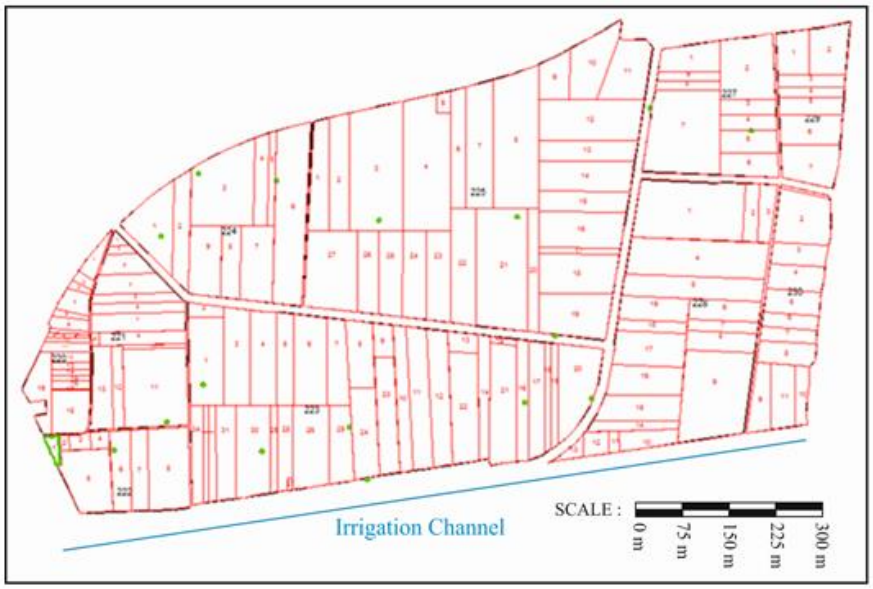

Figure 7. The parcelation plan which is approved by the enterprises belonging to Üçhüyükler Neighborhood, 1th Part

Conclusions

The agricultural sector has an important place in Turkey's economy. Efficiency in the agricultural sector is only possible if all infrastructure elements, especially irrigation, are fully implemented. While irrigation projects are planned, topography, plant and human factors must be surveyed very well, irrigation system and irrigation method must be selected and projected as best suited to the conditions. Irrigation projects must be planned and projected together with land consolidation projects in order to reduce the cost and to ensure that the agricultural activities to be carried out in the project area are efficient. Because, the importance of irrigation projects for businesses is great and the most important and progressive stages of land consolidation project are determined according to irrigation projects.

As a result of the implementation of the irrigation project and its implementation together with the land consolidation projects, product range will increase and agricultural spread will be activated due to intensive farmer participation. So that agricultural productivity will increase and significant contributions will be made to the welfare of the region

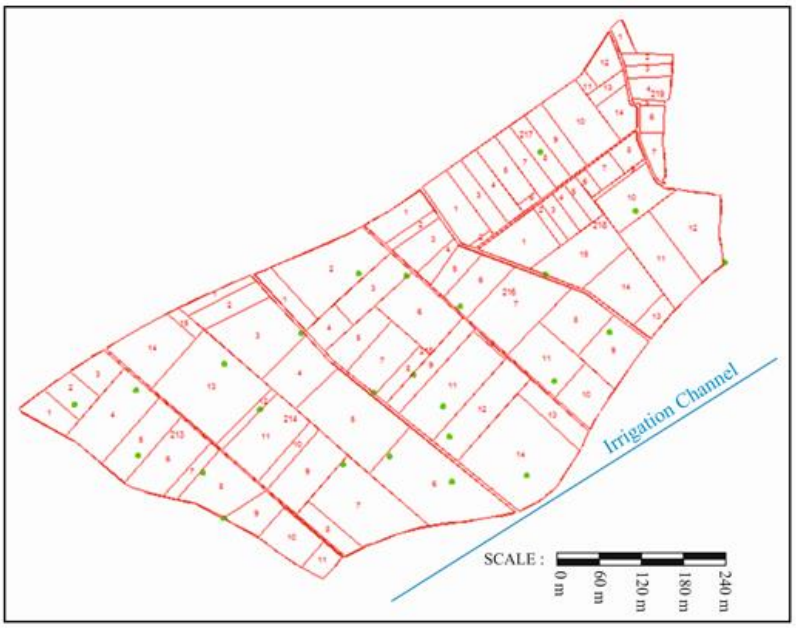

Figure 8. The parcelation plan which is approved by the enterprises belonging to Üçhüyükler Neighborhood, 2th Part

References

Ayten T, Çağla H, Akkuş S, Başçiftçi F, Yılmaz SA, Yalçın B, (2007) Kırsal Alan Düzenleme Prejelerinde Blok Planlamasından ve Derecelendirme Haritalarından Doğan Sorunlar, TMMOB Harita ve Kadastro Mühendisleri Odası 11. Türkiye Harita Bilimsel ve Teknik Kurultayı, 2-6 Nisan 2007, Ankara-Turkey.

Çevik B, Tekinel O, (1990) Sulama Şebekelri ve İşletme Yöntemleri. Çukurova University, Faculty of Agriculture, Textbooks, Yay. No: 81, Adana-Turkey. 163 p

Erkan H, (1985) Arazi Toplulaştırma. Textbooks, Konya-Turkey.

Kara M, (1980) Arazi Toplulaştırması. Karadeniz Technical University Publication, No: 29, Trabzon-Turkey.

Kumbasaroğlu H, Dağdemir V, (2007) Erzurum Merkez İlçede Tarım Arazilerinde Parçalılık Durumuna Göre Tarım İşletmelerinin Ekonomik Analizi. Atatürk Üniversitesi Ziraat Fakültesi Dergisi, 38 (1), Erzurum-Turkey, pp. 49-58.

SungurT, (1993) Su Yapıları Sulama ve Drenaj Şebekeleri ve İlgili Sanat Yapıları, General Directorate of State Hydraulic Work Printing Office, Ankara-Turkey, 170 p.

Şengün MN, (2006) Arazi Toplulaştırma ve Tarla İçi Geliştirme Hizmetleri Sulama Suyunun Tasarruflu Kullanımına Etkisi ve Çalışmaları Yürütmesi Gereken Kurumsal Yapıdaki Yanlışlıklar, TMMOB Su Politikaları Kongresi Bildiriler Kitabı, 2th Volume, pp. 435-446.

Takka S, (1933) Arazi Toplulaştırması. Kültür Teknik Derneği Yayınları, No:1, Ankara-Turkey.

Yılmaz N, Çiftçi N, (2005) Arazi Toplulaştırma Sahalarında Tuzluluğun Arazi Derecelendirmesine Etkisi. Arazi Toplulaştırma Sempozyumu, 15-16 Eylül 2005, Konya-Turkey.