ODTÜ KIBRIS'LA BİLİM EĞLENCELİDİR.

Hydraulic Design of A Bridge

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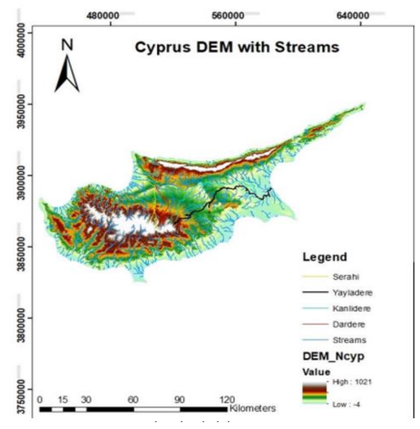
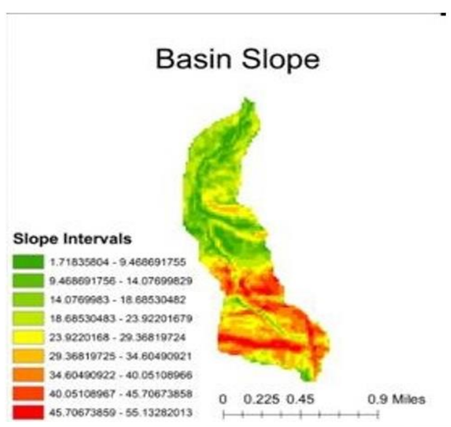
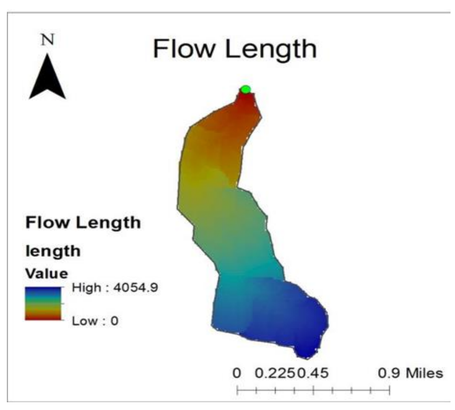
Introduction and Statement of the Project

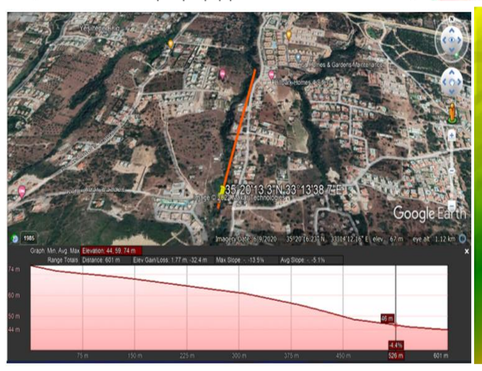
Bridges are one of the most important parts of a nation's infrastructure. They are structures that have enabled communication of human beings for years by connecting transportation in areas previously separated and ensuring the transportation of anything they produce and consume.
The role of hydraulic design of a bridge is to safely design the bridge. A lot of factors affect the safety of a bridge. The quality of bridge design impacts its strength and its ability to withstand conditions such as scouring. To be able to properly design a bridge, the hydraulic capacity of the bridge must be obtained. Bridges with poor hydraulic design are more prone to fail and collapse

Location and Features of Hydraulic Bridge

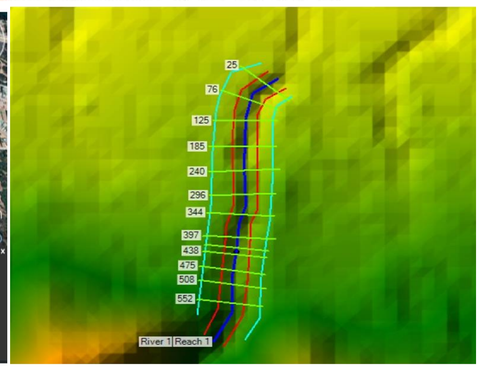




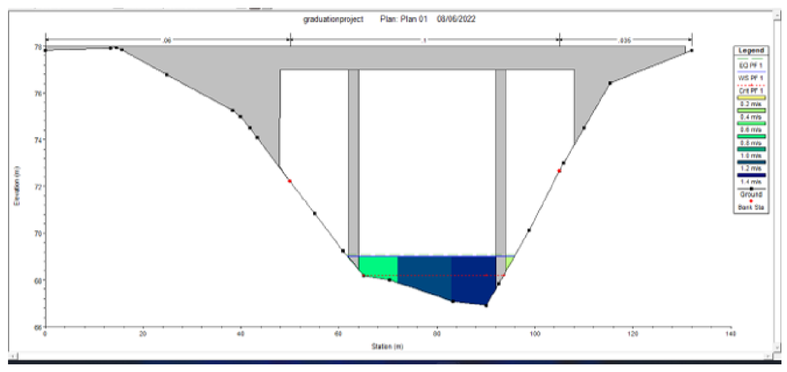




Slope of River



Cross-sections of DEM

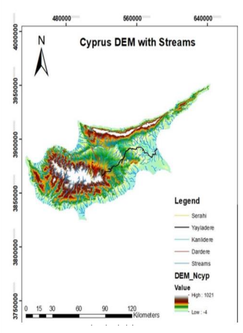


Bridge Downstream Cross-section

Design of Hydraulic Bridge

The strength and resistance to scouring of a bridge depend on the quality of its design. Finding the bridge's hydraulic capacity is necessary for good bridge design. The amount of rainfall, the slope, and the form of the land are some of the variables that determine design discharge. When constructing a bridge, other aspects like pier forces are also taken into consideration. Low hydraulic capacity results in a bridge that is less expensive, carries less traffic, and needs ongoing maintenance. Additionally, in order to reduce flood damage and prevent excessive velocity buildup, the hydraulic capacity of the bridge should be such that it minimizes backwater.

Design Discharge (ArcGIS & HEC-HMS



ArcGIS

- Creating outlet point with the given specific coordinates.
- Finding Basin Slope.
- Finding Flow Length.
- 35°20'13.3"N 33°13'38.7"E

HEC-HMS

Creating basin and subbasins.

Deciding Sub-basin parameters.

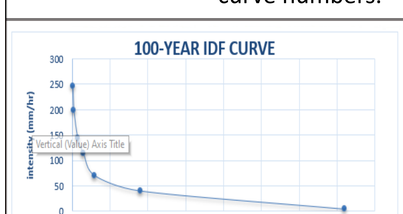
Selection of Run-off curve numbers.

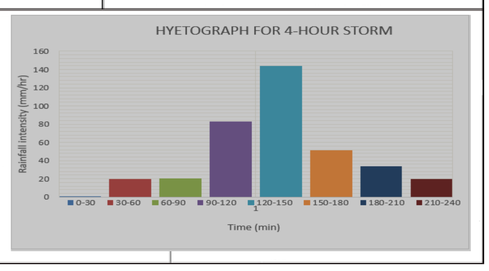
Subbasin	CN	S	L (KM)	L (ft)	Y	Y (%)	Tc (hr)	Lag (hr)	Lag (min)
1	81	2.35	1.30	4159.88	0.43	42.70	2.46	1.47	88.43
2	81	2.35	2.43	7811.60	0.63	62.80	3.35	2.01	120.71
3	81	2.35	1.88	6018.72	0.29	29.47	3.97	2.38	143.03

$$T_c = \frac{\ell^{0.8}(S+1)^{0.7}}{1{,}140\,Y^{0.5}} \qquad Lag = 0.6T_c$$

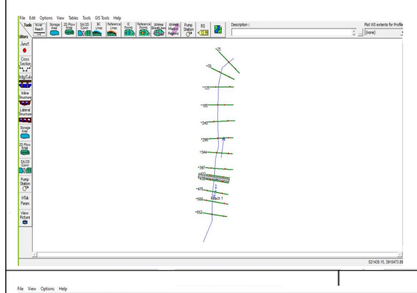
where:
L = lag, h
T_c = time of concentration, h
ℓ = flow length, ft
Y = average watershed land slope, %
S = maximum potential retention, in
$S = \frac{1000}{CN} - 10$
(AmericanUnits; $0 < CN < 100$)

Calculation of time of concentration and lag times.





Hydraulic Bridge Design



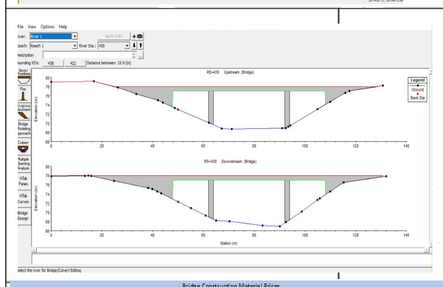
HEC-RAS

Finding Geometric data.

Finding cross-sections.

The station of those cross-sections was 438 and 422.

Deciding the location of Hydraulic Bridge.



The position of the bridge was set to 430.
thickness of the deck is 1m.
Starting station and pier spacing was described to the program those were 63 meters and 30 meters.
width of the piers was identified as 2 meters.
The discharge of the stream was set to 50.1 m^3/s .
The slope was found as 0.5 %.

Bridge Construction Material Prices					
No.	Products	Unit	Amount	Unit Price(TL)	Total Price (TL)
1.	Fresh Ready Concrete (C-60/C-60)	m^3	1764.3	253	446367.9
2.	Steel Bars (24) #(Ø6x2)	kg	6503.75	15000	97500
3.	Steel Bars (16) #(12x2)	kg	3850.32	15000	57750
4.	Bridge Reinforcements	kg	7742	15000	116000
5.	Plywood ,(Film covered)	m^2	700	79	55300
6.	Asphalt	kg	96	1.48	142.08
					743059.98

Vehicles					
No.	# of Vehicles	Vehicle Class	Daily Vehicle Loans (TL)	Working Days	Total Price (TL)
1.	2	Excavator	1500	30	90000
2.	4	Truck	500	25	50000
3.	2	Concrete Pumper	700	25	35000
4.	2	Finisher	1000	5	10000
					185000

Bridge Construction Employee Information					
# of Person	Masteryljob)	Working Hours (Monthly)	Hourly Salary (TL)	Specific Salary	Total Salary (TL)
3	Concrete Constructor	192	22.5	4320	12960
1	Pavement Constructor	40	22.5	900	900
2	Concrete Pumper Operator	192	26.5	5088	10176
2	Machinery Operator	40	26.4	1056	2112
1	Machinery Co-Operator	40	21.65	866	866
4	Truck Driver	192	26	4992	19968
10	Worker	192	16.45	3158.4	31584
2	Plywood Covering Worker	192	22.5	4320	8640
1	Plywood Co-worker	192	16.8	3225.6	3225.6
					90431.6

Cost Estimation

Cost Estimation Includes;

- Material Prices of Bridge Construction.
- Total prices of Used Vehicles in construction site.
- Total Salaries of Bridge Construction Labors

ODTÜ Kuzey Kıbrıs Kampusu