

## Symposium on Planning Challenges and Planning Education in Iraq

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Group 3: Infrastructure and settlement development: challenges in urban development and planning management

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This track focused on the interactions of transportation infrastructure and urban water resources management with rapid settlement development over the past decade. Water and wastewater infrastructure and transportation infrastructure has not been able to keep pace of the rapid urban expansion and IDP population influx in the Duhok valley, with visible greywater channels running in the open air on almost every street and visible automobile congestion in many areas of the city. Both problems are especially acute in the older areas of the city, but the infrastructure strategy of surface greywater channels is a deliberate engineering decision used in almost all parts of the Duhok. Both discussion took place, and included current challenges, possible policy changes to address challenges, and alternative engineering solutions or analysis to put the policy in action.

### ***Blue and Green Water Retrofits for Urban Mesopotamia***

As explained by Mr. Eng. Haval Ahmad Hussein - the Engineering Director for Duhok City and participant in the focus group discussions, the city of Duhok has a separated black and grey wastewater system, and a surface stormwater system, where blackwater is carried via underground piping to treatment plants, greywater runs out of houses and onto surface canals or gutters and into natural or trapezoidal channels and rainwater runoff follows the greywater system with the engineered channel being sized for 10 to 30-year rainfall recurrence intervals and which end in a treatment water plant outside of the city downstream. Areas of the city with informal development may not be connected to the blackwater system and have septic or other more primitive pit latrine systems. The discussion of challenges focused on two aspects of this system: the need to improve quality of surface greywater due to its use as irrigation in informal urban agriculture across the city, and 2) the adaptation of Duhok city to climate change caused urban flooding events that Duhok is experiencing based a 30 year precipitation analysis that was presented and on real time geo-located videos during intense rain events in the past 2 years.

The policy discussion for urban greywater improvement focused around the actual water quality test results that the city has conducted and which indicated that the water in many of the canals is not clean enough to drink, but does not exceed standards for most water quality parameters. However, evidence to the contrary exists based on field observations and questions about the sampling time (low flow / high flow) or locations in the network where samples were made (single greywater canal / large trapezoidal channel). It was agreed that a more thorough review of collected data within the Municipality and possibly further field studies would be needed to determine if water quality policy is truly being met in all locations. In terms of stormwater, no clear policy seemed to exist and the overall idea that such a policy would be necessary in Duhok was a challenging position for Mr. Haval Hussein to agree with. Within this framework, it emerged that there was a policy for urban agriculture and the policy was that urban agriculture was not formally permitted and that a revision of this policy could be an opportunity to help solve water quality or quantity problems.

The alternative solutions discussed for surface grey water and informal agriculture was dispersed treatment using a system of constructed wetlands located strategically adjacent to urban open spaces that could collect, funnel and treat surface greywater and then release it into plots for urban agriculture or into passive open

space for flood management and infiltration. The implementation of a stormwater management plan for basins in Duhok city would help prioritize spending on basins with the largest grey water quality and stormwater quantity problems. Some data barriers exist to fully carry out a detailed stormwater plan and design of alternatives, including detailed topographic mapping at the sub-meter level to develop detailed mapping of all canals and their flow directions and multi-spectral land cover data to identify suitable areas for constructed wetlands and passive green and blue infrastructure.

#### ***Duhok City Transport: Facts, Problems and Policy Options***

The transportation system layout in Duhok was never really congested when the city had a population of 100,000, but now at almost 1 million, the linear east-west roadway which pierces the old city center causes a bottleneck, and the larger multi-lane highway bypassing the old city to the south is constricted to expansion by the mountains. While alleviating traffic that would rather bypass the city center, land along the bypass itself has been developed and now both main arteries experience congestion in busy times of the day. The congestion causes smog and noise pollution within the valley, and the existing bus system (the only alternative transport mode available) does not connect the entire city in any significant capacity, is not on time, and is viewed as an alternative for the lower economic classes.

Although many alternative transportation options have been discussed by the city, there is no clear and direct policy that requires the implementation of any alternative systems to address congestion and pollution. This fact limits available financing for alternative systems and given the economic hardships in Kurdistan now stemming from their disputes with Baghdad and to operations cost of the Peshmerga's fight against ISIS money for transportation infrastructure in general is only sufficient for the most pressing maintenance and improvements. The inclusion of alternative transportation as a policy target for environmental improvement and economic development would be a positive step for Duhok and would help guide transportation planning in Duhok in the emerging post ISIS era when the financial crisis is sure to subside.

The first alternative discussed was the plan the city has for a second bypass route either south of Zawa Mountain or within the Duhok valley, and it became clear that the analysis basis for this alternative was not rooted in any type of transportation modelling with trip diversion estimates, but rather on basic engineering assumptions. While this may alleviate some traffic, it would not alleviate traffic in the center and there was not estimate to how such an alternative would affect atmospheric pollution. An alternative was presented for the development of a specific transportation model as a joint work between the College of Spatial Planning and Applied Sciences and the Duhok Municipality to begin computer modelling of transportation alternatives in conjunction with their pollution and land use change characteristics to solve the problems and inform policy.

All participants were encouraged by the discussions and this focus group pinpointed a number of growth areas for joint research, student projects, and engineering alternatives design which fit squarely within the realm of spatial planning and represent concrete action toward solving transportation and water resources challenges in Duhok.