Diverting construction and demolition (C&D) waste from landfill is a challenge for Palestine today to reduce the amount of solid waste flowing into landfills or dumpsites [1].Based on the questionnaire and interview survey in West Bank, issues on C&D waste addressed are summarized as follows: i) Random dumping of C&D waste material, either disposed in valleys, lands, or on the roads sides; ii) Exploitation and utilization of C&D waste materials through applying the 3Rs strategy; iii) Conscious consuming and minimizing the depletion of natural resources, as well as promoting reusing and recycling practices; iv) Safe disposal of C&D waste material, as some of the materials and their components are harmful contributing to many problems on the scale of environment and public health; v) C&D including hazardous materials contra banding from the Israeli's side to the Palestinian areas.C. Guideline of C&D Waste Management The purposes of the Guideline for C&D Waste in Palestine are: (i) to define the way in which stakeholders (construction or demolition works clients, planners, designers, contractors, sub-contractors, and suppliers) can act cooperatively in order to reduce C&D waste generated; (ii) to promote the minimization of the waste generation; (iii) to provide stakeholders (designers, developers, practitioners and relevant authorities) with an agreed upon basis for determining the adequacy of C&D waste management plan (WMP); and (iv) to provide both general and specific guidance in relation to preparing the appropriate C&D WMP for a certain scale of projects which exceeds a specified threshold size.(2) Coordination and cooperation with MSW service providers However, coordination and cooperation is possible between MSW and C&D waste management in some cases: (i) Assigning the locations of designated dumpsites for the C&D waste; (ii) Reusing some materials in the C&D waste can be utilized for the daily or final cover of solid waste in the sanitary landfill; (iii) Manufacturing and marketing some types of recycled materials such as cardboard, glass and plastics which are contained in both MSW and C&D waste; and (iv) Responsible organization for collection, transportation and disposal of C&D waste will be JSC or Local Government Unit (LGU) which is the same as MSW management as defined by the draft bylaw.Expected functions and specifications of the sorting facilities attached with transfer stations are as follows: (i) The transfer station is a land or building(s) at which C&D waste materials are received, crushed, and sorted for subsequent transport to a C&D waste processing facility or to a C&D waste disposal site; (ii) The transfer station is equipped with the necessary heavy machines such as loaders and bulldozers for on-site conveying; (iii) Enough number of transfer stations should be established in each governorate, to avoid illegal dumping of C&D waste at the roadsides or at the privately-owned land; (iv) The site (land and/or building(s) and installations of the transfer station are owned or hired by the LGU and/or the JSC.The questionnaire was distributed to JSCs and Local Government Units (IGUs) of 12 governorates in West bank (Jenin, Tubas, Tulkarem, Qalquilya, Salfit, Nablus, Jericho, Ramallah-Albireh, NW+N Jerusalem, NE+SE Jerusarem, Bethlehem, and Hebron), the Palestinian Contractors Union (PCU), and the Ministry of Public Works.D. Proposed C&D Waste Management System (1) Relationship with the municipal waste stream Integration between municipal solid waste (MSW) management and C&D waste management is not possible because: (i) Collection, transportation, and disposal operations are completely different as solid waste in its nature and generation source; (ii) Collection containers and vehicles used in both MSW and C&D waste are different in material, design and job; (iii) Collecting of C&D waste by MSW containers is not acceptable

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as the C&D waste may damage these containers; (iv) Transporting of C&D waste by MSW compacter vehicles must be forbidden as this may damage the compaction and hydraulic systems of the vehicle; and (v) The responsibility of collection and transportation of C&D waste belongs to whom generates the C&D waste, i.e., owner of the building or contractor, as defined by the draft bylaw.Processes related to transfer station are as follows: (i) The contractor collects C&D waste from the generation site, using containers usually rented or provided by the hauler; (ii) A hauler takes the C&D waste containers to a nearby transfer station via small vehicles; (iii) The amount of C&D waste in the vehicle is weighed at the entrance of the transfer station and certain rate of gate fees is to be paid for the transfer station; (iv) Recyclable materials are sorted and put in suitable containers or bins which are finally moved to the processing facilities inside the transfer station or hauled to processing facilities outside the transfer station.Some examples of how to obtain and approve a license is as follows: for owned or hired C&D dumpsite, the license is issued by the MoLG and approved by EQA; for a transfer station, it is issued by the MoLG and approved by EQA; for a truck used for C&D hauling from the generation site to transfer stations or to dumpsites, it is issued by the MoT and approved by the LGU; for a sorting and processing facilities inside the transfer station, the license is issued by the MoLG and approved by the MoNE; for a processing facility outside the transfer station, it is issued by the MoNE and the LGU in that area; and for operating a mobile stone crusher or other onsite treatment equipment, the license is issued by the LGU in that area and approved by EQA and the MoNE.The handling of C&D hazardous waste generated during construction and demolition processes is the responsibility of the contractor, who should do the following: (i) collecting the hazardous waste properly according to bylaw; (ii) placing it in special bins and cover these bins; (iii) storing the bins in an isolated area of the project site; and (iv) transporting the hazardous waste in a safe way to an designated landfill after getting the required permission from the landfill operators who will dispose of the hazardous waste properly without causing any problems to public health or any environmental negative impacts.The Palestinian Environment Law No. 7, 1999 has included "constructional waste" in its definition of Solid Waste under Article 1. Under Article 5, the law has stated that the Environment law shall protect the natural resources from constructional activities, among others. The Law has stated under Article 10 that "All agencies and individuals, in conducting any digging, construction; demolition, mining or transportation of debris and sands generated by such activities, shall commit themselves to take all necessary precautions for safe storage and transportation of such materials to prevent any environmental pollution".TABLE 2: Good practices of C&D waste management at LGU level Governorate LGU Good Practice Tulkarem Qafeen Reuse soils and rocks for reclamation of land in the city Hebron Alsheokh Crushing stone and reuse (300 ton/month) Hebron Bani Ne'em Crushing stone and reuse (150,000 ton/year) Jericho Jericho Reuse for landfill covering material Figure 3: C&D waste dumpsite near Silwad.A. II. Present Situation of C&D Waste in West Bank Reconnaissance Survey in and around Ramallah area In order to obtain general idea on C&D waste problem in West Bank, Palestine, a reconnaissance survey was held along motor roads around Ramallah–Al Bireh in 2015, where various real estate development projects including construction and demolition of buildings and infrastructure are currently implementing.Suggestions are as follows: (a) allocating enough number of dumpsites in each governorate, (b) enforcement of relevant laws and

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regulations, (c) cooperation between contractors and the Palestinian Contractor Union, and (d) establishing a information system of expected generated C&D wastes in order to offer that waste for those who need such wastes.(4) Licensing Procedures to obtain the necessary licenses for C&D waste management from the concerned authorities is as follows: (i) License is issued by the relevant authority and according to its specific regulations; (ii) License for C&D waste handling is issued by the MoLG or the LGU in its service area; (iii) In some cases, issuing the license needs the approval of EQA or the MoNE or both.(i) New residential development of 10 houses or more; (ii) New developments including institutional, educational, health and other public facilities, with an aggregate floor area in excess of 1,250 m2; (iii) Demolition/renovation projects generating in excess of 100 m3 in volume of C&D waste; and (iv) Other C&D projects generating more than 500 m3 of waste. Moreover, JSCs and LGUs in West Bank are facing problems as follows: 1) Lack of quantitative and qualitative C&D Waste, Also the number and the site of the random dumpsite for this special waste; 2) Reluctancy from the Local Authorities side, and not prioritizing the C&D issue; 3) Lack of awareness about the harmful impacts on Public Health and Environment; 4) C&D Waste Material lack of similar experiences among other neighborhood countries.The National Strategy for Solid Waste Management (20102014) [7] stated the following: "Currently, there are no clear standards or regulations for handling special waste in the Palestinian Territory and, thus, most of it finds its final destination in solid waste landfills or on remote roadsides (as is the case for C&D waste). There are also no national policies identifying best handling alternatives such as recycling options for these wastes despite the fact that much of it is recyclable".Proposed system (Figure 6) is required to develop appropriate infrastructures for C&D waste management by government, private sector, or public–private partnership initiatives, where the infrastructure includes transfer stations with C&D waste sorting facilities, processing facilities for recyclable components of C&D waste, and C&D waste dumpsites.Hazardous wastes are frequently encountered in demolition projects and may include asbestos, lead paints, contaminated soil, adhesives, drywall, and additives for concrete and blocks.In this paper, construction and demolition (C&D) waste is defined as waste materials that are produced in the process of construction, renovation, or demolition of structures which include buildings of all types (both residential and nonresidential) as well as roads, bridges, and other infrastructures based on US–EPA [3].Using a galvanized sampling tank of capacity 0.5 m3, C&D waste was sorted for measuring composition: concrete, bricks, stones, metal, plastic, wood, gypsum, asphalt, tiles, paper & cardboard, and other materials.The governmental bodies expected to be responsible for the licensing and approval of different processes of C&D waste management could be: Ministry of Local Government (MoLG); Environment Quality Auhority (EQA); Ministry of National Economy (MoNE); Ministry of Public Health (MoPH); and Ministry of Public works and Housing (MoPWH).In the West Bank of Palestine, the area called Area C, more than 60% of Palestinian territory, is virtually occupied by Israel, while in Areas A and B which is under the control of the Palestinian Authority, construction of buildings and infrastructure is being actively promoted, and then, a large amount of C&D waste is generated.TABLE 1: Generation source of C&D waste reported by LGUs, West Bank Source of C&D waste according to LGUs report LGUs (%) Construction of houses for Palestinian people 61% Transportation of C&D waste from outside the service area 22% Demolition and

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destruction of Palestinian houses 19% Demolition and destruction of Palestinian unlicensed houses by Israeli side 10% According to the result of questionnaire survey in 2016, 111 LGUs answered the generation sources of C&D waste, where four main sources were pointed (TABLE 1): construction of houses for Palestinian people (61% of LGUs), transportation of C&D waste from outside the service area (22% of LGUs), demolition and destruction of Palestinian houses (19% of LGUs), and demolition and destruction of Palestinian unlicensed houses by Israeli side (10% of LGUs).Through conducting questionnaire survey and workshops to highlight the issue of C&D Waste materials, the JSCs and relevant agencies started to think about the C&D waste materials as a serious concern and how to reuse and/or recycle them.The purpose of this draft bylaw is to regulate and minimize the amount of solid waste generated by new constructions or demolition of structures that are sent to dumpsites or landfills for disposal.E. Waste Management Plan The Waste Management Plan (WMP) of the C&D waste for each construction or demolition project is an important plan that helps builders and contractors to achieve contractual and environmental goals by minimizing C&D waste generated from their projects.Ministry of Public Works and Housing reported generation rate of C&D waste as 0.25 kg/person/day.limited activities but these indicated needs of reuse and recycle of C&D waste at local levels.III.1).

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