Summary

Public transport plays an increasing role in the disclosure of city cores and areas, as an alternative to the use of private cars which increasingly cause traffic congestion and heavy pollution at places where this is least desired. Electrified trams and low-floor light rail vehicles have been offering an alternative for over a century now, and the demand for new tram and light-rail systems does not seem to come to a halt. The public transport system must provide a certain amount of mobility to its public, with certain punctuality and safety. This must be done at the lowest possible investing and operating costs. In their turn, the vehicles used in such systems need to provide comfort and safety to their passengers. These are the boundary values between which the tram stabling and maintenance facilities must operate. For HTM Consultancy, the design of such these facilities (hereafter referred to as a 'depot') is often part of a project. Technical and operational aspects must be carefully weighed against their economical impact, and HTM Consultancy has access to knowledge of all these mentioned aspects. However, the question is if it is possible to define a methodology that can be used for the design of depots, implying all necessary aspects. A methodology has been developed using systems theory of innovation models. The methodology is named the "DIM", which is the abbreviation of Depot Innovation Model. DIM has two goals:

"Supply HTM Consultancy with operationally satisfying depot designs using a systematic approach"

And

"DIM should be understandable and applicable as a depot design guide by the HTM consultants who are in charge of depot design"

First, the depot's surroundings and boundary values are investigated. A list of specifications is extracted from these surrounding and boundary values. The build-up of infrastructure projects is structured by explicit guidelines [20], which introduce the following project phases and deliverables:

1. Feasibility studies
2. Preliminary research. Deliverables: Functional Design, Integral List of Requirements
3. Preliminary Design and Technical List of Requirements
4. Final Design
5. Pre-building

Appendix C1 discusses what output is needed for the above prescribed project phase deliverables. Using the list of specifications, the DIM is built up. The methodology, comprising of three main steps (or 'parts') is shown in Figure Summary-1 beneath.

In DIM Part 1 (see Figure Summary-2), the depot environment is investigated to state the following:

1. Global requirements on the depot design
2. Global IST investigation and identification of implied laws and needs for permit acquisition
3. Global project planning

In DIM Part 2, the depot's functional design must be constructed. As a guide, the functional model developed in appendix E can be used. The intention is that the designer should use de described systems methodology, to ensure design readability and to prevent miscommunication between all involved disciplines. The processes within DIM Part 2 are shown in Figure Summary-3.

In DIM Part 3, the functional design is made operational by following the next steps:

1. Find the necessary depot system area (See Figure Summary-4)
2. Make depot lay-out proposals at various possible geographical locations
3. Make project cost calculations
4. Make definite selection of depot equipment and layout

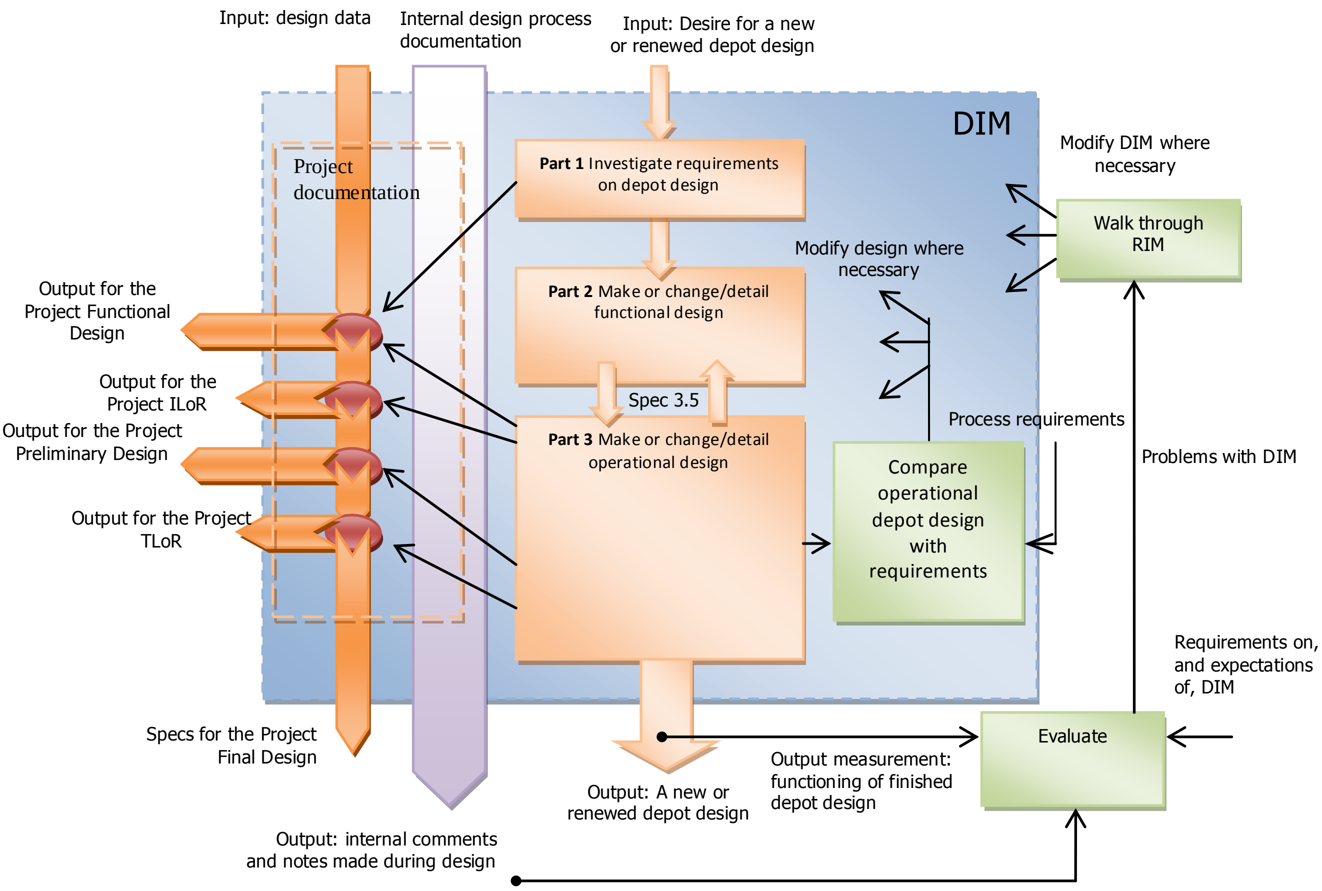

Figure Summary-1 The functional model of the DIM

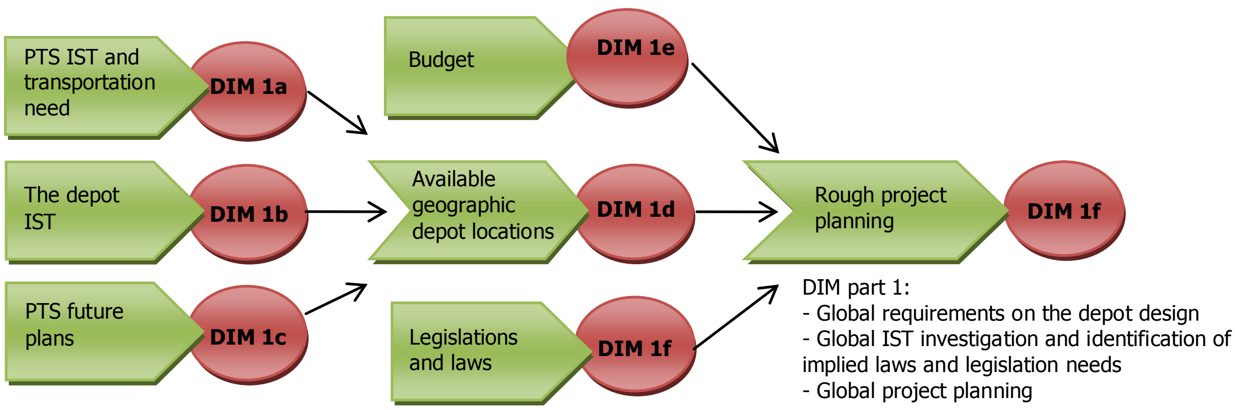

Figure Summary-2 **DIM part 1: Investigation of the requirements on the depot design**

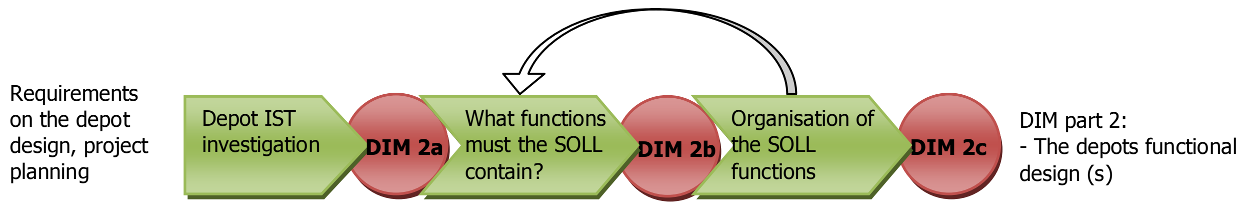

Figure Summary-3 DIM part 2: Functional design

DIM Part 2 and DIM Part 3 are run through iteratively until a satisfying design is reached which corresponds to the demands found in DIM Part 1. Also, parts of DIM Part 3 are iterative.

On a macroscopic scale (distances expressed in kilometers) the optimal geographical location of a depot system can be found using a multi-criteria analysis. The criteria that are of importance during macroscopic placing of the depot system design are:

- Amount of empty kilometres and empty hours (distance to operational centre of the PTS)
- Terrain accessibility to PTS tracks
- Ground costs and the ease of acquiring the ground
- Ease of acquiring of the necessary permits for a specific location
- Terrain reach ability for personnel
- Possibility for access roads for very large and heavy trucks if LRT's need to be transported by road for external maintenance
- Future PTS system expansion plans

On a detailed scale (distances expressed in meters or centimeters), the depot system design quality can be investigated when looking at:

1. The ratio set-up/real maintenance time
2. Optimal system component placing ensuring minimum LRT movements
3. Track layout operational smoothness analysis
    a. The amount of inter-crossing trajectories
    b. Terrain accessibility in degraded modes
    c. Tree diagram of non-conflicting routes
4. If enough process data are available, the process operational and economical effectiveness, efficiency, productivity and performance can be calculated using appendix F3.

DIM's goals, as stated above, are partly met. The DIM is useful for the starting phase of the depot design trajectory. Especially for the functional part, and the rough design part. As soon as a high detailed design is needed, it becomes harder to provide prescribing methodologies. At that point various disciplines must attribute to define all aspects of the depot system, and prescribing a methodology for all disciplines does not seem useful. However, DIM does provide guidelines to what should be delivered to accomplish the higher detailed final phases. The second goal states that the DIM should be understandable and applicable as a design guide. DIM's steps are meant to be quite straightforward, ensuring ease of understanding and use. Development and implementation of a software based DIM into HTM Consultancy's working environment which would ensure knowledge storage and accumulation is advised.