

SUNRAY V - AN INTELLIGENT CONTAINER TRUCKING MANAGEMENT SYSTEM

ANDREW J. GILL

Clarity Systems Pte Ltd, Singapore

clarity@pacific.net.sg

ABSTRACT

SunRay V is a Windows-based system which supports container trucking companies in the management and control of their operations. The scheduling module of SunRay V uses constraint programming [Van Hentenryck 89] technology, based on Ilog Schedule [Ilog Schedule 96] and Ilog Solver [Ilog Solver 96], to schedule container trucks efficiently, taking into account the numerous haulage constraints, considerations and preferences.

This paper first briefly introduces the container trucking operations domain and the SunRay V system before focusing on the SunRay V scheduling module's modelling, constraints and scheduling modes (predictive and on-line). The paper concludes with a brief discussion of the benefits of SunRay V in general and the scheduling module in particular to container trucking companies.

INTRODUCTION

Container Trucking Operations

The container trucking business is basically the provision of services for the transport of containers by road. The intensity and complexity of such services is particularly high around sea-ports such as the Port of Singapore Authority (PSA) where large numbers of containers are discharged and loaded from vessels.

Many steps and associated parties are involved in the movement of containers, particularly those involving the port. The details vary according to the type of movement (e.g. export, import) but the essentials that are most pertinent to the trucking service aspect can perhaps be best understood through examples:

- Example 1: Export Cycle

A customer (either directly or on behalf of a number of end-customers) requires to ship a container on a vessel. He engages a trucking company (haulier) to first deliver an empty container from a container leasing company. He then packs the container with the goods before the haulier picks-up the container and delivers it to the port. For the haulier there are two critical deadlines: the requested delivery time of the empty container and the port entry time booked by the haulier.

- Example 2: Import Cycle

A customer requires to receive a container from a vessel. The haulier must first pick-up the container from the port and deliver it the customer. The customer then unpacks the goods before the haulier picks up the empty container for return to the container leasing company. For the haulier the critical deadlines involved are free-store expiry (when the port starts charging for excess port stay) and detention expiry (when the container leasing company starts charging for non-return of the empty container). These deadlines may also be modified by customer requested delivery and return times.

The resources used by the haulier to provide transport services are trucks (or towheads) and trailers. The latter are used to carry the container during transport but may also be retained for a time at sites (usually customers) where there is no container mounting equipment. As a result of trailer retention, hauliers typically operate with trailer-towhead ratios of between 5:1 & 7:1 depending on the average trailer retention period. Trailers which are not in use are parked at one or more sites called trailer parks. Trailers, like containers, come in a number of lengths usually 20' (foot), 40' and 45'. A truck may have to draw, deposit or exchange trailers at a trailer park in order to configure itself properly for the next job.

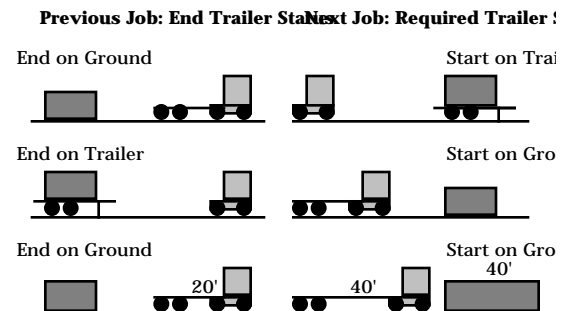


Figure 1. Job Connections Requiring Trailer Changes

In capacity planning a haulier tries to determine how many jobs (or paid-trips) he can handle using his own fleet in the planning period (typically the next day). Depending on the resource availability and the job deadlines, some of the jobs may have to be sub-contracted