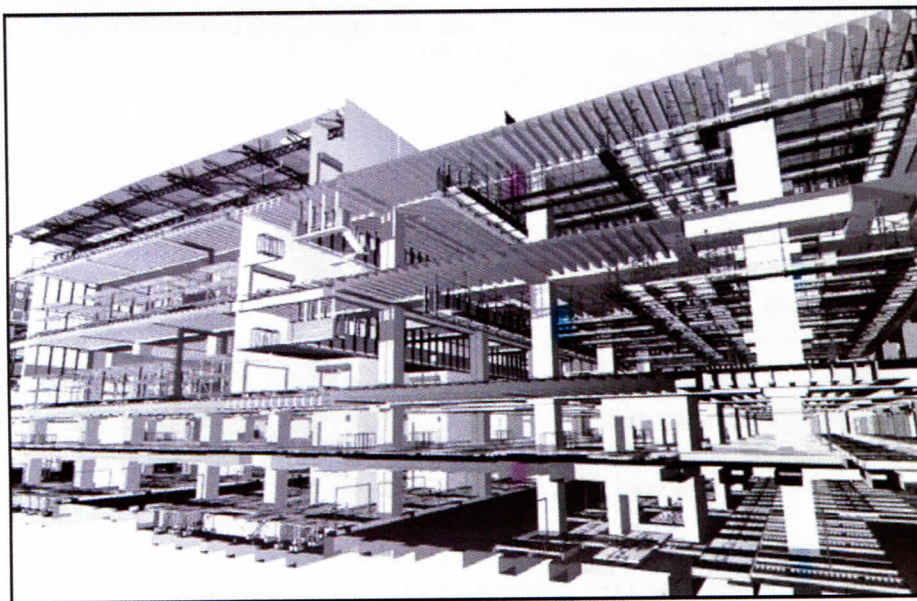


have a clearance clash with the “kinetic envelope” of the cargo pallets as they are moved and process throughout the facility.

Clashes were identified using a specialized clash matrix that incorporates design specifications and operational requirements (headroom, MHS specifications, structural and architectural co-ordination, and MEP co-ordination) into the analysis (Figure 3). The analysis is done on a priority basis and issues are resolved before any construction ever begins. This is a continual process and a dedicated engineer works on this continuously through-out the design co-ordination process. This has resulted in far less on-site RFIs, cost over-runs, and delays.

The proactive approach adopted by CX in this project has resulted in smoother operation and forced traditionally segregated elements of the design process (structural engineers, architects, MEP, etc) to collaborate in a systematic fashion from the outset. This has required the extensive retraining of key personnel to use standardized systems and software platforms to ensure that there is consistency in the design and format of data. The challenge for the BIM manager, as reflected by the project director, is the demand of commitment from designers and contractors. Resistance come from the professional inertia of coming back to 2D: “at times we have had to insist that sliding back to 2-D methods is just not acceptable”. The approach proved to be bringing about the intended culture change in the industry.



**FIGURE 3.** Scheme of the new CX cargo terminal of Hong Kong

## DISCUSSION

Value creation by members of a temporary project organisation requires the involvement of the entire project supply chain. BIM coordination helps close the communication gap with other team members. However, such a fundamental change in the culture of the industry cannot be brought about by technology alone. It is essential that processes and procedures are put in place on top of the procurement system<sup>[4]</sup>. The cooperation and collaboration among stakeholders depend to a great extent on the management of relationships within the project team, a temporary multi organization<sup>[5, 8]</sup>. The case studies indicate that the social infrastructure and relationship management are to be developed to underpin the implementation of BIM. As these infrastructures now are starting to coalesce the opportunity for true cooperation is now beginning to emerge<sup>[14]</sup>.

The BIM process creates new challenges by modifying the timing of the payment structure of projects, with more money being expended “up-front”<sup>[7]</sup>. The BIM demands a complete model before construction begins where clashes and other problems can be resolved virtually before encountered on site. Resistance to BIM occurs in situations where architects and engineers, who traditionally expect the majority of the workload to be in the latter half of the design phase as RFIs are issued, have their workload shifted towards the beginning of the design phase. The cash flow is modified among consultants, which demands a culture change in the current procurement system.