



PROJECT BRIEF

- TO APPLY SUSTAINABLE PRODUCT DESIGN PRINCIPLES TO THE JCB LOADALL REAR LAMP CLUSTER SHOWN IN FIG. 1
- LIFE CYCLE ANALYSIS (LCA) OF THE LAMP ASSEMBLY TO DETERMINE WHICH COMPONENTS CAUSE THE MOST DAMAGE TO THE ENVIRONMENT DURING MANUFACTURE, USE AND DISPOSAL OF THE PRODUCT.
- AN INNOVATIVE REDESIGN OF THE LAMP ASSEMBLY TO FIT THE EXISTING LOADALL DESIGN BUT GREATLY REDUCE THE LAMP ASSEMBLY'S EFFECT ON THE ENVIRONMENT WITHOUT COMPROMISING FUNCTIONALITY.



THE PRODUCT

- TWO OF THE REAR LAMP UNITS ARE FITTED TO EACH JCB LOADALL VEHICLE.
- APPROXIMATELY 10,000 JCB LOADALLS ARE IN SERVICE WITH THIS LIGHT UNIT.
- EXISTING ASSEMBLY HAS A 15 YEAR SERVICE LIFE BEFORE REPLACEMENT

THE RADICAL REDESIGN

- USES LED ARRAYS WITH 50000 HOUR SERVICE LIFE
- CAN BE EASILY ASSEMBLED & DISASSEMBLED
- MUCH LIGHTER THAN PREVIOUS DESIGN
- STRONG & ROBUST
- MOUNTS TO JCB LOADALL WITH NO ALTERATIONS TO MOUNTING BRACKETS OR WIRING.

THE PROJECT

- LIFE-CYCLE ANALYSIS OF THE MOST DAMAGING AREAS OF THE PRODUCT.
- INDICATION OF MOST DAMAGING AREAS OF CURRENT DESIGN AND RECOMMENDATIONS TO REDUCE THIS.
- ASSESSMENT OF THE DISASSEMBLY OF THE CURRENT DESIGN/ ECONOMIC LEVELS OF DISASSEMBLY POSSIBLE.
- CRITERIA FOR REDESIGN TO INCREASE EFFICIENCY OF DISASSEMBLY OF THE CURRENT DESIGN.
- A STEP-WISE REDESIGN OF CURRENT MATERIALS AND COMPONENTS FOLLOWING GUIDELINES PRODUCED IN PREVIOUS SECTIONS.
- AN INNOVATIVE REDESIGN THAT RETAINS THE CURRENT FUNCTIONALITY OF THE PRODUCT BUT OTHERWISE RE THINKS THE CURRENT DESIGN.
- AN ASSESSMENT OF THE PREFERRED REDESIGN FOR BOTH LIFE-CYCLE IMPACTS AND DISASSEMBLY ISSUES.

DISASSEMBLY ASSESSMENT

ORIGINAL DESIGN

IMPORTANT FIGURES:
19 OPERATIONS
612 SECONDS DISASSEMBLY-TIME
38 PARTS
11 PARTS REDUNDANT
THE SOFTWARE IDENTIFIED THE FOLLOWING PARTS AS REQUIRING REDESIGN TO ALLOW FOR EASIER ASSEMBLY:
WIRING LOOM
BULB HOLDERS
LENS COVERS
DIFFUSER
METAL FRAME
NYLON WASHERS

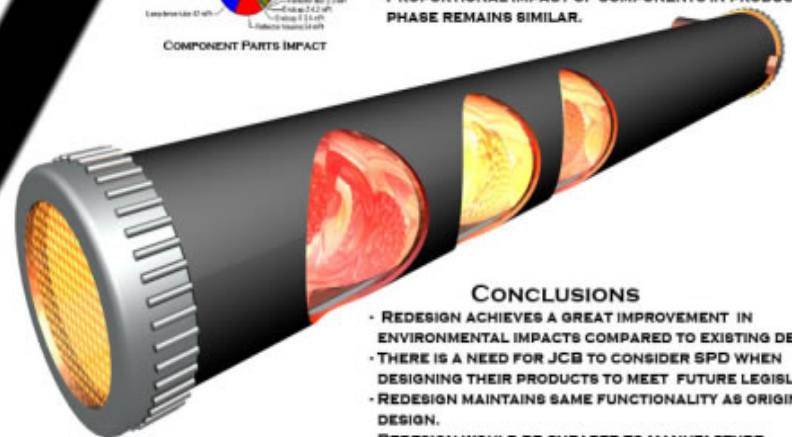
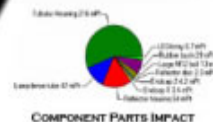
NEW DESIGN

IMPORTANT FIGURES:
7 OPERATIONS
55.12 SECONDS DISASSEMBLY-TIME
15 PARTS
0 PARTS REDUNDANT
NO NEW PARTS IDENTIFIED AS REQUIRING REDESIGN



FINAL DESIGN ECO-ANALYSIS

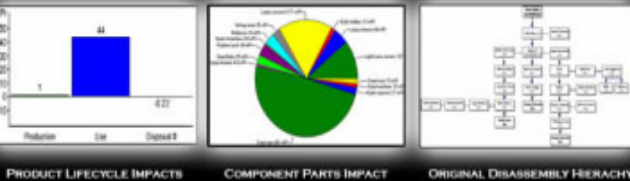
- USED THE ECO-IT SOFTWARE TOOL TO HIGHLIGHT MAJOR DESIGN IMPROVEMENTS THROUGHOUT PRODUCT LIFECYCLE
- TOTAL ENVIRONMENTAL IMPACT REDUCED FROM 44.78PT TO 19.24PT.
- GREATEST REDUCTION IN THE USE PHASE, FROM 44PT TO 19PT. THIS CONSISTS OF THE ELECTRICITY CONSUMPTION OF THE LED'S AND FUEL CONSUMPTION FOR THE WEIGHT OF THE ARM.
- PROPORTIONAL IMPACT OF COMPONENTS IN PRODUCTION PHASE REMAINS SIMILAR.



THE REDESIGNED LAMP ASSY.

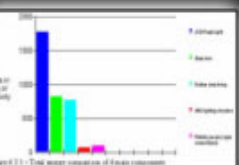
CONCLUSIONS

- REDESIGN ACHIEVES A GREAT IMPROVEMENT IN ENVIRONMENTAL IMPACTS COMPARED TO EXISTING DESIGN.
- THERE IS A NEED FOR JCB TO CONSIDER SPD WHEN DESIGNING THEIR PRODUCTS TO MEET FUTURE LEGISLATION.
- REDESIGN MAINTAINS SAME FUNCTIONALITY AS ORIGINAL DESIGN.
- REDESIGN WOULD BE CHEAPER TO MANUFACTURE, SERVICE & RECYCLE.



ECO-IT ANALYSIS

USED TO GIVE A SCORE TO EACH COMPONENT BASED ON ITS MATERIAL, PRODUCTION PROCESS, USE AND END OF LIFE PROCESS. SIMPLIFIED TO REDUCE INTENSIVE DATA COLLECTION.



BOUSTEAD MODEL ANALYSIS

- USED TO FIND TOTAL ENERGY CONSUMPTION OF EACH COMPONENT.
- STEEL ARM AND RUBBER LAMP FIXING CONSUME THE MOST ENERGY.
- OTHER GRAPHS DONE FOR THE ANALYSIS WERE:
TOTAL FUEL USE COMPARISON
TOTAL ELECTRICITY USE COMPARISON
AND
TOTAL TRANSPORT FUELS USE COMPARISON

USE ANALYSIS

FOR 25 YEAR SERVICE LIFE TOTAL ENERGY USED TRANSPORTING LAMP UNITS IS APPROXIMATELY 4.6×10^3 MJ
ENERGY USED DURING LAMP OPERATION FOR 25 YEAR SERVICE LIFE TOTAL ENERGY USED BY LIGHT UNITS IS APPROXIMATELY 2376MJ
REPLACEMENT OF BULBS (SERVICE LIFE) 400 HOUR BULB LIFE WITH VEHICLE SERVICE LIFE OF 25 YEARS = 145 NEW BULBS IN THE VEHICLES LIFETIME



MATERIALS ANALYSIS

BOUSTEAD MODEL - STEEL ARM LIFECYCLE INPUTS & OUTPUTS



THE ABOVE FLOW CHART SHOWS POLLUTANTS PRODUCED FROM PRE-PRODUCTION TO END OF LIFE

ABS PLASTIC PRODUCTION

PROCESS FLOW CHART

ALTERNATIVE MATERIALS & PROCESSES WERE ASSESSED AND THEIR IMPACT COMPARED WITH THOSE BEING USED IN THE MANUFACTURE OF THE EXISTING REAR LAMP ASSY.

