USER CENTERED DESIGN
A helmet for two wheeler riders

Prof. B. K. Chakravarthy
IDC, IIT Bombay
THE CONTEXT

• Exponential increase in traffic density and the number of casualties.

• Outcry against making helmet usage compulsory.

• Life saving devices which people refuse to wear!

• Conflict of wanting to protect oneself but not wanting to wear a helmet.
SCOPE OF INTERVENTION

- Organization of the product
- Materials
- User aspirations
- Existing ergonomics
TYPES OF HELMETS

- Full face helmet
- "Convertible" or "Flip-up"
- 3/4 face helmet
- ½ helmet
TYPICAL CONSTRUCTION

Acrylic visor
Protection from dust and foreign objects

EPS foam Absorbs kinetic Energy, Reduces deceleration of the head

PVC trimming

PU padding for wear comfort

Composite shell - pierce protection Alternate Material - Fiber glass, Carbon fiber, Kevlar
MATERIALS USED

- Kevlar
- Carbon fiber
- Lexan
TECHNOLOGIES

• Designed to protect the head from rotational injury.

• Polymer membrane slips in a controlled manner over the inner carbon-Kevlar shell.

• Reevu rear view system:

• Inbuilt rear view mirror through a sequence of mirrors.
FALL
BRAIN INJURY

Open type:
• Skull bone fracture

Closed type:
• Caused by violent acceleration of head
• Brain tissue collides with inside of the skull
ENERGY ABSORBING DEVICE
STANDARDS

Indian standards:
- BIS - IS 4151

Test lines:
- Minimum area to be protected
- Six sizes-550 to 600mm circumference of inside band
- Constructional requirements
- Performance
SIMILAR PRODUCTS

- Protection
- Armor
- Crumple zones
- Packaging
- Securing
- Watches
- Belts
- Caps/monkey caps
FIELD STUDY

Locations
• Mumbai - Powai market, Powai road, Santacruz
• Pune - Aundh, F.C road, Inner city.

Observing Users
• Traffic lights - to understand what users do.
• Pan shops/stores- to observe behavior
• Storage habits- during stops and at office
• Journey start/end points-
  - to see ingress egress actions
• Informal discussions, gentle probing
OBSERVATIONS

Securing
• Helmet comes loose
• Excessive play
• Constant adjustment
• Buckle irritates skin
• Buckle difficult to operate
• Riders seldom buckle up
COMFORT

• Becomes hot and muggy
• Higher CO2 levels
• Excessive sweating which hinders vision
• Deterioration of the helmet lining
• Bad smell
• Scarf or a balaclava underneath
• Ride with the visor up
STORAGE

- Place it on rear view mirrors or on the fuel Tanks, done even if helmet lock is present.
- Have to dismount the vehicle and use both hands to secure the helmet to the vehicle.
STORAGE

- Apprehensive about available helmet locks
- Some use chains and wire locks.
- Tendency to place the helmet or hook it on to something.
- Hung on rear view mirrors, kept on footboards and fuel tanks.
PERCEPTION ISSUES

- Perceived as a barrier
- Tendency to wear it on highways
- “It won't happen to me” attitude
- “Getting into” the helmet
- Claustrophobic feeling
- Loss of identity
- “Wind in the air feeling” is lost
- Helmet is a hassle
• Interaction with the environment less
• helmet restricts the field of view
• isolation from the various sounds of the road
• talking to the pillion rider is difficult
PRODUCT BRIEF

- Should encourage use
- Should look protective and safe
- Should protect the head against impact and piercing from any side
- Provide protection against environmental factors
- Have a single operation securing
- Be conducive to carry in multiple ways
- Occupy less volume when not in use
- Easy to wear and right fit for the head
- Should not wobble or shake on wearing
IDEATION
wear it like a cap
Unique finish to differentiate fielding part
Rings with thermal padding

Carbon fiber/steel mesh for pierce protection

Guides
EASY OPENING VENTS

KNOB FOR OPENING VENTS
dimple padding for impact protection
IDEA CLUSTERS

Grouping according to the core functionalities.
Ventilation cluster:
   Comfort when in use.
Storage cluster :
   Short term and long term.
Wearing cluster :
   Convenient wearing and removing of the helmet.
VENTILATION CLUSTER
REPRESENTATIVE
LARGE GAPS REDUCED

- Can have cut outs for specs
- Wire mesh 'cap' for pierce protection
- Shell and foam
- Chin fitting
- Holding grip

67 160 161 163 13
CONTOUR CHANGED TO EAR PROFILE
PROFILE CHANGED FOR BETTER GRIP
CONCEPT A - VENTILATION

Handle grip for holding

Cut outs for eye wear

Fine slits for ventilation

Additional element to cover the sides

Nylon net to cover the ear, protects against dust, dirt without hindering hearing

elastic nylon band for securing comfortable to use and single hand
STORAGE CLUSTER
REDUCTION IN STORAGE VOLUME
CONCEPT B - EASE OF STORAGE
EASE OF USE OF CLUSTER
OVERLAPPING PARTS
REDUCE CONTACT AREA WITH SKIN WHILE WEARING
SECURING CAN BE INTEGRATED WITH THE HELMET
INITIAL
SKETCH
SINGLE HINGE CHANGED TO TWO
LATERAL MOVEMENT ACCOUNTED FOR
CONCEPT C - EASE OF USE

- Hinge points
- Grip for easy holding
- Securing band passes through groves in the side panels and is attached only to the top portion.
- Side panels can be pushed up when stationary for better ventilation.
CONCEPT D - EASE OF WEARING
REPRESENTATIVE EASE OF WEARING
USE NATURAL WEARING ACTION

Rings with thermard padding

Carbon fiber/steel mesh for pierce protection
SURFACE AREA EXPOSED REDUCED
RINGS MADE BIGGER AND WIDER
CONCEPT D - EASE OF WEARING

- Net provides ventilation
- Three rings of titanium or kevlar held together by a strong nylon net
- Adjustable band with side locking system
- Band doubles up as retention when helmet is folded. Can also be used as a sling
- Foam
- Net
- Shell
EVALUATION OF CONCEPTS
<table>
<thead>
<tr>
<th>Concept</th>
<th>Advantages</th>
<th>Disadvantage</th>
</tr>
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</table>
| ![Image](image1) | Good air circulation  
Multiple ways of gripping  
Light weight  
Strong style statement | No reduction in volume  
Difficult to manufacture in FRP  
Rare chance of piercing injury  
Problem of dust |
| ![Image](image2) | Reduction in volume  
Ventilation on sides  
Easy to carry and hold | Moving parts add to complexity  
Projects a weak image |
| ![Image](image3) | Reduction in volume  
Good ventilation all around  
Convenience of | Three part manufacture  
Does not look robust  
Loose parts |
FINAL SELECTED CONCEPT
VALIDATION

- Dr. Dinesh Mohan (IIT - Delhi) an expert in the areas of impact and bio-mechanics.
- Design changed to a 2 part configuration.
- Gap between the shell reduced to min of 4 mm.
- Integral height adjustment provided for snug fit on the head.
REFINEMENT

- Three ring to two ring shift.
- Exploration of relative proportions of the rings.
- Detail of foam cross section to enable sliding.
- Detail of upper ridge for locking.
- Rain protection.
SECURING
FORM REFINEMENT
MANUFACTURING DESIGN

• Shells made of engineering plastics
• Liners and ear guards made of Elastomers
• Silicon gasket at partition to prevent water ingress
PROTOTYPE TESTING
INNOVATIVE DESIGN

- Collapsing helmet
- Ventilation through partition
- Smart looking
- Excellent wear comfort
- Easy to store
- Easy to wear
- Fits all head sizes
THANK YOU