P. b./ Education under 6 Environ design

390 REQUIREMENTS FOR THE RAPID TRANSIT STATION

Christopher Alexander, Van Maren King, et al

San Francisco, 1964

for Bay Area Rapid Transit

ditto Berkeley, Calif.

copy

TABLE OF CONTENTS

ACCIDENTS AND SAFETY

1. Prevent people falling, being pushed, or jumping off the platform onto the tracks - either to commit suicide or to retrieve a fallen object.

2. Make it impossible for passengers to fall or step into the gap between the platform and the train

3. Make the change in level between train and platform so smooth, and consistent from station to station and door to door, that there is no danger of tripping during boarding or alighting.

4. To prevent people being dragged along by the train, no one must be in contact with the outside of the transit car as the train starts to move out of the station.

5. Prevent the accident in which the horizontal bar of a turnstile catches men or women in the groin as they push through.

6. The last minute rush for a train that is about to leave must not lead to accidents, tripping, slipping on wet areas of floor, skidding, stumbling, bumping into other people, collision with moving train, etc.

7. Wherever it would be dangerous for passengers to run, the form of the passage (or whatever else) must discourage running.

8. Make it impossible for people to get pushed and knocked down by people in a hurry or crushed by crowds behind them.

9. Passengers who ride standing must be able to keep their belance without great effort even during maximum acceleration, deceleration, jerking and transverse motion.

10. Anybody who stumbles in the car must within a few inches fall against something resilient which will break his fall.

11. Anywhere a person is likely to lose balance (steps, transit car, ramp, single step, etc.) there should be a handrail or grab bar placed just at the point his arms reach for instinctively.

12. Keep kids off the tracks.

13. Make sure people do not fall forward or sideways off their seats when train stops or starts suddenly, lurches around a curve or jerks.

14. Protect all walking surfaces from water which will make a slippery surface (rain penetrating entrance doors, rain and mud from outside being tracked in on people's shoes, seepage, condensation, etc.)

15. Refuse anywhere where people walk (stairs, escalators, passageways, etc.) causes accidents of slipping and falling, and must therefore be avoided.

16. Since stairs are a major source of accidents due to slipping and misteps, such accidents must be prevented. ie. by reducing the total number of steps along any path through the station.

17. Prevent a door pushed open by one person, springing back and hitting the next person in the face.

18. Old people who do not want to show their age will resist grabbing onto anything which is awkward or indicates their old age.

19. Avoid the very common stumbling and falling accidents which occur as people step down off the bus.

20. Since elderly people lack muscular control when stepping down and tend to misjudge heights and distances and so get into accidents, all places where this can happen must be protected against it (escalator off and on, stair off and on, boarding and alighting, doors, machines).

21. Any seating must be situated with respect to the flow of people so that those seated may stretch their legs without tripping those who are walking past and those standing and walking do not step on the toes of those seated.

22. Breaks in surface continuity of floors like vent grills which will catch women's heels must be kept to a minimum.

ACOUSTICS

23. Anywhere passengers are waiting, the noise of incoming trains must not be deafening.

24. Reduce echoes, shouts, and noise produced by footsteps, pranksters, and crowds talking in passageways.

25. If the acoustic charateristics of the car discourage conversations between people who got on together, and were already talking when they got on, they will feel the ride inhibiting, and will not take it again. Noise level in the car when train is going through tunnel (where noise is dissipated least efficiently), must be low enough for two people 2' apart to talk comfortably.

26. If people in the car have the sense that others are listening and can hear what they say, their conversation will be inhibited (c.f. the embarrassed silence in a crowded elevator).

27. Wherever a person wants a phone, there must be one placed in such a way that he may hear the person he is talking to but not be over-headed by people around him.

28. Do not allow loud transistor radios to disturb other passengers or dominate any part of the station.

ADVERTISING

29. To avoid offending passengers, and to keep down cleaning and maintenance costs, advertisements must be placed to resist mutilation, obscene scrawling, tearing, etc.

30. The placing, illumination and organization of advertisements must not compete with, or detract from operational signs and displays.

31. Advertisements must be visible to everybody, especially when the crowds are thickest, since from the advertiser's point of view this is the prime advertising opportunity.

32. Advertisers want all advertisements and show cases to be placed at points of maximum passenger volume, so that they are exposed to the largest number of potential buyers.

33. Advertisers want their ads to be lit in such a way as to attract the attention of passers-by.

34. Advertisements must be designed so that water running down the walls will not make ads look grubby, especially when station and train cars are hosed down.

35. The temptation to stop and look at shop windows must never occur where steady uninterrupted flow is required.

BOARDING AND ALIGHTING

36. Minimum dwell-time.

37. No one train door should hold up the train because it has more passengers going through it than the others. However a perfectly uniform distribution of boarding passengers along a train is not necessarily the best. Some cars may have more people getting off than others; some may have less available seats than others and empty cars fill faster.

38. To reduce conflict, boarding and alighting passengers should never meet.

39. Boarding passengers should know in advance exactly where the car door will stop, so that they can wait at the right place, and not waste precious time and

energy running backwards and forwards during the train's very limited dwell time.

40. Before the train stops boarding passengers need to be waiting at those points along the platform where the incoming cars are emptiest.

41. People waiting for a second train on a particular track must not interfere with passengers boarding on a first train.

42. To cut down movement in the train, people must see enough of the train before they get on to get a general sense of which part of which car they want to be in.

43. Since signs on trains are hard to read and not dependable, boarding passenger must get the right train without having to read any sign on the train itself. Ideally he should never be in contact with a train he does not want to ride.

44. Platform to car seat "distance" should be minimum.

45. People should be warned when the train doors are about to close and should not be allowed to hold the doors open and thus delay the train.

46. Every passenger must be able to find a seat before the train starts without holding up the boarding flow because he stops at the door to look around.

47. When a car is jam packed to the edge prevent the last boarding passenger getting caught in the door because he can't squeeze far enough in.

48. Passengers should not have to fight their way through a crowd in order to get on and off the train.

49. Passengers want to use that car which will minimize the walking distance to an exit at the destination station, after they alight.

50. Boarding passengers start moving the moment their train comes into the station.

51. In accelerating and decelerating trains walking passengers will lose their balance unless they walk in the same direction as the dynamic forces acting on the train (forwards in an accelerating train, backwards in the decelerating train).

52. Passengers who want to stand as close to door as possible (because they are only going one station, and decide to remain standing) must not stop just after boarding in a way which holds up rest of boarding flow.

53. Passenger must know when his station is coming up, far enough in advance so that he can get ready.

54. To speed up the alighting process, alighting passenger should be encouraged to get up, move to the door, etc., far enough in advance.

55. So that alighting passengers do not hesitate as they reach the platform, there must be only one way to walk away from the car door, and the passenger must know in advance which way this will be.

56. Alighting passenger should not be required to get up before the train has reached a standstill.

57. People in the car must recourage the appropriate exiting doors clearly enough so that they do not go to a wrong door expecting to get out.

58. Standing and sitting passengers in the train, in the station must be able to identify that station even when the car is crowded (moving or stationary train).

59. Once on the platform, after leaving the train, the exit must be the most prominent thing in sight.

CIRCULATION

60. Total effective cross section of flow channels must be large enough to take maximum required flows.

61. Capacity of flow channels, in persons per minute, must be the same at every point along the channel so as to avoid bottlenecks.

62. Encourage people to move faster wherever possible so that the station's flow capacity (in passengers per minute) can reach the required maximum.

63. Eradicate conflicts between commuters who do everything fast and automatically, and irregular passengers who do not know where to go, how to pay, which way to turn, what sign to look at for what information, etc.

64. "Distance" from packed car to train must be minimal.

65. "Distance" from sidewalk to train must be minimal.

66. Passengers on their way to the train and passengers on their way away from the train must never get in each others way anywhere in the station.

67. Whenever a pedestrian can see his objective, he must be able to walk straight towards it (beeline), not need to make a visible detour.

68. Any path through the station should deviate as little as possible from a straight line (zig zagz, hairpins, back-tracking irritate passengers).

69. Wherever possible avoid crossing flows of moving passengers.

70. Many commuters, in the nervous pattern of commuting, want to keep moving without stopping from the moment they enter the system until the moment they leave.

71. Since people do not all want to walk at the same speed, each person must have full control over his own movement, move at whatever speed he chooses, and not be swept along by a crowd.

72. Ambiquous points where passenger can become unsure he is going the right way because he has had to make an arbitrary decision in order to continue, must be eliminated.

73. Passenger must not be required to pay attention to two things at once.

74. Any section of flow that needs to be reversed during any part of the operating day must dovetail smoothly in both directions and whild stationary with the remainder of the flow (passages, ticket gates, reversing or reversible escalators).

75. If conflicting flows are unavoidable all people involved must be able to see what is going on.

76. Two lines of people leaving ticket machines or gates must not cross paths.

77. The people who accumulate in front of concessions, shops and stands, must not interfere with through flows.

78. Moving people must not bump into or have to go around knots of people standing, talking, or saying good-bye.

79. People with children, seeing eye-dogs, packages, coats, umbrellas, and briefcases must be able to move smoothly through the system without nuisance to themselves and others, through ticket gates, in and out of seats, in and out of train and station doors, and through crowds.

80. Along any high volume flow there need to be periodic places where people can step out of the flow to tie a shoelace, get a better grip on the package they are holding, blow their noses, etc.

81. If access to the station is from the sidewalk, the sidewalk must be wide enough to accomodate the additional flows created and the width of the entrance itself without pushing people on the street at rush hour.

82. Rush hour pedestrian flows crossing streets must not reach such a volume that they create traffic jame.

83. Wherever handrails accompany a flow, the surface of the handrail must allow hands to move along it smoothly and continuously without interruption. (Since they are one of the first direct sensory impressions the

passenger encounters as he enters the station, they should be pleasant to hold onto, not cold and moist.)

84. Ticket gates must not break stride of walking passenger.

85. No passenger should encounter a closed door.

86. Passenger needs time to complete or prepare for an operation. (looking for money, looking for ticket, putting away ticket, closing purse) without slowing down the flow of passengers behind him, and without losing his place in line.

87. Women with strollers should be able to use the system.

CLEANING

88. The entire station must look clean 24 hours a day.

89. Avoid nooks and corners which attract dirt and litter, because they are unused, because litter gets blown into them, because they cannot be reached by mechanical cleaning equipment.

90. Make it possible to clean the station in an uninterrupted sequence without having to go over areas twice.

91. Floor, wall and ceiling surfaces must be unbroken so that large areas can be cleaned in a single sweep.

92. Reduce to a minimum all areas and surfaces which must be cleaned.

93. Brake dust and vaporized grease, flying through the air when train comes into the station and applies brakes, must not settle on visible surfaces.

94. There must be some way of detecting and dealing with urgent cleaning problems as they occur - a bottle breaks and spatters its contents, a passenger vomits in the car.

95. Since heavy mechanical cleaners are moved from station to station by train, any area which requires mechanical cleaning must be accessible for such a machine from the train level.

96. At each level where mechanical cleaning is done, there must be an access to hot water, soap water sump basin, with hose access, electrical outlet and storage for barrels of sawdust, soap, wash-buckets, hot water tanks, electric panel box, tool storage, storage and drying racks for wet mops, etc.

97. Since rotary mechanical cleaners veer away and are hard to control even on slight gradients, all major floor surfaces which need this kind of cleaning must be level.

98. Avoid fixtures whose cleaning requires finicky expensive smell scale treatment (handrails, knobs, etc.)

99. To prevent fires there must be some way of keeping the tracks free of litter.

100. All signs must be easy to clean, and within easy reach of whatever means the janitor has for cleaning them (probably a rag in his hand).

101. Do not allow the exhaust from starting buses to blow in the faces of waiting passengers or to discolor walls or buildings.

102. There must be a way of preventing people from tracking water, mud and dirt into the station.

103. People need to dispose of waste and put out cigarettes at those places where it occurs to them to do so -- in the transit car, just after leaving the transit car, just before boarding, just after leaving the station, while walking, and anywhere else there is a pause in people's time scale.

104. Since people do not like to get on a littered train which looks used and dirty, trains must be kept free of debris 24 hours a day.

105. The maintenance crew must be able to clean and wash

the cars without any special operations like closing windows, moving furniture, fooling with doors, etc. If possible the car should be hosed in one operation, inside and out.

COMFORT CONDITIONS

106. All areas where people have to be must be protected from the rain and wind.

107. All areas where people spend more than a minute or two without moving should be provided with an economical way of controlling temperature and humidity.

108. At any point where a person may wait more than a few seconds (at the platform, in line, at bus stop, change machines, ticketing) there must be an opportunity to sit, lean or rest.

109. Artificial lighting, wherever it occurs, must be free from glare.

110. Passengers in cars should be protected from sun glare and glare caused by extreme contrast between window lights and surround.

111. In hot weather people do not want to sit in direct sunlight, in cold weather they seek it.

112. People who want to smoke should be able to do so, and people who dislike smoking should be able to find a place where there is no smoking.

113. Passage to and from automobiles and buses must be protected from rain (including shelter for wsiting).

114. In an open station the rain canopy over the station platform must extend beyond the crown of the transit car, or else water falls on the nearside of the train-roof from the canopy, and then bounces down onto the passengers alongside the train.

CONCESSIONS AND STORES

115. Stores and concessions want to be on the most heavily travelled paths.

116. Stores want to get customers both from station traffic and from other passing traffic.

117. Neither stores nor concessions want to locate their displays or selling counters in an area which people pass through in a hurry. The best location is a place where potential customer has just completed something and is therefore open to suggestion, i.e. just after turnstile where he is still almost stationary.

118. A concessionaire wants to expose potential buyers to his display for so long that they make up their minds to buy before they pass it.

119. Store windows should not be obscured by crowds walking or standing in front of them.

120. Newspaper and cigarettes stands need to be in the main stream of rush hour flow, so placed that a buyer does not have to cross a fast moving stream of other passengers to reach them.

121. People in a hurry want to throw down the correct change for a paper, pretzel, etc. without waiting to hand it to a busy saleman,

122. Those who do not want a newspaper must not have to hesitate even as much as a single step at points where others are buying newspapers.

123. Passengers leaving trains need candy stores, flower shops, camera supplies. In addition, at suburban stations, they need cleaners, groceried and larger stores.

124. Passengers about to board trains need newspapers, cigarettes, magazines, drinks, mailboxes, candybars.

125. There need to be places where a person can grab a snack or cup of coffee and still be within view of the mainstream of the crowd, either for the pleasure of watching, or to watch for some specific person.

126. Many concessionaires will welcome the opportunity to make change, as a way of getting more customers within selling range.

127. The thing that makes people buy is a view of other people buying.

128. Vending machines, snacks and drinks, are of most use to waiting passengers and must be placed accordingly.

129. Concessions need to be placed somewhere dust and dirt do not settle on food or goods on display.

130. The area immediately around vending machines and concessions must be kept free from continual dirt, litter, candy wrappers, spilled drinks, empty cartons, which will keep potential buyers away.

131. Displays and entrances which require extra work, extra maintenance, and extra policing, as they do when they are on a mezzanine, are a nuisance to store owners and should be avoided.

132. It is highly desirable for a store owner if his store has an entrance which people treat as a meeting place.

133. Certain stores may require that pedestrian flow around them should not be too smooth and channeled -people enjoy elbowing and fighting their way thru crowds when they are shopping so that from the store owners' point of view, congestion is useful because it contributes to the excitement of buying, and therefore increases sales.

134. If a large store is likely to have huge sales, and the store opens directly off the subway, there must be provision for the crowds of customers who will wait outside the doors before the sale opens - this will probably be just at the worst moment of the rush hour.

CRIME AND POLICING

135. Every part of the station that is open must very obviously be under surveillance, as much to discourage crime, as to detect it (especially at night).

136. Reduce entirely the feeling of isolation and enclosure which tempts assaults (exits, toilets, stair landings, vending machines, blind corners in passages, between columns, etc.).

137. There must be at least two ways of getting away from every single point in the system, so that there are no dead end places where a woman can be trapped - unescorted women will not use the system at night if it appears unsafe in this respect.

138. Keep all places well illuminated to prevent possible crime - these crime often take place in the darker section between two places which are well lit for functional reasons.

139. There should be no places like telephone booths which, under the pretext of use, can become operation points for perverts because they are concealed from view.

140. Since any long uninterrupted enclosed passageway is frightening because of the danger of assault in the middle, such passageways must always be short.

141. To reduce crime, no part of the station should be deserted when it is in operation.

142. At no point must non-public areas be open to the public (in existing systems these often invite crime, e.g., women being pulled into tunnels and molested).

143. Lighting fixtures, signs and other tempting objects, must be resistant to vandalism and removal.

144. Avoid pursesnatching by malcontents on trains who try to grab something from a passenger on the platform as the train moves out, or vice cersa.

145. Prevent deliberate mutilation of seating - or design seating in such a way that mutilation doesn't show.

146. Make it impossible for pickpockets to operate in crowds.

147. Make it impossible for pickpockets or lush workers to operate in the car, either on sitting, sleeping or drunken passengers; people must sit on their wallets; seat must not provide clear access to persons' side, no gap between seat and back.

148. To discourage holdups, the public should never be allowed to see actual money handled or the inside of money machines.

149. Storage of money received from ticketing and change operations must be proof against, and not encourage, robbery.

150. Protect passengers from rocks being thrown through the windows and resulting flying glass.

151. Newsboys, janitors, station agents, police, cleaning crews with mops must be able to get into the station without paying.

152. The money collectors must be able to collect money from the strongroom or ticketing machines and transfer it to their armored car safely and easily.

153. Wholesales must be able to drive their trucks close to entrances and to wheel their stock close to booths, storage points and vending machines.

154. Simplify the operations involved in getting trash and refuse from points where it accumulates to points where it can be picked up by truck.

155. Trash collection requires access for garbage trucks someplace where it does not offend passengers.

EMERGENCIES

156. Prevent panic during emergencies.

157. In an emergeny isolated persons or crowds must be able to open all doors and gates outward. If crowds are involved the gates must stay open.

158. In any emergency, it must be possible to empty the station in a few seconds (supplemented by fire escapes, escape hatches.)

159. In case of fire or major accident, people must not be caught in a constricted space, but must have ample space to expand out into. (A panicked crowd requires more space per person than an orderly crowd.)

160. It must be clear at once what to do in case of emergency (fire, accidents) - both in the signing, natural actions, communications, and in the natural actions which the physical layout invites.

161. Workmen and emergency crowds must be able to get from the tracks into the station.

162. In case of fire, dense smoke will overcome passengers, reduce visibility and create panic unless vented away from passenger areas.

163. A passenger in distress should scream or shout for help and be heard without having to overcome screening high background noise level, the fact that help is out of range, the fact that the attendant has no way of knowing the difference between false alarms and real distress, the feeling that it is useless.

164. Every point in the system must be within 15' - 30' of an alarm device (especially in the case of fire, accidents, or assault the passenger must have direct communication with the station agent.

165. Escalator should be located so that any accident is likely to have a witness. The shutoff must be in plain view so that the witness can stop the escalator even under stress conditions, yet placed so that kids will not abuse it.

166. Rescue, fire, and police equipment - (ladders, stretchers, and fire hoses, etc.) must be easily admitted to any point in the station in case of emergency.

167. In emergencies, a toilet, cot, hot water, quiet, warmth must be available - close to all potential accidents, with easy surface vehicle access, and under the control of the station agent.

ESCALATORS

168. If escalators are restricted in number, people who specially want to use them must know from the outset of their passage through the station where they must go so as to be in the escalator flow.

169. Since climbing up flights of stairs is actually impossible for some people (e.g., heart and asthma cases) there must be at least one escalator travelling up at all times.

170. People must always be able to choose a stair instead of an escalator if the escalator is crowded or they don't like escalators.

171. Make it possible for people in a hurry to pass others who are standing on a moving escalator.

172. People must not try to walk up a down-escalator, or down an up-escalator.

173. People must be able to judge accurately where the moving tread of an escalator starts and where the break between treads occurs.

174. It is very annoying to encounter a shut down escalator during off hours, especially since the variable riser heights make it dangerous to use as a stair - make it poaaible for a lone person to start the escalator for his own use.

175. Every escalator requires a motor housing and an area for servicing underneath it.

EXITS AND ENTRANCES

176. Entrances should stand out so sharply from their surroundings that they are immediately visible from any point up to a quarter of a mile away.

177. Since entrances cannot be successfully distinguished from exits by an entering passenger, he must be able to enter through any opening in the exterior face of the station and still find his way smoothly and immediately to the train-bound flow.

178. Sizes of various exits and entrances must be proportional to volumes of passengers going to and coming from different directions.

179. There must be enough doors and enough capacity just inside them so that entering passengers can walk straight into station, and will under no circumstances have to wait outside.

180. Passengers entering and exiting through sidewalk entrances must not disrupt the pattern of normal sidewalk traffic.

181. There must be a hesitation point, just before people emerge into outside, where people can stop to put up an umbrella, fasten coat, decide which way to go.

HEATING AND VENTILATING

182. Reduce the difference between outside air temperature and the inside temperature so that the passenger dressed for the outdoors not encounter uncomfortable changes.

183 Do not allow any wall, ceiling or floor surfaces near a passenger to have a lower temperature than air temperature; if it does have, the body will feel that the surroundings are dank and chilly.

184. Eliminate excess humidity caused by moisture sources like puddles, wet walls, crowds, wet raincoats. Humidity is undesirable because it accentuates heat, cold, mustiness and smells.

185. The quantity of fresh air and the rate of air movement must be adequate to eliminate stuffiness and smells.

186. Passageways and entrances must not act as channels for high speed air movement and flying dust.

187. The stale tunnel air brought into the station by trains must be vented out so that it does not bother passengers.

188. Collect condensation where warm moist air meets cold surface so that it will not drip onto passengers or floors (stations and transit cars).

189. A crowded hot train must be adequately ventilated.

190. Any draft, whether from vents or windows, is irritating to passengers particularly when it blows on legs, disarranges hairdo, etc.

INFORMATION

191. At every point in the station and surrounding shops and parking lots a passenger must know how many minutes and seconds he has before his train.

192. Departing passenger should not be aware that train is coming, or about to leave, if he cannot catch it from where he is (this would only include frustation).

193. If the level of information a passenger wants is too detailed to be displayed at a given point, there must be a sign at that point indicating where he can get this information.

194. Wherever people need it, there must be a system map, schedule and other overall system information (at station entrance, transfer points and on the trains).

195. Information about schedule changes, temporarily closed station, exits under repsir, forthcoming system changes, must reach all passengers.

196. Everyone in the train or station must be able to hear the loud speaker messages in times of emergency or sudden schedule change or train delay.

197. Each community will want to give passengers information about all their own special features which are near the station (stores, theaters, parks, zoo, buildings, museums).

198. People need information about constantly changing events, concerts, movies, sales, ets. - if it is always displayed in some characteristic way, people will be able to find it at once.

199. At certain points, particularly when leaving the train, passenger wants to know what time it is.

200. Every waiting area, including places where people are standing in line, requires a level of illumination which allows people to read comfortably.

201. The floor needs enough light on it to make people confident that they can walk as fast as they want.

202. Grills, litter, treads, and breaks in walking surfaces must be easy to see.

203. The lighting of signs, advertisements should coincide with the lighting of general spaces so that special lighting of signs and ads is not required.

204. Any area under surveillance requires a high enough level of illumination so that details can be observed at the maximum surveillance distance.

205. To increase the legibility of the characters on a sign, the brightness contrast between the background surface of the sign and the surrounding illumination must be minimum.

206. At those points where the eyes are forced to adjust to a very extreme change in overall brightness the walking surface must remain continuous to prevent stumbling and falling accidents.

207. There must be a provision for emergency lighting which will provide the minimum necessary lighting in the case of a power failure.

208. The whole interior of the cars require a level of illumination which allows people to read comfortably.

MAINTENANCE

209. Since any maintenance or replacement to be done on site must be done during the repairman's working day (8 AM to 5 PM), on site maintenance must not interfere with normal daytime operations.

210. At any place where people change their pace, there is intense wear on the floor surface, which must therefore be easy to replace.

211. Since maintenance of mechanical and electrical gadgets such as window shades, doorswitches, etc., demand skilled labor and is therefore very expensive, eliminate all such fixtures wherever possible.

212. Glass should only be used if absolutely necessary and must then be placed in such a way that it is least vulnerable to accidents, vandalism and people walking into them.

213. It must be easy to replace ads, especially those which must be changed often.

214. Repair and replacement needs must come to the attention of maintenance department immediately.

215. All light bulbs should be easy to replace.

216. Since train windows are constantly getting broken by vandals throwing rocks, these windows must be very easy and cheap to replace.

217. Seats in cars will take a lot of wear; either the whole seat or the surface should be easy to replace.

OPERATIONS

218. To reduce payroll, use minimum number of personal to run, clean, police, supervise, patrol, and maintain the stations and transit cars.

219. In view of uncertain information about expected and future volumes, it must be possible to add extra ticket machines, change machines and ticket gates.

220. System must be able to accommodate rush hour traffic without wasting capital investment on space and machines that are idle for 23 hours of the day.

221. Flexible operation demands that the car be able to travel in both directions: seating arrangement, driver's compartment, door poitioning.

222. Operation of a two car train must be as efficient as the operatic of a ten car train: in particular, passengers must never go toward boarding areas from which they cannot reach a car.

223. There must be no way for a passenger to reach the trains without passing through a ticket control.

224. Women who come into downtown stations for a day's shopping, need a place to leave extra pairs of shoes, coats, parcels, locked up.

225. Special provision must be made handicapped persons - the blind, deaf, deformed, crippled, and old (cane guides, seeing eye dogs, a way of attracting the attendant's attention, etc.).

226. There must be no places where it might become difficult or anbiguous to assign responsibility for maintenance or liability for accidents (BART vs. city or BART vs. private owner).

227. There must be an alternate machine (or person) to take over the instant an operating machine breaks down.

228. Any device intended as a barrier must not allow people to vault over, climb over, squeeze past, or crawl under it.

229. It is wasteful, from the company's point of view, if there is any unused space in the car, under seats, between seats, in front of seats if they are widely spaced, in corners, on the steps where the doors open, and all such waste must be eradicated.

230. Trainman must be able to check all train doors before they close .

231. Prevent people from leaving parcels, clothes and belongings in the train by mistake.

232. It must be possible to turn an individual car thru 180° and still have it marry with the rest of the train.

233. Very easy access to electronic train control equipment and fixtures in the station. (This is likely to be such a frequent need that the access must be possible without causing any disruption of service or delay to passengers).

234. However a person orients himself in the city normally he must be able to maintain this orientation as he moves through the station.

235. To avoid the feeling of being in some undeterminate underground cavern while in a subway station people like to see the sun, daylight or some indication of a maintained connection with the outside world which they have temporarily lost touch with.

236. Pattern of movement through the station should be so simple in form that even a stranger can grasp it without thinking about it.

237. Passengers must know which exit will get them onto the street where they want to be.

238. After exiting passenger reaches the street, he must know exactly where which parts of the city lie and which way he must go to continue his journey.

PARKING AND FEEDERS

239. Passengers who transfer from train to feeder should not feel that his trip is being interrupted. The trip from door to door should "read"as a planned part of a total transportation operation.

240. "Distance" from bus to train should be minimal.

241. Passengers must immediately be able to find the bus they need as they leave the station.

242. Groups of people waiting for the bus must not interfere with people going in and out of the station.

243. Buses and cars must be able to load and unload, without impediment, on their right hand side.

244. Incoming cars and buses must not spray waiting passengers during rainy weather.

245. All the buses that ever need to be at the station at one time must be able to wait either at the boarding platforms or else in view of the boarding platforms.

246. Passengers coming home at night must be able to find the car waiting for them without trouble.

247. The wife picking her husband up at the station must be able to wait and have something to do for a few minutes in the uncertain interval before the train he is on arrives.

248. There must be a way for the kiss-and-ride commuter to be driven to within a few feet of the train.

249. The kiss-and-ride commuter does not want to get out of his car in a great hurry because someone behind is hooting at his wife to move on and make room.

250. People should be able to get to and from their cars without crossing high volume streams of moving vehicles or walking so close to them that they get splashed in rainy weather.

251. Entrances to parking lots should be easy to see and easy to reach from surrounding streets.

252. When you drive into a parking garage or parking lot, you want to know exactly where to go to find an empty parking space.

253. Prevent non-users of the system from using parking spaces when the system users need them.

254. People who use the transit system require free parking; they consider this a privilege that goes along with the ride.

255. Make it very easy for passengers to remember where they left their car parked (in station lot) so that they have no trouble finding it in the evening.

256. Parking lots and structures must not create opportunities for night-time crime.

257. Provision must be made for all those vehicles different from the standard auto: bicycles, small autos, motorcycles and motorbikes.

258. Provision for several taxis to wait right next to station exit at rush hour.

259. Provide light automotive service at station so that people can leave their car all day for service.

260. Waiting areas must accommodate the maximum crowd which can accumulate during the worst 90 second head at peak hour with a safety factor to allow for a five-minute train delay.

261. People will not tolerate a wait of more than three minutes at any point in the station without becoming restless and annoyed.

262. It must not be boring to wait whether the wait is 5 minutes or 30 minutes.

263. Many people like to pace up and down when they are waiting and must be given the opportunity to do so without moving away from whatever they are waiting for.

264. Passengers carrying packages must be able to put them down while they're waiting.

265. People waiting should feel certain that they will get on the train and get a seat without having anxiously to keep their place in line.

PSYCHOLOGICAL EFFECTS

266. The passenger must not encounter more than some maximum number of gates, turnstiles, fare-paying operations, transfers, holdups, delays, lines, and queues, on his passage through the system.

267. Eliminate the feeling of claustrophobia caused by being underground, in a packed transit car, crowded passageways, windowless rooms, etc.

268. Need for a sense of control over your own destiny as you ride the system (the same as you have when you drive a car).

269. Since regular passengers need to rely on habit, allow them to get a complete feeling of certainty, reliability and familiarity with the pattern and sequence of operations (comparable to the feeling of reaching for a familiar light switch in the dark). For example, the position of exits in the car and the relation of entrances to ticket machines, etc. should always be the same.

270. Need for feeling of luxury associated with deep carpets, slow motion, measured pace, quiet, dark rich colors, acoustic absorption, muffle.

271. People have a need for the psychological support of something (like a column or wall) to stand by.

272. Nobody likes the eerie quality of an empty or near empty train or car; it carries echoes of danger and uncertainty and must be eradicated.

273. Incoming train should not be frightening; people do not feel safe if they are too close to moving train as it comes into station.

274. People want a chance to wake up on their way to work (breakfast, newspaper, fresh air, walking further) to make a sucessful transition from the relaxed quality of family to the bustle of city and office.

275. People want to relax on the way home from work.

276. People seek (need) the definition of area provided by pools of light.

SIGNS

277. At any point in the system, a passenger must always be able to tell from his surroundings and from the signs visible to him at that point, just which point he needs to go to next.

278. Wherever possible information should not be carried by signs, but by the architecture itself, which is both more potent, and less liable to confuse the reader by proliferated messages.

279. On any path whatever through the station, the signs a passenger encounters must form a properly coordinated sequence.

280. Each sign of different operational type needs a distinctive graphic character (e.g., green triangle for the station name, blue and yellow stripes for the exit).

281. People do not want to stop in order to read a sign; especially when they are walking or running they must still be able to absorb the information in every sign. Signs must be at right angles to the line of sight and direction of travel.

282. At any point where a passenger tries to read a sign, the sign must subtend an angle small enough to fall within the foveal cone and large enough for its characters to be legible.

283. The total amount of information in any one sign or collection of signs should not be so great that a viewer cannot easily pick out the item he is looking for at a single glance.

284. Train bound passenger must know how to get to the train he wants.

285. A passenger should not have to know more than the name of his destination station in order to reach that destination. The signs he follows should not require him to know its compass direction, the line it is on, the terminal station, etc.

286. Every sign must have enough light on it day and night; they must be as easy to see by daytime natural light as by nighttime artificial light.

287. Total amount of visual information in sight (including visual clutter, handrails, light bulbs, knobs, stanchions) must be very restricted so that it does not fight the information in signs.

288. Passenger will require a great deal of redundant information for the sake of his own peace of mind and confidence. That is, he must be assured that he is in the right place, even when he could not possibly be in the wrong place.

289. No sign should have as a possible outcome that the passenger has to go back where he came from; in other words, it should never be necessary to go up to a sign in order to find out that one ought to be going the opposite way.

290. Since signs which prohibit actions (i.e. "don't spit", "no smoking", etc.) are irritating, these messages must be conveyed by other means.

291. Signs should not be obscured by crowds.

292. All signs in the cars must be placed in such a way that people, either standing or sitting, do not have to lean over others to read the sign.

293. Passenger does not want to be forced to be near other passengers he finds undesirable. This requirement becomes most critical at rush hour.

294. Nobody wants to sit touching a stranger; each person wants a clearly demarcated space around him which is "his".

295. People particularly want to avoid unexpected contact with each other. If circulation difficulties make people feel they are being pushed or shoved by others, they will stereotype the offenders and decide the system is no good.

296. System should encourage friendliness rather than fear, (smiles, nods, casual conversation). In present systems, people are usually on the defensive and basically mistrustful of each other.

297. System must be designed to serve many kinds of people (sizes, occupations, pleasures, purposes, status groups, and nationalities).

298. Prevent any form of segregation or any situation where defacto segregation might become a practice.

299. Convention, enforced by social pressure, should be used to control people rather than brute force, fixed rules, or directions.

300. Family groups (mother with child, parents with small children), couples, card playing commuters have need of a seating arrangement which allows them to maintain an inward privacy and in appropriate contact with each other.

301. Teenage kids and other special groups who move about 6 or 10 at a time must not be allowed to dominate a place to such an extent that everybody else feels uncomfortable.

302. Seat and car layout must not allow missionaries, exhibitionists, drunks, and other undesirable characters to isolate captive passengers.

STAIRS

303. High cost of stairways and escalators makes it necessary to reduce their total number and get the maximum use from each.

304. The total amount of climb that people are forced to make by stair must never be a strain.

305. Unless angle of climb and the number of risers in a flight of stairs are standard, comfortable for normal walking rhythm, people will trip, misjudge the stairs, slow up the people behind them, etc.

306. People should not have to make both ascending and descending movements along any single path.

307. A person walking in a crowd cannot see the ground and, therefore, cannot tell where stairs start (especially at down flights); there must be something to make the beginning of stairs, above head height.

308. Stairs should be placed so as to discourage and make unnecessary any diagonal or lateral movements across it, because these lead to accidents and flow constrictions and general instability.

STATION ATTENDANT

309. The station attendant should have a general overview of the station as a whole and must be able to investigate any one incident in detail without losing this general overview.

310. Station attendant and other system personnel who have to deal with the public should not be so pressed for time that they cannot be courteous and accommodating to passengers.

311. A passenger caught without money, unable to work machines, needing rest rooms etc., must be able to find the attendant instantly.

312. Attendant's booth must be large enough and pleasant enough so that he does not get cramped if he spends a long time there, and so that he can modify it with his own belongings. Materials he touches inside the booth should be comfortable (warm and soft instead of hard and shiny).

313. Station attendant, concessionaires and other system personnel require washroom, lavatory, and personal storage.

314. Transition from outside of the station to the inside must be psychologically immediate: interior of the station, trains, boarding and alighting, etc., should be so visible and accessible from the outside that no one will think it too much trouble to use the system.

315. At any point where a passenger is aware that he is entering the station, he needs to be met by a welcoming atmosphere.

316. Prevent feeling of tiredness, gloom and low illumination associated with transit and subway stations, even when walls are faced or under a thin skin of aging dirt, by maintaining a high overall brightness contrast.

317. To get system accepted as part of the city, the station and tracks should face streets rather than backyards and alleys.

318. The system should encourage people to be on their best behavior by making them feel over-awed by a situation better than they are used to (the hick in the Waldorf Astoria).

319. System should encourage courtesy - young people for old, old people should feel they are going to be treated courteously, men giving up their seats to women, etc.

320. Avoid situations where mechanization is oppressive.

321. Certain parts of the design should actively communicate to the passengers the fact that their needs are of primary importance and that the system is taking care of them.

322. Passengers, especially women, should be able to enjoy the Fifth Avenue feeling of being looked at (a kind of Easter parade where people go to see and to be seen). Encourage the pleasure of flirtation which people thrive on - the flash of the eyes that pass between a man and a girl, even if it leads to nothing, can make the day for both of them.

323. The system must appeal to the California temperament of being on the go, out-of-doors, quick and easy, etc.

324. So that the ride makes positive use of the passenger's time and is therefore a worthwhile alternative to automobile commuting, provide facilities on the trains for letter writing, reading, shoeshines, coffee and donuts, telephones, etc.

325. Arrange waiting facilities so that a woman will not become uneasy if she has to wait alone at night.

326. Prevent lechers, minor assaultants, etc. annoying women on crowded rush hour trains.

327. Wherever they are, people prefer a view of living things (people, automobiles, movement, color) to a view of dead things (buildings, rooftops, parking lots).

328. There is a need for rendezvous points. These must be easy to describe (so that people will actually use them for meeting), very easily accessible to the outside, and close to the tickets and trains.

TICKETING

329. Prepare people so that by the time they reach any machine they have in their hand, exactly what that machine requires (correct change, ticket oriented the right way, etc.)

330. At no point should a passenger be confronted with an operation that he cannot complete because of no change, inadequate ticket, etc.

331. Strangers to the system should have sufficient warning of the need for an automatic ticket and how to get it so that they do not make mistakes based on assumptions about the way other systems work.

332. - the high cost of ticket machines makes it necessary to justify investment by guaranteeing a minimum amount of business for each machine.

333. Purchaser requiring change should not have to go to more than one machine to get a ticket, i.e. automatic change making vendor.

334. Station agent must be watching entering ticket gates and in case of a maifunction or passenger difficulty be able to reach them.

335. If a line forms anywhere, people at the back of the line must know what the line is for so that they do not join it by mistake thinking it is for something else.

336. So he can choose the fastest queu, a passenger approaching a set of queus must be able to see all of them.

337. People waiting in a line for one purpose, will be irritated if there are others ahead of them in the line waiting for other more time-consuming purposes.

338. A passenger who gets stopped at the ticket control because of an incorrect ticket, must not hold up the flow of passengers behind him.

339. Passengers who need them must know where to find ticket machines and change machines.

340. People who accumulate in front of one machine must not interfere with people trying to reach another or with a through flow.

341. Wherever the manipulation of small objects occurs (coins, tickets, tokens), it is certain that every now and then someone will drop one. These places should be designed to reduce this effect and should be organized so that people can recover their lost objects with the least effort, causing the least trouble to others. In particular, eliminate cracks between machines and walls, holes between ticket gates, downhill paving under change machines, etc.

TRACKS, STRUCTURE, AND POWER

342. Minimize the effect of extreme subterranean forces due to soil loads and hydrostatic pressure by keeping any non-cylindrical volumes near the surface.

343. Structural columns must not obstruct any essential view of trains, people signs.

344. Each station must have an internal drainage system which collects all rainwater, water from incoming trains, cleaning and seepage.

345. Minimize the transmission of track-train vibration to station structure.

346. Each station needs an electrical substation placed so that transformers can be installed and removed.

TRANSFERRING

347. Any passenger transferring from one train to another must know exactly where to go and what to do.

348. Transferring between trains on different tracks must be quick and easy.

349. Transfers must be easy between different trains travelling on the same track.

350. It must be possible to get easily (and without paying again) from the up line to the down line, or vice versa, so that the person who goes past his stop, or changes his mind, can change direction.

TRANSIT CAR

351. The longer the distance a passenger is travelling, the more comfortable and accommodating the ride could be.

352. The shorter the distance a passenger is travelling, the closer he wants to sit to the door of the train.

353. Allow each person his own peculiar way of sitting so that he is not regimented to sit in an identical fashion in one of a row of identical seats.

354. Seating should provide room for feet and knees of the largest sitting passenger and should allow people of all sizes and ages to sit with their feet firmly on the ground.

355. Passengers walking in the car must not trip over the feet or legs of seated passengers.

356. The train car will be 10 feet by 70 feet and must hold at least 75 seated passengers.

357. Reduce the danger, apparent danger, difficulty, and unpleasantness of passing from one car to the next.

358. Many passengers want to sleep while they travel; seat should provide head rest and hold drowsy passenger firmly enough so that does not spill over into the next seat, get bumped from side to side or against the steel side of the car as the train accelerates, sways and decelerates.

359. Make it easy to get in and out of seats without bumping your head, tripping over another passenger's legs, having to excuse yourself as you push past him, disturbing his paper, having to bend your body as you slip sideways into the seat, etc.

360. Some people prefer to stand even when there are vacant seats and want a place to stand so as not to be disturbed in conversation or while reading by people squeezing and walking past.

361. In the car, particularly when it is moving, you need something to hang on to as you change direction. Thus getting up from your seat and going towards the door, you need some kind of pole to swing yourself up and round by.

362. People may want to stand near seats so that they can move in and occupy them as they are emptied.

363. Prevent women being annoyed by staring passengers; many women prefer to sit in such a way that their legs are not exposed, and women do not like being forced to face a strange man full front for the duration of their ride.

364. People sitting do not want a view of someone else's crotch, bottom, briefcase, etc.

365. On the train, to feel secure, a person wants to maintain direct contact with his packages, either with his hand resting on them, his foot next to them, or with them in direct view on a rack.

366. Make certain large suitcases, packages, cannot be left in aisles where they will obstruct or trip people.

367. Any passenger must be able to see out of the transit car at all times unobstructed by columns outside, people inside, coats and umbrellas, condensation on the windows, angle of view, or the reflection on the glass.

368. Provide a way in which passengers can hang their coats, wet umbrellas, top coats, etc., without annoying or obstructing other passengers or having water drip onto seats, people, or walking surface.

369. Many passengers prefer to face direction of movement.

370. Passengers who reaches out for a grab bar to steady himself must not grab hold of someone else's ear, coat, etc.

371. There needs to be a way to rest your elbows as you travel — sitting or standing.

372. All train windows must be fixed — people stick their arms out of open windows and get hurt, openable windows need to be closed by maintenance crew every time car is washed, people don't open the windows even when it gets stuffy, people disagree about whether to open them or not if they are openable; also weight, cost and maintenance costs are less for fixed windows.

USER HABITS

373. People will not walk more than a few feet from any entrance into a waiting area, and, therefore, tend to congregate about the entrance.

374. People tend to follow one another sheep-like, tend to gravitate toward exiting lines, and to use the person in front of them as the best indicator of where to go next.

375. Friends who get separated at escalators, exit and entrances, train doors, etc. tend to stop and turn and wait for each other.

376. Wherever paths diverge, people will stop to talk and say goodbye etc.

377. People are used to keeping to the right.

378. Wheerever there is more than one opening, people tend to go to the nearest one even if they are not sure it is the right one.

379. In loose crowds of moving people, individuals will dodge and run towards gaps and openings in the moving crowd.

380. If he has a choice the person willvalways go to a man rather than a machine.

381. People are prepared to wait longer getting into the system than they will wait to get out of the the system: i.e., exiting ticket gate delays.

382. The means of litter disposal must reflect of throwing litter. People have a tendency (hence a need) to throw litter into corners, gutters, secret places where it cannot be seen and where the act of disposal can be concealed.

383. People tend to buy when getting off the train rather than when getting on (so that they do not risk missing any trains).

384. People need something to stare at vacantly while they daydream.

385. Many people enjoy a chance to use mirrors, especially when they are waiting or just before they emerge from the station.

WALLS AND FINISHES

386. Wall surfaces should be inviting to lean against. Since they are perpetually disfigured by kids who spray paint and scratch names and remarks on them, and by slow deterioration, there must be some way to freshen up or replace them.

387. Certain kinds of discoloration are beyond maintenance and must be prevented from occurring in the first place - dirt around heating vent openings, seat backs where sweaty shirts stick in summer, lights where moths beating themselves to death discolor ceiling, hair oil on glass panels and seat backs.

388. Wherever the station is underground, seeping ground water must be carried past the structure and surfaces so that is will not seep through and crack and stain the finish and so create the "damp" feeling of being underground.

389. Ceiling surfaces must not be perforated, or irregular so that dirt can get into layers which periodically break loose and shower dirt on passengers below.

390. The bottom foot of walls, stair risers and other vertical surfaces must be scuff-proof.