

### 2.4. CONTINUOUS SHUFFLING MACHINE (CSM)

By Michael Shackelford



*The Wizard of Odds*, has twenty years of computer programming experience and thousands of hours of casino gambling experience. His mathematical analysis of casino games is accurate and reliable. He has also extensively reviewed blackjack offerings on different Internet sites. Shackelford hosts the popular Internet site for casino players at [www.wizardofodds.com](http://www.wizardofodds.com). He has written the soon to be published book "Casino Gambling 102". His game of choice is blackjack and his gambling philosophy is to bet big when he has the edge and small when he doesn't.

Frequently I get questions and complaints about the continuous shuffling machine (CSM). For those who aren't familiar with them, a CSM is used to randomly insert discarded cards back into the shoe. This is not to be confused with an automatic shuffler, which shuffles an entire deck or shoe. Reasons in favor of casinos using the CSM is that the dealer never has to shuffle, thus dealing more hands per hour, and it eliminates the opportunity for card counters to exploit a game. The effect of the CSM is that every hand is like the first hand of a shoe.

Certainly card counters have reason to complain about the CSM. If - every blackjack game had them they may as well learn a new game. However the reaction of the basic strategy or casual player has also been very negative. One legitimate complaint is that an increased number of hands dealt per hour is directly related to losing more money. Expected loss per hour is simply the product of the house edge, the average bet, and the number of hands dealt per hour. However what many basic strategy players may be surprised to know is that the CSM actually **LOWERS** the house edge.

The reason for this is hard to explain. The alternative to a CSM is the cut card. Dealing until the cut card is reached, and then finishing that hand causes what is known as the cut card effect. The cut card itself may be placed with equal probability in a high card rich section of the deck, a low card rich section, or a neutral section. If the cut card is placed in a high card rich section both players and dealer are going to draw relatively few extra cards out of the deck. However if the cut card is in a small card rich section many additional cards will be drawn. This causes a disproportionate number of small cards to be played in the last hand of a shoe.

While the last hand of a shoe tends to be bad for the player the other hands tend to bend a little in the player's favor. The reason for this is complicated. However the dynamics of the game cause a disproportionately large number of big cards to be played in all but the last hand. Briefly, if a player or dealer has a pat hand consisting of high cards he will not draw any further cards. However with a low total the player or dealer will have to draw more cards out of the deck. With some small cards already removed this causes hitting to occur in what is on average a slightly high card rich deck. So although the initial cards can be equally high or low the additional cards drawn tend to favor large cards.

To illustrate this point I did a large simulation and tracked every card observed in a game in which the cards were shuffled after a constant number of hands. The following table displays the results.